

Years of life lost due to chronic obstructive pulmonary disease in Khuzestan province during 2011–2019: A population-based study

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is one of the major causes of morbidity and mortality and a major public health problem all over the world. Therefore, this study aimed to investigate the years of life lost (YLLs) due to COPD between 2011 and 2019 in Khuzestan province, southern Iran. **Methods:** This cross-sectional study evaluated a total of 715 COPD-related deaths during 2011–2019 in Khuzestan, Southern Iran. Required information comprised of age, gender, and number of deaths were collected. First, crude and age-standardized mortality rates were calculated, and then the joinpoint regression was used to evaluate the trend of YLLs. **Results:** The highest number of deaths during the study period was observed in males (65%) and in the age group of over 70 years (52.6%). There was also a decreasing trend in crude and age age-standardized mortality rates in both genders. The total number of YLLs in both genders was 8650, 5747 in men and 2903 in women. Based on the results of joinpoint regression, the percentage of annual YLL changes was –1.5% in men, –10.7% in women, and –6.6% in both genders. **Conclusion:** Estimating the trend of YLLs due to COPD can effectively help and lead the way of health policymakers and provide useful information to estimate the economic burden of the disease and assess health needs and priorities of a population.

KEY WORDS: Chronic obstructive pulmonary disease, Iran, joinpoint regression, trend, years of life lost

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INTRODUCTION

Chronic respiratory diseases are airborne diseases, one of the most important of which is chronic obstructive pulmonary disease (COPD).^[1] COPD is a common inflammatory airway disease, which is characterized by airflow limitation. This disease is not completely reversible, but it can be either prevented or treated. COPD is one of the leading causes of morbidity and mortality^[2-7] and a major public health concern worldwide.^[8]

Risk factors associated with COPD are divided into two categories: external factors, including smoking, tobacco use, air pollution, and occupational exposure, and internal factors, including age, gender, and genetic factors. Each of these factors may cause this condition either individually or together.^[9] Smoking, as the most important risk factor, is responsible for 90% of cases of COPD.^[10] Clinical manifestations of the disease include shortness of breath,

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cough, and mucus production. The disease gradually progresses and eventually leads to respiratory failure.^[1]

The prevalence of COPD has dramatically increased in recent years due to urbanization, industrialization of communities, and use of fuels in homes, especially in Asian and African countries, so that it has been reported as ranging from 3 to 22% in Asian countries,^[11] and generally affects 4–9% of adults.^[12]

The disease is one of the leading causes of global disease burden,^[13] and was responsible for 3,188,300 deaths worldwide in 2015, with a mortality rate of 21.7%, which accounted for 5% of the global all-cause mortality. It should also be noted that more than 90% of COPD-related deaths have occurred in low- and middle-income countries.^[14] According to the global burden disease (GBD) study in 1995, there were 144,141 cases of COPD in Iran with an incidence of 60.5 per thousand populations in 2015.^[11]

In 2016, evidence on the global burden of disease showed that COPD is the cause of four deaths in the world and the World Health Organization estimated that the disease will be the third leading cause of death by 2030.^[10,11,15] Therefore, in the absence of interventions to reduce associated risk factors such as smoking and tobacco use, this mortality rate will continue to rise.^[15] This disease imposes a heavy economic burden and exorbitant costs of treatment and care on society and individuals all around the world.^[14] That is why the World Health Organization set a new health target in 2012 to reduce the risk of premature deaths from COPD and other chronic diseases by 25% by 2025.^[15]

To reduce COPD-related death, economic burden, and costs, we must provide an accurate estimate of the burden of this disease. Accordingly, the Disability-Adjusted Life Years (DALY) index, which is one of the indicators of population health, is commonly used to measure the disease burden. DALY is the sum of the years of life lost (YLLs) and the years lived with a disability (YLDs),^[16] Years of Life Lost [Yll]. In addition to calculating the number of deaths, it also considers the age of people at the time of death and gives weight to each person according to the distance between age at death and life expectancy. For example, death at a younger age, which is further away from life expectancy, weighs more.^[17] This index is an efficient tool for health policy makers to make accurate decisions to reduce the burden of this disease. Therefore, due to heavy air pollution in Ahvaz and the high incidence of COPD in this city, this study was conducted to estimate the burden of this disease and calculate its YLLs.

MATERIALS AND METHODS

In this cross-sectional study, we extracted all COPD deaths from the (ADRS) adult respiratory distress syndrome in terms of age, gender, and year of death, according to international classification of diseases10 (ICD-10). In

this system, which is performed by the health center of each province, all possible useful resources are used to detect, record, and collect information, such as hospitals, cemeteries, forensic medicine, health centers, and health homes. The codes used in this study were J40–J44. Duplicate death records were excluded from the study based on the similarity in father's name, date of death, and the national identity code. The age groups used in this study included: 0–4, 5–14, 15–49, 50–69, and over 70 years.

The total populations of cities affiliated to Jundishapur University of Medical Sciences of Ahvaz were estimated using the basic data of the health centers and the census performed between 2011 and 2016, according to the annual growth of the population. For standardization, the standard population of the year 2013 for low- and middle-income countries was used.

Statistical analysis

The crude mortality and age-standardized rate (ASR) of COPD by gender and death year were calculated. The joinpoint regression was applied to calculate the mortality rate during the study period. A *P* value less than 0.05 was considered statistically significant. Data were analyzed using SPSS 22.0 and Excel 2016.

To calculate the YLL, using a standard life table, determine life expectancy for different age and sex groups, and calculate the number of deaths due to chronic COPD, in each age group, the following relationship is followed.^[12]

$$YLL = N C e^{(ra)} / (\beta + r)^2 [e^{-(\beta+r)(L+a)} [-(\beta+r)(L+a) - 1] - e^{-(\beta+r)a} [-(\beta+r)a - 1]]$$

Where

N = the number of deaths at a certain age and gender.

L = the standard life expectancy of the victims at the same age and gender.

r = discounting rate which is 0.03.

β = a contract in calculating the age value, which is equal 0.44.

C = a constant adjusted value equal to 0.1658.

a = age at death. *e* = constant equal to 2.71.

Analysis of the number of YLLs due to premature death from COPD by using the YLL template 2015 was conducted using EXEL 2016.

To examine the trend for different years, joinpoint regression based on the log-linear model was applied. To examine the trend for different years, joinpoint regression based on the log-linear model was used. Joinpoint regression analysis describes changing trends over successive segments of

time and the amount of increase or decrease within each segment. The resulting line segment between joinpoints is described by the annual percent change (APC) that is based on the slope of the line segment and the average annual percent change. The analysis of the trend was carried out by Joinpoint Regression Program 4.9.0.0.

The protocol of this study was examined and approved by the Research Ethics Committee of Jundishapur University of Medical Sciences, Ahvaz, Iran with the ethical code IR.AJUMS.REC 1399,906.

RESULTS

During the 9-year study period (2011–2019), 715 deaths from COPD occurred in the cities affiliated to Ahwaz Jundishapur University of Medical Sciences. Of these, 65.0% (*n* = 465) were men and 52.6% (*n* = 376) were in the age group of over 70 years.

As seen in Table 1, the crude mortality rate decreased from 4.0 (per 100,000 population) in 2011 to 2.2 in 2019 in men (*p* for trend = 0.305), while it decreased from 3.0 (per 100,000 population) in 2011 to 0.9 in 2019 (*p* for trend = 0.175) in women. Also, the standardized mortality rate was shown to decrease from 7.1 (per 100,000 population) in 2011 to 2.6 (per 100,000 population) in 2019 in men (*p* for trend = 0.117), whereas it decreased from 5.0 (per 100,000 population) in 2011 to 1.1(per 100,000 population) in 2019 in women (*p* for trend = 0.124).

Total YLLs during the study period were 5747 (0.4 per 1000) in men, 2903 (0.2 per 1000) in women, and 8650 (0.3 per 1000) in both gender (male/female sex ratio, 2.0) [Table 1].

The highest number of deaths in both genders was observed in the age group of over 70 years, while the lowest number of deaths in men was in the age group of 0–4 years and the age group of 5–14 years in women [Figure 1].

The highest and lowest YLLs were, respectively, in the age groups of 50–69 and 0–4 years in men, and in the age groups over 70 years and 5–14 years in women [Figure 2].

According to the joinpoint regression, the 9-year trend of YLL rate due to premature mortality was decreasing: APC was -1.5% (95% CI -11.8 to 10.1, *P* = 0.761) for male, -10.7% (95% CI -24.7 to 5.8, *P* = 0.158) and -6.6% (95% CI -20.7 to 9.9, *P* = 0.280) for both genders.

The model shows one join point in 2014 for total when the APC was -29.4% (95% CI -56.9 to 15.6, *P* = 0.121).

DISCUSSION

The present study was performed on 715 COPD deaths in the cities affiliated to Ahwaz University of Medical Sciences between 2011 and 2019. COPD is a chronic respiratory disease,^[1] with many complications and a high mortality rate. In 2017, chronic respiratory diseases were the third leading cause of all-cause mortality rate, and a total of 3,914,196 COPD-related deaths occurred throughout the world, with an 18% increase compared to 1990.^[1] Of the total 715 deaths that occurred during the study period, 65% occurred in men and 52.6% in those over 70 years of age. A study in Iran showed that the number of COPD deaths in Iran was 39,064, accounting for approximately 2.8% of all deaths between 1995 and 2015.^[11] In Poland, COPD accounted for 1.8% of all deaths between 1999 and 2014.^[10] In the Chinese province of Hubei, COPD was responsible for 10.05% of all deaths in 2015.^[14]

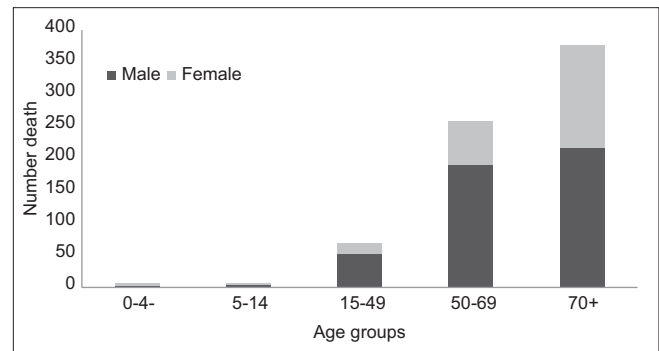


Figure 1: Number of deaths due to COPD by sex and age groups

Table 1: Crude and standardized mortality rate (per 100,000 population) and YLLs due to COPD by gender and year in the cities affiliated to Ahwaz University of Medical Sciences during 2011-2019

Year	No. death		Crude mortality rate		ASR (95%CI)		YLL			
	Male	Female	Male	Female	Male	Female	No.		(Per 1000)	
							Male	Female	Male	Female
2011	58	43	4.0	3.0	7.1 (6.1-8.1)	5.0 (4.1-5.9)	746	596	05	0.4
2012	80	53	5.5	3.7	7.9 (6.7-9.1)	5.0 (4.0-6.0)	922	582	0.6	0.4
2013	55	26	3.7	1.8	5.7 (4.7-6.7)	2.5 (1.8-3.2)	620	230	0.4	0.2
2014	28	17	1.9	1.2	2.7 (2.0-3.4)	1.5 (1.0-2.0)	366	216	0.2	0.1
2015	43	12	2.9	0.8	3.9 (3.0-4.8)	1.1 (0.6-1.6)	527	123	0.4	0.1
2016	44	16	2.9	1.1	4.0 (3.1-4.9)	1.6 (1.1-2.1)	495	181	0.3	0.1
2017	65	38	4.2	2.5	5.8 (4.8-6.8)	3.5 (2.7-4.3)	854	416	0.6	0.3
2018	58	31	3.8	2.1	5.2 (4.2-6.2)	2.7 (2.0-3.4)	667	331	0.4	0.2
2019	34	14	2.2	0.9	2.6 (1.9-3.3)	1.1 (0.6-1.6)	550	228	0.4	0.1
Total	465	250	3.4	1.9	4.9 (4.6-5.2)	2.6 (2.4-2.8)	5747	2903	0.4	0.2

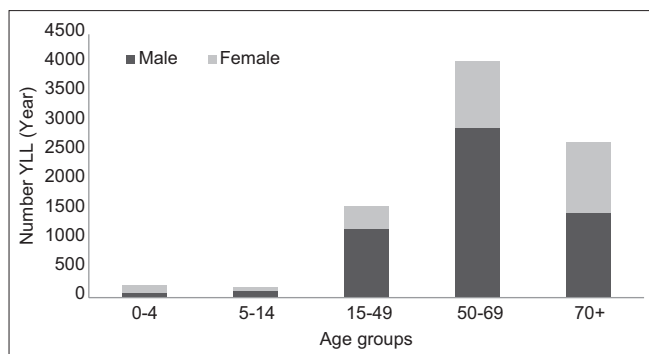


Figure 2: Years of life lost due to COPD by sex and age groups

According to the results of our study, a crude mortality rate of COPD decreased from 4% in 2011 to 2.2% in 2019 in men and from 3 to 0.9% in women. Tang and colleagues conducted a study in Hebei, China, and reported a decreasing trend in COPD mortality over a 25-year period.^[14] Similar to the results of our study, a systematic review study showed that the COPD mortality rate had a decreasing trend from 1990 to 2017.^[1] In Poland, this declining trend of COPD mortality rate was also observed from 1990 to 2014.^[10]

The results of our study also showed that the ASR had a decreasing trend in both men and women. The ASR ranged from 7.2 in France to 36.1 per 100,000 people in Hungary^[18] and was decreased from 188.68 in 1990 to 74.94 per 100,000 in 2015 in Hebei state,^[14] while it decreased from 235.2% in 1990 to 90.5% in 2010 in China.^[13] Other studies have shown similar trends.^[8,13,16,19] This declining trend can be due to the development of diagnostic and therapeutic methods and improved access to health services, and subsequently, timely treatment and effective prevention of death due to COPD.^[14]

In our study, YLLs were in an order 0.4 and 0.2 in men and women per 1000, with a decreasing trend over a 9-year period. This decreasing trend has been reported in other previous studies. In China, COPD is also recognized as one of the main causes of YLL. In Jiangsu, COPD caused, respectively, 1.76 and 1.18 YLLs in men and women in 2007.^[20] During a 16-year period in Poland, it decreased by 22% from 1999 to 2014, with 31.8% reduction in men,^[10] 27.2% increase in urban women, and a 10% reduction among rural women.^[10] Another study conducted in Iran showed that the COPD YLL increased by 48% from 1995 to 2015.^[11] The results of the GBD2015 study showed that increased life expectancy and aging were associated with reduced overall health status and increased morbidities. However, it must be noted that the technology advancement and availability of effective treatment and timely treatment have led to significant prevention of COPD deaths.^[14]

The number of COPD-attributable YLL in our study was two times higher in men than in women. A study performed in Finland showed that YLL was reported 4.7 for men and 2.0 for women per 1000.^[21] Another study showed

that 78% of those with COPD were males.^[22] Other studies, similar to our study, reported higher COPD-attributable YLL in men.^[13,23] Higher YLL among males can be attributed to many reasons, including the higher number of male death cases^[11] and higher number of risk factors for COPD in men.^[24,25] In addition, in Iran, demographic structure and characteristics also play a considerable role in higher COPD YLL in men.^[11] Other reasons than can explain higher COPD YLL among men include a higher population of men, higher prevalence of smoking among men, and higher environmental exposures, such as tobacco and pollutants among male individuals.^[10]

In our study, the highest number of YLLs was seen in men aged 50–69 years and women over 70 years of age. One study found that the risk of COPD death was higher in the age group of 45–49 years compared to other age groups.^[16] A study in Ethiopia also found that about 60% of COPD deaths occurred in people over the age of 30 years.^[26] It should be mentioned that a higher proportion of the COPD burden in this age group can be due to the population structure of Iran and also exposure to COPD-related risk factors, such as air pollution, smoking, and occupational exposures, are more likely in this age group.^[11]

Limitations

The obtained rates and values may be underestimated due to the use of different criteria and diagnostic methods, as well as the investigation of different age groups,^[27] and uncoordinated coding of the disease; thus, results should be interpreted with caution.^[6]

CONCLUSION

COPD is one of the leading causes of death in many countries, that is, the World Health Organization has identified it as the fourth leading cause of death in the world.^[6] The disease is known as a major public health challenge.^[10] Despite the recent reduction in the number of COPD-attributed YLLs, we must keep in mind that the risk factors for this disease are increasing. Therefore, updated information on population distribution, risk factors, and COPD mortality trends is quite useful for physicians and health policymakers. Estimating the trend of YLLs due to COPD can effectively help and lead the way of health policymakers and provide useful information to estimate the economic burden of the disease and assess health needs and priorities of a population.

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Conflicts of interest

There are no conflicts of interest.

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