

Death Specific Rate Due to Asthma and Chronic Obstructive Pulmonary Disease in Iran

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Abstract

Background: Asthma and COPD could be considered as a major health problem in industrialized and developing countries. The present study was designed to analyze the trends of mortality from asthma and COPD at national and sub-national levels in Iran based on national death registry, from 2001 to 2015.

Methods: We used Death Registration System (DRS) as the basic source of data. DRS data were available from 1995 to 2010 in Iran's Ministry of Health. Although, Tehran and Isfahan, two most populated cities in Iran, had independent death registry systems in their cemeteries, by combining their data we achieved more comprehensive and representative data on death among Iranian people. We addressed incompleteness and misclassification of death registry system using demographic and statistical methods. We also employed spatio-temporal and Gaussian process regression (GPR) to extrapolate and interpolate mortality rates for the missing data.

Results: Age-standardized asthma mortality rate was 7.2 (5.6-9.2) in females and 8.8 (6.9-11.1) in males at the national level in 2015. Age-standardized COPD mortality rates in females and males, respectively, were 8.46 (6.6-10.9) and 12.38 (9.8-15.6) during the studied years. A reduction in age-standardized asthma mortality was observed during the period of study. In addition, the trend of COPD mortality was increasing.

Conclusion: It seems that mortality rate attributable to COPD has risen during the past 15 years in Iran. It could have increased due to increased exposure of people to related risk factors such as air pollution which is a common problem in larger cities and border provinces.

KEYWORDS: Asthma, COPD, mortality, Iran

Introduction

Asthma and Chronic Obstructive Pulmonary Disease (COPD) could be considered as a major health problem in industrialized and developing countries [1]. In 2015, the Institute for Health Metric and Evaluation (IHME) estimated that more than 3.58 million cases of mortality was due to asthma and COPD all over the world [2]. COPD was the fourth main cause of death worldwide in 2015 [3]. Moreover, COPD is one of the top ten major causes of mortality, with a growing number of mortality, globally [4]. Furthermore, asthma and COPD impose a huge economic burden on health care systems in industrialized and developing countries [5-7]. While asthma is observed in all age groups, COPD is more common in adults [7].

There is a scarcity in data on mortality from asthma and COPD in developing countries [5]. Also, the trend of cause-specific mortality rate is an appropriate indicator for the measurement of the performance of health care services [8-10]. Moreover, cause-specific mortality rate could demonstrate the status of health risk factors in different communities. Furthermore, it is an important component to estimate the burden of diseases [11]. Cause-specific mortality is a critical input for making policies, planning interventions, and prioritizing research and could also be utilized to achieve a snapshot of the health status at international and national levels.

The present study was designed to analyze the trend of mortality from asthma and COPD at national and sub-national levels in Iran based on national death registries, from 2001 to 2015. The results of this study will provide important information to estimate the level and trend of burden of asthma and COPD which in turn provides data for the ongoing study of the National and Subnational Burden of Diseases, Injuries, and Risk Factors (NASBOD) in Iran [12].

Method

This study aimed to calculate cause-specific mortality rates of asthma and COPD at the national and sub-national levels in Iran from 2001 to 2015. To achieve age-specific groups, the total number of the subjects were divided into 18 age groups with five-year age intervals.

Data preparation

We used the data obtained from Death registration system (DRS) and two major cemeteries in Tehran and Esfahan (Behesht-e-Zahra and Bagh-e-Rezvan) and employed demographic and statistical models to address incompleteness and misclassification and interpolated and extrapolated mortality rates for the missing data from 2001 to 2015 by age, sex, and province.

This study is a part of a larger study entitled the National and Subnational Burden of Diseases, Injuries, and Risk Factors (NASBOD) in Iran that is aimed to estimate the burden of diseases in Islamic republic of Iran [12]. We estimated the level of all-cause mortality by sex, age, year, and province and then we employed cause fraction of mortality of asthma and COPD to estimate cause-specific mortality rate for

asthma and COPD in all the subgroups. Another study from NASBOD estimated incompleteness of DRS for children and adults at national and sub-national levels in Iran [13]. The other study from NASBOD addressed misclassification of DRS and estimated cause of deaths for 165 diseases and injuries [14]. In this paper, we used the results of that study to estimate cause-specific mortality rates for asthma and COPD by age and sex at national and sub-national levels [14].

DRS was our basic source of data. DRS data were available from 1995 to 2010 in the Ministry of Health. Although, Tehran and Isfahan, two most populated provinces in Iran, had independent death registry systems in their cemeteries, by combining their data we concluded a comprehensive draft which represented Iran's death data. [14].

In addition, we used covariates including wealth index, years of schooling, and urbanization to run the regression model [15]. Briefly, we used Generalized Linear Mixed Model, age-spatio-temporal and Gaussian Process Regression (GPR) models to estimate all-cause mortality rates [16]. Mixed model included random effects of provinces and fixed effects of covariates including years of schooling, urbanization, and wealth index. The residuals from the mixed model were weighted on the basis of space, time and age, and then the weighted residuals were added to previous estimates. Finally, GPR modeling (sampling and non-sampling variance) were used to estimate uncertainty interval for each point estimate [17].

In order to estimate cause-specific mortality rates, all-cause mortality rates were divided into causes specific rates on the basis of cause fractions. These fractions for all age-sex groups were calculated for each province and year. A similar modeling, as mentioned above, was applied to address missing data points and extrapolate, however, a simulation approach was used to estimate uncertainty intervals [14].

Results

The total number of mortality from asthma and COPD in Iran in 2015 was 6,686 cases (5,152-8,677) and 8,832 (6830-11392), respectively (Table 1). The findings showed a reduction in age-sex standardized asthma mortality rate, while the COPD mortality rate increased during the period of the study (Figure 1).

The death rate from asthma slightly decreased in both males and females. While, this death rate from COPD increased (about six times from 2001 to 2015) (Table 2). Furthermore, the death rate from COPD was higher among males than females. Age-sex standardized asthma mortality rate at the national levels decreased in females from 8.4 (6.7-10.6) in 2001 to 7.2 (5.6-9.2) in 2015. The age-sex standardized COPD mortality rate in males increased from 3.65 (2.9-4.6) to 12.38 (9.8-15.6) during the same period of time.

Furthermore, there was a large diversity between provinces in terms of asthma and COPD mortality rates during the period of the study (Table 3). Tehran and eastern provinces of Iran had the highest rates of mortality from asthma. In addition, Tehran and other largest cities in Iran had the highest rate of mortality from COPD. Besides, almost all the small provinces had the lowest rate of mortality from COPD. The rate of mortality from COPD differed by more than 2.5 times between the least and the most populated provinces (Figures 2, 3) (Table 3). Furthermore, the annual percent of change in asthma to COPD ratio by province in 2001 and 2015 has been demonstrated (depicted) in figure 4.

Discussion

To the best of our knowledge, this study is the first quantitative report about the mortality from asthma and COPD in Iran. The results showed the declining trend of age-standardized mortality from asthma during 2001 to 2015. In contrast, the rate of mortality from COPD increased over the studied years. It can be due to the promotion in people's access to health care services. The studies have shown that with aging of the population, the prevalence of COPD is increased [18]. Based on the results, the increase in COPD mortality rate that was observed in our study might be attributed to both the decline in birth rate and the increase in life span among Iranian population. De Marco et al. found that aging had a relationship with decreased prevalence of asthma and increased prevalence of COPD [19]. Better diagnosis might be the other potential cause of increase in the COPD-specific mortality rate. The decline in COPD mortality rate is also reported in some other countries [20]. Although in this study, the rate of mortality from COPD had increased in both sexes, the results of a study in England and Wales showed an increase in COPD mortality rate in females, but it reported a decrease in males [21]. Apparently as a patient grows old, it becomes more probable to be diagnosed with COPD, rather than with asthma [22]. So, nationally lung specialists' propensity attributes deaths to COPD instead of asthma [19]. The report on mortality from asthma and COPD estimated by IHME and the global burden of disease reinforced our results in 2015 [2].

Over the period of the study, because of increased access to new medications the quality of treatment and care for serious and fatal cases of asthma was improved. Moreover, it might be the result of improvement in medical education over recent years which helped physicians to become more familiar with the management of severe asthma. Moreover, the number of intensive care units that are needed for the management of cases with severe asthma has significantly increased in Iran during recent years [23].

In recent years, the days with high levels of ambient air pollution per year increased almost in all of provinces that are located at south, center, and western border of Iran [24]. A study in Tehran indicated that air quality of Tehran during of time period 2002 to 2012 12% decreased (). Moreover, air pollutants have an important role in increasing the prevalence of COPD and even asthma [25, 26]. Other study reported that air pollution may have a role in exacerbation and even mortality due to COPD and asthma [27, 28]. Therefore, these higher levels of air particulate and pollution could be a reason for increasing COPD mortality rate in Iran. Furthermore, based on our study results, it can be an important reason for changing the trend of asthma to COPD mortality.

COPD mortality rate in all age-sex groups were higher in males than females[29]. It can be due to the higher prevalence of smoking among males than females in Iran [30]. Previous studies showed that the trend of smoking prevalence is increasing among Iranian adolescents[31]. Nevertheless, Humerfelt et al. found a significant association between getting worse airflow obstruction disease and metal fumes, sulfur dioxide gas, nitrous gas, and ammonia [32]. It seems that men are more exposed to occupational injuries and environmental pollution, so these factors are expected to increase a higher rate of mortality from COPD in men, than in women.

In other word, using of biomass in Iran has decreased over 20 years because extension of access to gas fuel in rural regions. Although there was not any published documents to decrease contact of rural women to

biomass fuel in Iran, the formal reports indicated that utilization of gas fuel is increase exponentially in rural community during recent twenty years, because of extending of gas piping. It seems that this factor may be had effect on changing in the mortality due to COPD.

We observed geographic disparities in asthma and COPD mortality in different provinces of Iran. Tehran and eastern provinces had the highest asthma and COPD mortality rates. The high rate of asthma and COPD mortality in Tehran might be attributed to the high density of vehicles and the large number of pollutant industries; thus, pollutants originated from fossil fuels could be possible cause of pollution and diseases. Moreover, the high mortality rates observed in eastern region of Iran especially in Sistan and Baluchistan could be attributed to ambient air pollutants and dust that are produced by seasonal winds as well as deforestation, and loss of forest per capita; these factors have reduced the age of onset of asthma and COPD in these regions, too. Moreover, the annual percentage of change that have been used to show how mortality rates change over the years, and this epidemiological justification is indeed acceptable. For instance, the provinces of west and south west are the ones with the highest percentage of annual change due to the fact that these provinces are exposed to dust entering from those areas of Iran. Also, according to previous study, the prevalence rate of smoking in Alborz's cities was observed 50% which has direct association with increasing of respiratory diseases [33]. Another point noticeable looking at the average changes is that the percentage of annual changes is not considerably large (about 5%) because in general the mortality of COPD worldwide has increased since 2001, as pointed out in other studies [34].

Furthermore, a study reported that, the prevalence of smoking has an increasing trend in Iranian population (31). Indeed, the previous studies proved an association between smoking and increasing prevalence of mortality from asthma and COPD in adults (34).

Considering the fact that smoking and air pollution are both risk factors for COPD (14), it is necessary to plan smoking secession interventions and air pollution reduction programs, as public health priorities. Moreover, people who live in metropolitan areas and those who are exposed to occupational pollution should be monitored regularly.

This study had some limitations. All health registry data have some problems such as incompleteness, misclassification, and duplications. We tried to address these problems (14). Accordingly, lots of issues were solved, but correction of DRS could increase the validity of future studies. Another limitation of the study was the scarcity of data, which was addressed in our analysis by using regression models.

Conclusion

These findings are the first results on mortality rate from asthma and COPD at national and subnational levels in Iran. Our results showed that there are inequalities in asthma and COPD mortalities at the provincial levels in Iran. To decrease inequality, it is recommended to plan for reducing ambient air pollutants by increasing vegetation areas and decreasing industrial air pollutants. In addition, further studies are required to confirm our findings and determine additional causes for changes in mortality rate due to asthma and COPD.

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Conflict of interest

All authors state no conflicts of interest.

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Figure 1. Mortality comparison between Asthma and COPD during 2001 to 2015.

Figure 2: Status of provinces of Iran, in terms of Asthma mortality rates (per 100,000) in 2001 and 2015

Figure 3: Status of provinces of Iran, in terms of COPD mortality rates (per 100,000) in 2001 and 2015

Figure 4: Annually Percent of Change Asthma to COPD ratio from 2001-2015

Table 1. Descriptive analysis of total number of death for all-ages due to Asthma & COPD among Iranian population since 1990-2015

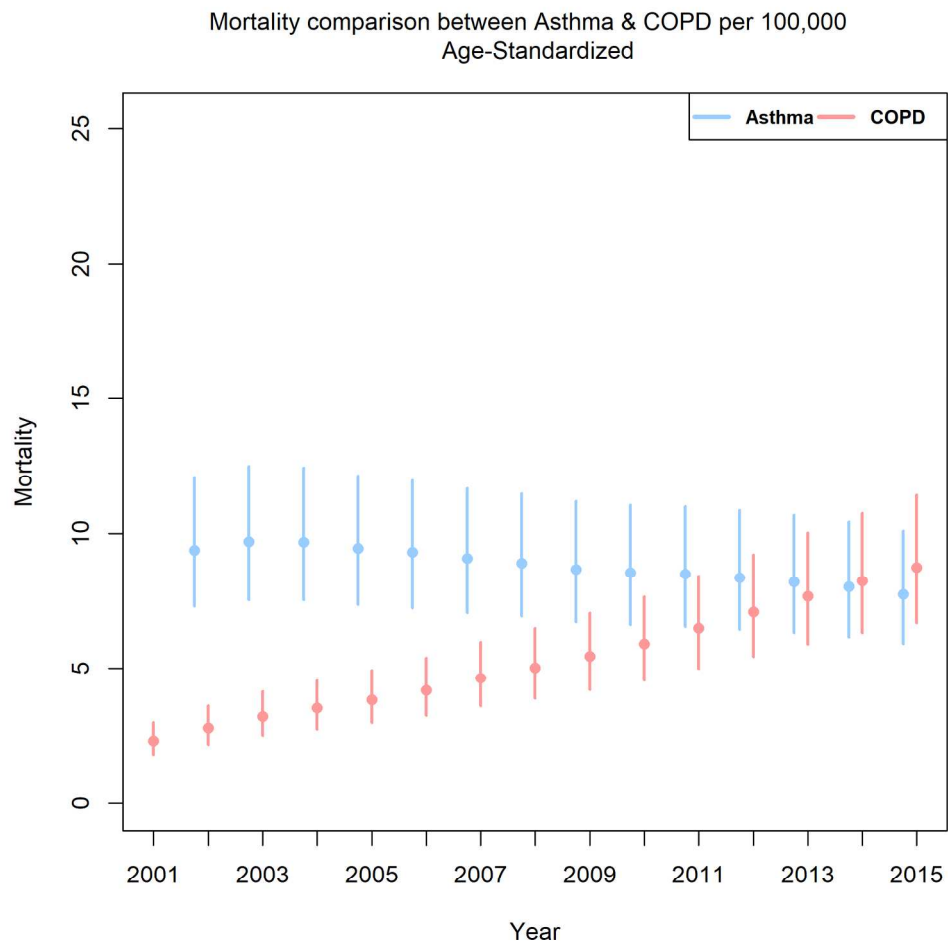
year	Asthma	COPD
2001	13010 (10166-16661)	3665 (2863-4699)
2002	13024 (10185-16675)	4304 (3370-5510)
2003	12773 (9989-16337)	4842 (3795-6188)
2004	12181 (9532-15573)	5204 (4084-6641)
2005	11658 (9122-14909)	5470 (4292-6979)
2006	11067 (8665-14146)	5793 (4546-7388)
2007	10536 (8245-13466)	6208 (4867-7918)
2008	10055 (7856-12876)	6577 (5150-8404)
2009	9597 (7480-12308)	6871 (5369-8800)
2010	9197 (7150-11822)	7176 (5594-9201)
2011	8837 (6864-11377)	7723 (6012-9907)
2012	8378 (6497-10810)	8139 (6327-10460)
2013	7871 (6091-10161)	8474 (6575-10912)
2014	7295 (5632-9444)	8707 (6751-11223)
2015	6686 (5152-8677)	8832 (6830-11392)

Table 2. Mortality rates of Asthma & COPD per 100,000 among Iranian population since 2001-2015

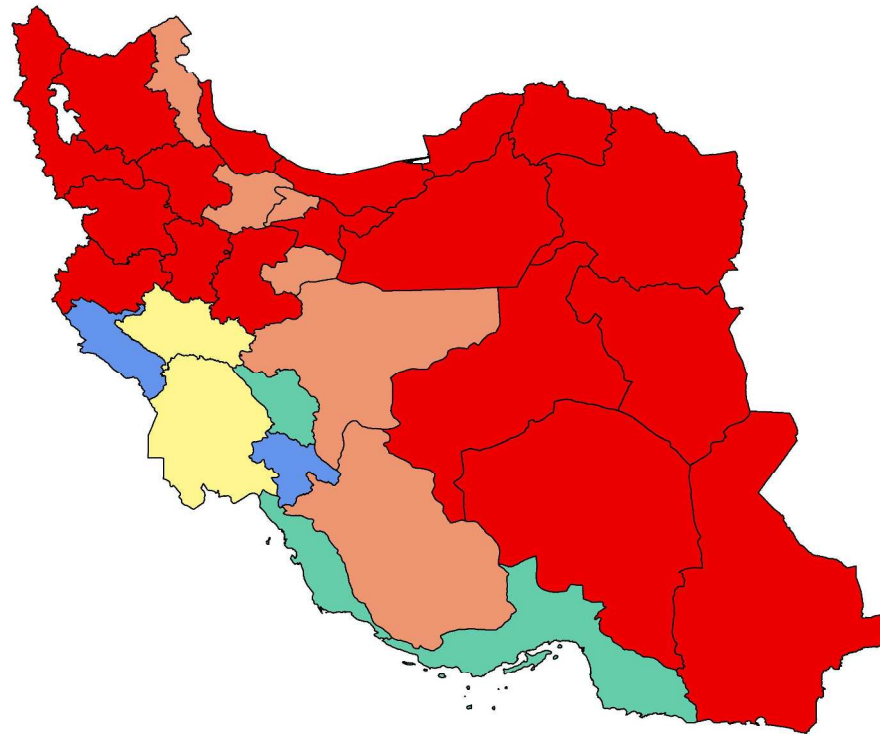
sex	year	Asthma	COPD
Female	2001	8.4(6.7-10.6)	2.2(1.7-2.8)
Male	2001	11.8(9.4-14.6)	3.6(2.9-4.6)
Female	2002	8.8(7-11)	2.6 (2.1-3.3)
Male	2002	12.1(9.7-15)	4.4 (3.6-5.5)
Female	2003	8.8(7-11.1)	3.0 (2.4-3.8)
Male	2003	12.3(9.9-15.3)	5.1 (4.1-6.4)
Female	2004	8.7(6.9-10.9)	3.3 (2.6-4.2)
Male	2004	12.2(9.9-15.2)	5.7 (4.6-7.1)
Female	2005	8.6(6.8-10.9)	3.6 (2.9-4.6)
Male	2005	12.1(9.8-15.1)	6.2(5-7.7)
Female	2006	8.5(6.7-10.7)	4.0(3.1-5)
Male	2006	12(9.6-14.9)	6.8(5.4-8.4)
Female	2007	8.4(6.6-10.6)	4.4 (3.5-5.6)
Male	2007	11.7(9.4-14.5)	7.4(5.9-9.2)
Female	2008	8.1(6.4-10.3)	4.7 (3.7-6)
Male	2008	11.4(9.1-14.2)	8.0(6.4-9.9)
Female	2009	8(6.3-10.2)	5.1 (4-6.5)
Male	2009	11(8.8-13.7)	8.4 (6.7-10.5)
Female	2010	8(6.3-10.1)	5.6(4.4-7.1)
Male	2010	10.7(8.6-13.4)	8.9 (7.1-11.2)
Female	2011	7.9(6.2-10.1)	6.2(4.8-7.9)
Male	2011	10.6(8.4-13.2)	9.9(7.9-12.4)
Female	2012	7.8(6.1-10)	6.8(5.3-8.7)
Male	2012	10.3(8.2-12.9)	10.7(8.5-13.4)
Female	2013	7.7(6-9.8)	7.4(5.8-9.5)
Male	2013	9.9(7.9-12.5)	11.4 (9.1-14.3)
Female	2014	7.4(5.8-9.5)	7.9 (6.2-10.2)
Male	2014	9.4(7.4-11.8)	12.0(9.5-15.1)
Female	2015	7.2(5.6-9.2)	8.5(6.6-10.9)
Male	2015	8.8(6.9-11.1)	12.4(9.8-15.6)

Table 3. Age-standardize mortality rates due to Asthma & COPD per 100,000 among Iranian provinces for the years 2001,2005,2010,2015

province	2001		2005		2010		2015	
	Asthma	COPD	Asthma	COPD	Asthma	COPD	Asthma	COPD
Markazi	11.2(9.2-13.6)	3(2.4-3.6)	11.3(9.2-13.7)	5.3(4.3-6.5)	10.2(8.3-12.5)	8.5(6.9-10.4)	8.6(6.9-10.6)	12.4(10-15.3)
Gilan	9.7(7.8-12)	2.3(1.8-2.8)	9.9(7.9-12.2)	3.9(3.1-4.8)	8.6(6.9-10.8)	6.2(4.9-7.9)	7.6(6-9.6)	9.2(7.2-11.6)
Mazandaran	10.4(8.2-13.1)	2.3(1.8-2.9)	10.7(8.4-13.6)	4.1(3.2-5.2)	9.5(7.4-12.2)	6.3(4.8-8.2)	8(6.1-10.4)	9(6.8-11.7)
Azarbaijan,East	15.1(12.2-18.6)	4.1(3.3-5.1)	15.3(12.3-18.9)	6.8(5.5-8.4)	13.6(10.9-16.9)	10.2(8.2-12.7)	11.2(8.9-14.1)	13.8(11-17.3)
Azarbaijan,West	15.2(12.5-18.4)	3.9(3.2-4.8)	14.9(12.3-18.1)	6.5(5.4-7.9)	12.2(10-14.9)	8.7(7.1-10.6)	9.6(7.7-11.8)	11.6(9.4-14.3)
Kermanshah	9.6(7.9-11.7)	3.5(2.8-4.2)	10.2(8.4-12.4)	6.1(5-7.4)	9.7(7.9-11.8)	9.1(7.4-11.2)	8.4(6.7-10.4)	13.6(10.9-16.8)
Khuzestan	8.1(6.5-10)	2.5(2-3.1)	7.9(6.4-9.8)	4.3(3.5-5.4)	7.6(6.1-9.5)	7.1(5.7-8.8)	7(5.5-8.8)	10.7(8.5-13.4)
Fars	8.9(7.2-11.1)	2.7(2.2-3.3)	8.4(6.8-10.5)	4.2(3.4-5.2)	7(5.6-8.8)	5.6(4.4-7)	6.4(5-8.1)	8.7(6.8-11.1)
Kerman	11.1(9.1-13.3)	2.8(2.3-3.4)	12.3(10.1-15)	5.9(4.9-7.2)	12.2(9.9-15)	10.3(8.4-12.7)	10.5(8.4-13)	14.7(11.8-18.2)
Khorasan,Razavi	15.3(12.2-19.1)	4.3(3.4-5.4)	14.4(11.4-18.1)	7(5.5-8.8)	12.1(9.5-15.3)	9.3(7.3-11.8)	9.4(7.3-12.1)	12.5(9.7-16)
Isfahan	9.5(7.4-12.2)	2.8(2.2-3.5)	9.9(7.7-12.8)	5(3.9-6.4)	9.5(7.3-12.3)	7.9(6.1-10.2)	8.6(6.5-11.3)	12.4(9.5-16.2)
Sistan and Baluchestan	12.6(9.8-16.2)	2.7(2.1-3.6)	14.5(11.2-18.5)	6(4.6-7.8)	13.1(10.2-16.8)	9(7-11.6)	11.3(8.7-14.5)	13.1(10.1-16.8)
Kordestan	10.3(8.5-12.6)	3.2(2.6-3.9)	10(8.2-12)	5.1(4.2-6.2)	8.9(7.3-10.8)	7.4(6.1-8.9)	7.2(5.9-8.9)	10.2(8.3-12.6)
Hamedan	9.9(8.2-11.8)	3.1(2.6-3.8)	10(8.3-12.1)	5.1(4.2-6.2)	9.2(7.5-11.1)	7.8(6.4-9.5)	8(6.5-9.9)	11.4(9.3-14)
Chahr Mahaal and Bakhtiari	7.5(6.1-9.2)	2.1(1.7-2.6)	6.6(5.4-8.1)	3.2(2.6-3.9)	5.4(4.4-6.7)	4.2(3.4-5.2)	5(4-6.2)	6.5(5.2-8.1)
Lorestan	7.7(6.3-9.4)	2.5(2.1-3.1)	7.4(6.1-9)	4(3.3-4.9)	6.5(5.3-7.9)	5.8(4.8-7.1)	5.1(4.1-6.3)	7.7(6.3-9.5)
Ilam	5.2(4.1-6.6)	2.1(1.7-2.7)	5.5(4.4-6.9)	3.2(2.6-4.1)	5.7(4.5-7.2)	5(4-6.3)	4.9(3.9-6.3)	7.4(5.8-9.4)
Kohgiluyeh and Boyer-ahmad	6(4.6-7.8)	1.7(1.3-2.2)	6.6(5.1-8.4)	3(2.3-3.8)	6(4.6-7.8)	4.1(3.2-5.3)	4.9(3.8-6.4)	5.9(4.6-7.6)
Bushehr	7.6(6.1-9.3)	2.7(2.2-3.4)	7.5(6-9.2)	3.8(3.1-4.7)	6.3(5-7.9)	5.3(4.2-6.6)	5.8(4.5-7.3)	8.2(6.5-10.5)
Zanjan	11.1(9.1-13.5)	3.7(3-4.5)	10.5(8.6-13)	5.7(4.6-7)	8.1(6.3-10.3)	6.8(5.2-8.8)	6.1(4.6-8.1)	8.5(6.3-11.6)
Semnan	9.6(7.6-12.1)	2.9(2.3-3.8)	10.6(8.4-13.3)	5.3(4.2-6.7)	9.7(7.7-12.3)	7.3(5.8-9.2)	8.4(6.6-10.6)	10.6(8.3-13.4)
Yazd	10.4(8.4-12.9)	2.8(2.3-3.5)	10.6(8.5-13.1)	5.6(4.5-7)	9.4(7.5-11.7)	8.5(6.8-10.6)	8(6.3-10)	12(9.6-15.1)
Hormozgan	6.6(5.2-8.4)	2.1(1.7-2.7)	7.3(5.8-9.2)	3.6(2.9-4.6)	6(4.6-7.7)	5.1(4-6.6)	5.8(4.4-7.6)	8.4(6.4-10.9)
Tehran	14.2(9.9-20.1)	4(2.8-5.6)	12.7(9-18)	5.7(4.1-8)	10.7(7.6-15.2)	8.2(5.8-11.5)	8.2(5.7-11.6)	10.5(7.4-14.8)
Ardabil	8.4(6.9-10.3)	1.9(1.6-2.4)	9.5(7.8-11.5)	3.4(2.8-4.1)	8.9(7.3-10.9)	5.3(4.3-6.5)	7.7(6.2-9.5)	7.6(6.2-9.4)
Qom	9.5(7.2-12.7)	3.5(2.6-4.6)	9.6(7.3-12.7)	5.9(4.5-7.8)	7.6(5.7-10.1)	7.4(5.6-9.9)	6.4(4.8-8.5)	10.4(7.8-13.8)
Qazvin	8.6(7.1-10.4)	2.6(2.1-3.1)	9(7.4-10.9)	4.4(3.6-5.4)	8.6(7-10.5)	7.2(5.9-8.8)	7(5.7-8.7)	10.2(8.3-12.5)
Golestan	11.7(9.6-14.2)	3(2.5-3.7)	12.7(10.4-15.5)	4.4(3.6-5.3)	12.4(10.1-15.3)	6.4(5.2-7.9)	11.5(9.2-14.3)	9.9(7.9-12.4)
Khorasan,North	11.6(9.1-14.5)	3.5(2.8-4.4)	12.7(10.2-15.9)	5.4(4.3-6.8)	11.6(9.2-14.6)	7.7(6.1-9.7)	9.3(7.3-11.9)	10.7(8.4-13.5)
Khorasan,South	12(9.5-15.2)	3.2(2.5-4)	13(10.2-16.4)	5.3(4.1-6.7)	12.2(9.5-15.4)	7.3(5.8-9.4)	10.2(7.9-13.1)	10.5(8.2-13.5)
Alborz	8.4(6.4-10.9)	2.6(2-3.4)	10(7.8-12.9)	5(3.8-6.4)	11.4(8.8-14.8)	9.4(7.3-12.1)	10.8(8.3-14.1)	14.6(11.3-19)



Asthma 2001

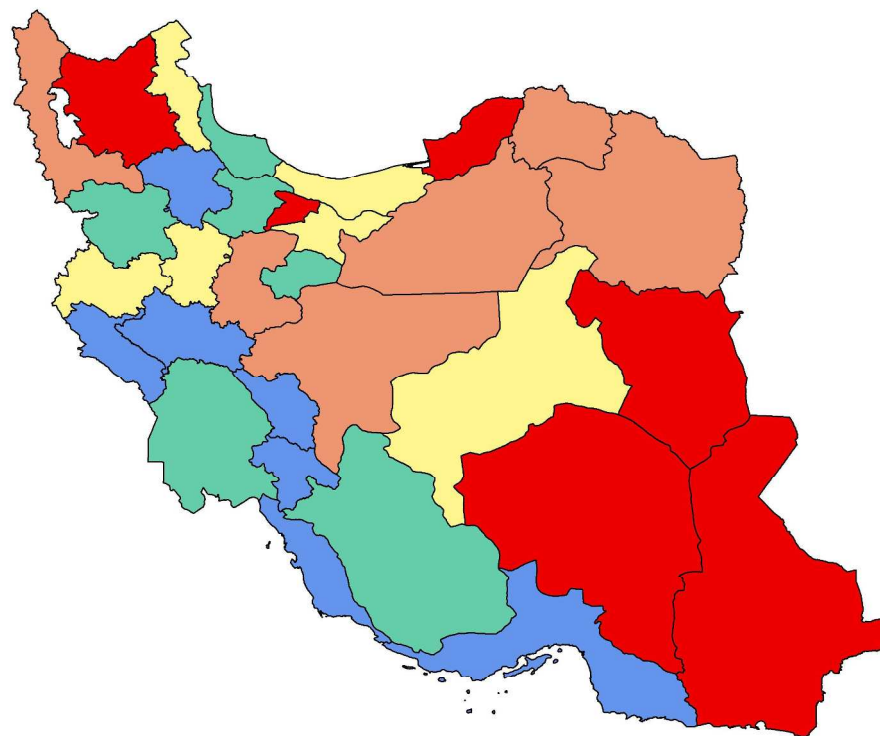


Mortality of Asthma (Rate per 100,000)

[4.9,6.1]	(6.1,7.57]	(7.57,8.37]	(8.37,9.57]	(9.57,11.5]
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Accepted

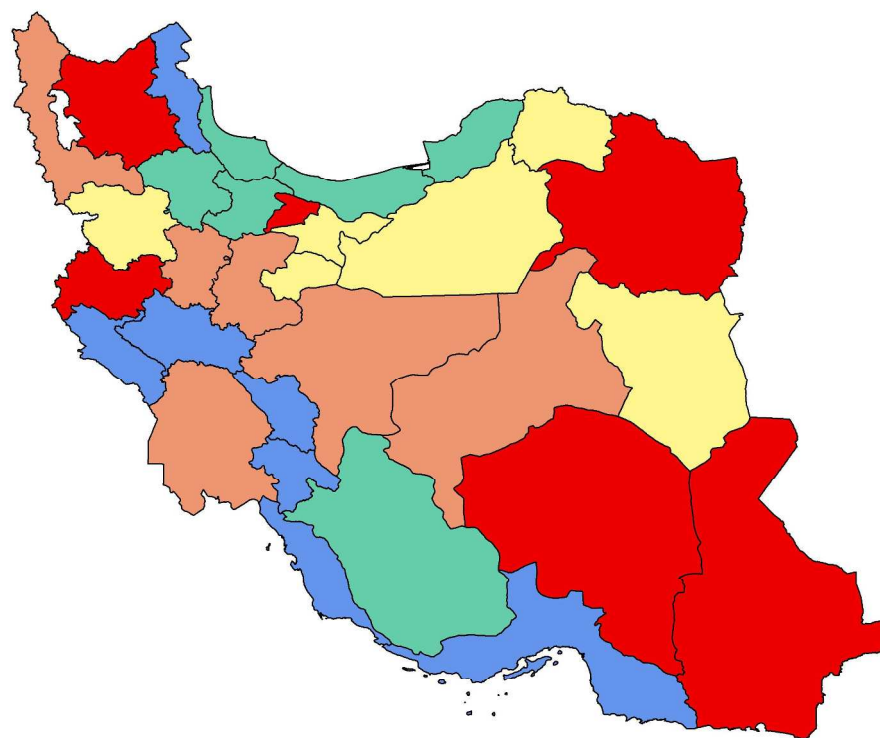
Asthma 2015



Mortality of Asthma (Rate per 100,000)
 [4.9,6.1] [6.1,7.57] [7.57,8.37] [8.37,9.57] [9.57,11.5]

Accepted

COPD
2015



Mortality of COPD (Rate per 100,000)
 [5.89,8.36] (8.36,10.2] (10.2,10.7] (10.7,12.4] (12.4,14.7]

Accepted

Annually Percent of Change Asthma to COPD ratio
from 2001-2015

