

# Years of life lost due to asthma in a population-based 10-year study in Yazd, Iran

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## ABSTRACT

**Introduction:** Asthma is a prevalent disease in both children and adults. Significant progress in the management of asthma and prevention of asthmatic attacks resulted in a reduction of asthma deaths, but there is a variation among different regions based on health-care access and environmental factors. We aimed to investigate the trend of asthma mortality during a 10-year period in Yazd Province, a region in the center of Iran. **Methods:** We obtained our data from the death registry of Yazd health center. This registry collects data from hospitals, clinics, forensic medicine department, and cemeteries. All deaths due to asthma from 2002 to 2011 were included in our study. We used the remaining life expectancy of each person at death and sex group to calculate the years of life lost (YLL) due to asthma. **Results:** Nearly 10,371 years of life was lost due to asthma in our study (M/F ratio of 1.29). Asthma mortality rate increased with age, rising sharply after age 50. Average YLL per death was 18.6 years. Asthma mortality rate decreased from 6.66/100,000 in 2002 to 3.97 in 2011. YLL from asthma among men decreased from 796 in 2002 to 338 in 2011, but among women, it showed an increase from 335 to 534 at the same time. **Conclusion:** The trend of reduction in asthma mortality is not similar between different age and gender groups. Further studies are needed to determine the cause of increasing trend among more vulnerable groups.

**KEY WORDS:** Asthma, mortality, years of potential life lost

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## INTRODUCTION

Asthma is a respiratory multifactorial disease influenced by environment and genetics. The definition of asthma has evolved over time showing the changes in our understanding of the disease.<sup>[1]</sup> However, asthma is better managed in modern medicine, still many environmental factors, and allergens such as pet exposure at home or air pollution of the living area may contribute to the beginning of an asthma attack.<sup>[2,3]</sup>

Asthma attack imposes a significant burden on public health causing the death of about 1,80,000 people annually worldwide with considerable difference

among various regions.<sup>[4]</sup> Regarding the possibility of management and control of asthma, the mortality rate can be reduced considerably. In addition to control of symptoms, interventions should be aimed at reducing the life-threatening outcomes of asthma, most prominently severe asthma attack.<sup>[5]</sup>

Globally, the number of deaths due to asthma has decreased 9.1% worldwide from 380.2 in 1990 to 345.7 in 2010. Age-standardized death rate per 100,000 showed 42.1% reduction decreasing from 9.0 in 1990 to 5.2 in 2010.<sup>[6]</sup> Years of life lost (YLL) is a component of the burden

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of disease which is affected by not only the mortality rate but also the victims' age at death. It has been used for calculating the impact of leading causes of mortality in previous studies.<sup>[7]</sup> In this study, we aim to evaluate asthma mortality and YLL due to that over 10 years.

## METHODS

The population of our study included all people residing in Yazd Province who died from asthma from 2001 to 2011. Yazd is a province with a population of 1,074,428 (M/F ratio: 1.06) according to 2011 census. About 82.8% of the population live in urban areas.<sup>[8]</sup> For data collection, we used the same method used in some other longitudinal studies in this area.<sup>[9]</sup> We obtained mortality data for asthma (C60-C63) based on the International Classification of Diseases-10 codes. The data were collected from the death registration system in Yazd provincial health center. This registry gets data from all available sources including hospitals, cemeteries, and local health facilities. After receiving the monthly death certificates, reports are investigated and duplicates are removed. When we detected an incomplete record, we tried to call the responsible physician or family of the victim to obtain complete information.

A total number of population in this study is based on three national censuses in 1996, 2006, and 2011. The population between these years were estimated based on national growth rates by National Organization for Civil Registration and health center vital horoscope data. Vital horoscope is a tool for collecting health statistics and vital events such as birth and death in Iran rural areas.<sup>[10]</sup> Average mortality rate and YLL were calculated in Excel software. YLL was calculated by the method of global burden of disease study in 2010. In this method, life expectancy of victims in each age/gender group is multiplied by remaining life expectancy to measure YLL. Calculations were done by the World Health Organization standard methods using Excel spreadsheets.<sup>[11,12]</sup> We did statistical analysis by the statistical package for the social sciences (SPSS), Version 16 (IBM Corp., Chicago, Illinois, USA). Chi-square test was used to compare mortality rates in different years and among genders.  $P < 0.05$  was considered statistically significant.

## RESULTS

During 2002–2011, asthma caused the death of 563 people. On average, 33 men and 24 females died in each year due to asthma (M/F ratio: 1.4). Asthma death rate decreased from 6.66/100,000 in 2002 to 5.75 in 2011. However, in the beginning of our study, asthma mortality rate was higher among men (9.65 vs. 3.45/100,000); at the final year of our study, mortality rate among women was higher (3.30 vs. 4.69/100,000) [Table 1]. The crude asthma mortality rate in men is higher compared to women (6.4/100,000 vs. 5/100,000). Sexual difference in

asthma mortality was not significant between males and females ( $P = 0.097$ ).

Mean age of victims in our study was  $73.5 \pm 14.96$  years (males:  $73.72 \pm 13.97$ , females:  $73.20 \pm 16.25$ ). Only one victim was younger than 40 years. Mortality rate for those older than 60 years was 60.2/100,000, respectively. The difference in mortality between 10-year age groups was statistically significant ( $P = 0.003$ ). The incidence of asthma death increased with aging in both genders. The number of deaths began to rise sharply after the age of 60. However, the number of deaths decreased in the oldest age group of >85 years, and mortality rate per 100,000 population continued to rise. Most victims of asthma death are in the age group of 80–84 years [Figure 1].

About 10,470 years was lost due to asthma in the 10-year period of our study (M/F ratio: 1.3). Average YLL for each death due to asthma was 18.6 years. YLL due to asthma decreased from 1131 years in 2002 to 872 in 2011 [Table 2]. This was associated with a reduction among males from 796 in 2002 to 338 in 2011. YLL due to asthma increased from 335 in 2002 to 534 in 2011 among women [Figure 2].

## DISCUSSION

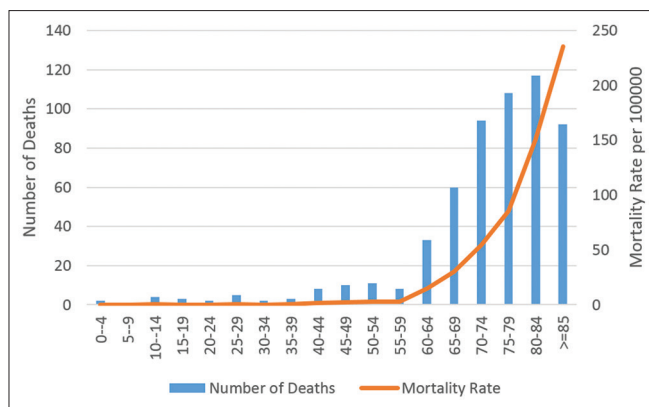
Our study showed that the mortality due to asthma decreased from 6.66/100,000 in 2002 to 3.97 in 2011. This reduction was not similar in both genders. It was associated

**Table 1: Annual number of deaths and mortality rate per 100,000 population in Yazd Province from 2002 to 2011**

Year	Total number of deaths	Population	Mortality rate		
			Male	Female	Total
2002	60	900,964	9.65	3.45	6.66
2003	64	918,385	8.00	5.87	6.97
2004	70	936,013	9.29	5.54	7.48
2005	68	953,855	7.88	6.32	7.13
2006	64	971,917	7.35	5.76	6.58
2007	56	990,791	5.61	5.70	5.65
2008	43	1,006,492	4.60	3.92	4.27
2009	52	1,022,680	4.92	5.26	5.08
2010	44	1,039,392	4.46	3.99	4.23
2011	42	1,056,638	3.30	4.69	3.97

**Table 2: Annual years of life lost due to asthma in Yazd Province from 2002 to 2011 classified by age group**

Age group	Years of life lost		
	Male	Female	Total
0-10	85.2	166.5	251.7
10-20	218.9	300.2	519.1
20-30	317	122.8	439.8
30-40	54.5	209	263.5
40-50	479	311.8	790.8
50-60	421.7	245.6	667.3
60-70	1237	1078.4	2315.4
70-80	2062.3	1312.7	3375
80-90	995.4	686.8	1682.2
>90	75.8	89.9	165.7
Total	5946.8	4523.7	10,470.5

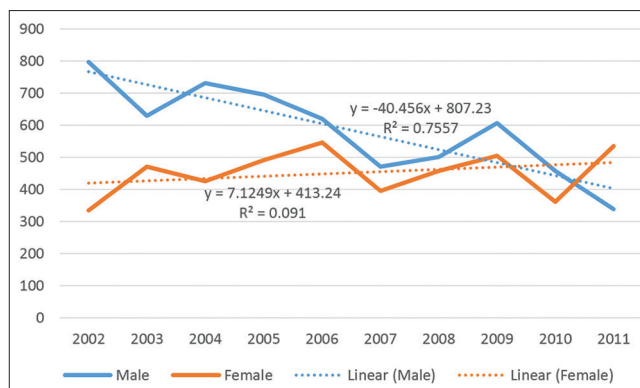


**Figure 1:** Mortality due to asthma in Yazd Province from 2002 to 2011 among classified by age group

with a significant decrease among men and an increase among women. YLL due to asthma mortality followed a similar pattern. Asthma YLL among men decreased from 796 years in 2002 to 338 in 2011, while among women, it increased from 335 years to 534 in the same period. This overall reduction in asthma mortality was seen in similar studies. In a study in Japan investigating the trend of asthma mortality in the second half of the 20<sup>th</sup> century, overall asthma mortality decreased in both sexes despite an increased mortality among 5–34 years.<sup>[13]</sup> In Europe, asthma mortality decreased from 6287 in 1985 to 1164 in 2012 which showed about 80% reduction.<sup>[14]</sup>

However, asthma mortality rates are widely different among countries; it should be noted that type of registering death, coding, and obtaining information from death certificates plays a role in this difference.<sup>[15]</sup> The most severe presentations of asthma are fatal and near-fatal attacks. In addition to asphyxia, respiratory arrest can cause cardiac arrhythmia leading to death. Regarding the important role of age, using an index that considers age at death in addition to mortality rate can provide a better picture. Therefore, calculating YLL can provide us with a meaningful index to evaluate the loss of society due to a disease.<sup>[16]</sup>

In a study, it was shown that the prevalence of asthma is increasing in different countries. The most prominent increases were seen in Australia, Canada, and the United Kingdom which are among the countries with the highest rate of asthma. However, even in Asian countries such as China with low baseline rate of asthma, the prevalence has increased. This may emphasize that this increase is a real change and not just a result of better diagnostic tools.<sup>[6]</sup> Most studies about the prevalence of asthma in Iran are carried out using the International Study of Asthma and Allergies in Childhood protocol and among children. According to a meta-analysis in Iran, the prevalence of asthma is estimated to be around 7.5% which is higher compared to average of the world. However, more studies are required to give a more precise estimation, especially in adult population. Considering the more



**Figure 2:** Years of life lost due to asthma in each year from 2002 to 2011 in Yazd Province classified by sex

urbanization and industrialization of the area, air pollution, and unbalanced development in big cities, a study predicted further increase in asthma prevalence in Iran.<sup>[17]</sup>

Currently, in the United States, asthma affects 22 million people including 7 million children. Despite 11 billion dollars spent on the treatment of asthma, it is estimated that 4000 people die annually due to asthma complication in the US.<sup>[18]</sup> Active asthma prevalence in Riverside County in California is 19.3% among people under 18 compared to 9.1% in adults. However, rate of asthma death in adults is higher than children (10.4/100,000 vs. 2.6).<sup>[19]</sup> Regarding the high economic burden and YLL due to asthma, prevention and management of this disease should be prioritized in health policies.

Despite increased prevalence of asthma in countries, death due to asthma has been decreasing in recent years following the development of newer treatment methods and management strategies such as inhaled corticosteroids. In a review published in Lancet journal, 195 countries were divided to five groups of low, low-to-middle, middle, middle-to-high, and high sociodemographic index. The lowest YLL due to asthma were seen in high-income countries, but the fastest reduction in asthma YLL belonged to countries with low and low-to-middle income.<sup>[20]</sup>

## CONCLUSION

Annual mortality due to asthma has decreased in the last decade in Iran. About 10,470 years were lost due to asthma in the 10-year period of our study. The mortality is increasing among women asthmatics and this trend needs further study to understand the possible underlying mechanisms for this gender based difference.

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