Research Paper

Mortality Rate and Years of Life Lost Due to Premature Death From Respiratory Diseases: A Five-year Trend (2014-2018)

Alireza Heidari[1], Mohammad Javad Kabir[1], Zahra Khatirnamani[1*], Masoumeh Gholami[1]

1. Health Management and Social Development Research Center, Golestan University of Medical Sciences, Gorgan, Iran.

Use your device to scan and read the article online

Citation Heidari A, Kabir MJ, Khatirnamani Z, Gholami M. Mortality Rate and Years of Life Lost Due to Premature Death From Respiratory Diseases: A Five-year Trend (2014-2018). Journal of Research & Health. 2023; 13(1):1-10 http://dx.doi.org/10.32598/JRH.13.1.2055.1

doi: http://dx.doi.org/10.32598/JRH.13.1.2055.1

CC BY NC

ABSTRACT

Background: Chronic respiratory diseases impose a significant socioeconomic burden on individuals and communities and are severely overlooked compared to other non-communicable diseases, such as cardiovascular disease, cancer, and diabetes. This study aimed to investigate the mortality rate and years of life lost due to respiratory diseases in northern Iran.

Methods: The documentary research method was used and data were collected using the census. The population included all deaths registered in the Department of Health, Golestan University of Medical Sciences in Iran during 2014-2018.

Results: Between 2014 and 2018, 2462 deaths due to respiratory diseases were recorded in Golestan Province, of which 1416 people (57.5%) were men and 1046 people (42.5%) were women. The Mean±SD age of death was 62.28±26.29 years, with an Mean±SD of 62.56±25.32 years for men and 61.90±27.56 years for women. The highest number of deaths due to respiratory diseases in all the studied years was in men and women aged 80 years and above (28.7% and 31.1%, respectively). Approximately, 6864 years of life were lost due to premature death during this period, with men (3511 years, 7.2 per 1,000) contributing more than women (3353 years, 7.2 per 1,000).

Conclusion: Given the rapid increase in population and given that the crucial risk factors for respiratory diseases are smoking, exposure to pollutants, and allergens, more comprehensive research seems necessary throughout Iran. In addition, this study was designed before the onset of the COVID-19 pandemic, and due to changes that this pandemic has caused in the mortality rate, therefore, it is recommended to investigate the trend of mortality by respiratory diseases during this pandemic.

Keywords: Years of life lost, Mortality, Respiratory diseases, Iran

Article info:
Received: 30 Jul 2022
Accepted: 06 Nov 2022
Publish: 01 Jan 2023

*** Corresponding Author:**
Zahra Khatirnamani, PhD.
Address: *Health Management and Social Development Research Center, Golestan University of Medical Sciences, Gorgan, Iran.*
Phone: *+98 (173) 2558200*
E-mail: *khatirzahra@gmail.com*

1. Introduction

As major public health issues worldwide, Chronic Respiratory Diseases (CRDs) such as Chronic Obstructive Pulmonary Disease (COPD), pneumoconiosis, asthma, interstitial lung disease, and pulmonary sarcoidosis impose significant socioeconomic burdens on individuals and communities and are severely overlooked compared to other non-communicable diseases, such as cardiovascular disease, cancer, and diabetes [1-3]. Therefore, respiratory diseases are of particular relevance to public health and are the central focus of the World Health Organization's (WHO) surveillance and prevention strategies [4, 5].

In the International Statistical Classification of Diseases and Related Health Problems-10th Revision (ICD-10), this group of diseases covers a wide range of acute and chronic respiratory disorders (J00-J99), including acute upper respiratory tract infections, influenza, and pneumonia, other acute lower respiratory infections, other diseases of the upper respiratory tract, chronic lower respiratory diseases, lung diseases due to external agents, other respiratory diseases principally affecting the interstitium, suppurative and necrotic conditions of the lower respiratory tract, other diseases of the pleura, and other diseases of the respiratory system [6].

Acute respiratory infections include a wide range of diseases, such as the common cold, pharyngitis, tonsillitis, influenza, and lower respiratory tract diseases [7, 8]. Clinically, acute lower respiratory infections can be divided into bronchiolitis and pneumonia, which are difficult to differentiate, especially in children under two years of age [9, 10]. The importance of these diseases is reflected in their impact on the healthcare system.

Seasonal influenza is a major cause of additional outpatient visits each year. Depending on the season, influenza can cause about 30,000 hospital admissions due to primary and secondary infections [11]. Before the outbreak of the COVID-19 pandemic, seasonal influenza killed about half a million people worldwide in 2018 [12].

The morbidity and mortality due to lung diseases are overwhelming. Each year, hundreds of millions of people are affected by chronic respiratory conditions and four million people die prematurely due to these diseases [13]. Respiratory infections are the leading cause of death in developing countries. Although the global burden of disease study in 2020 showed that deaths related to lower respiratory tract infections have decreased compared to 2 decades ago, the mortality rate is still too high [14]. This is especially the case for infants and young children, with nearly three million children, mostly under the age of 5, dying of pneumonia and lower respiratory tract infections each year [14]. Pneumonia kills more children than the human immunodeficiency virus, tuberculosis, and malaria combined [15].

Asthma not only kills 180,000 people worldwide each year but also imposes a great socioeconomic burdens due to morbidity and disruption of life [16]. This disease affects 235 million people worldwide and accounts for over 30% of all child hospitalizations in the United States [13] with an increasing incidence in both developed and developing countries. All ages, races, and ethnicities are affected by this disease, but large variances have been observed between countries and within demographic groups. The burden of asthma is higher in urban areas, partly due to environmental exposures and lack of access to effective care and medication, especially in low-income countries [16].

A study in Golestan Province in Iran found that death due to respiratory diseases accounted for 7.58% of all deaths in 2018 [17]. Given that the trend and rate of mortality from respiratory diseases have not been estimated for this province and Iran as a whole, the purpose of this study was to investigate the mortality rate and years of life lost due to respiratory diseases during 2014-2018. Also, according to the mortality rate of respiratory system diseases, studies can be conducted to compare with the mortality rate after the outbreak of COVID-19.

2. Methods

The documentary research method (secondary analysis) was used and data were collected from clinical records. The population included all deaths registered in the health department of Golestan University of Medical Sciences (GOUMS) during 2014-2018. Mortality information was obtained from the statistics and performance analysis unit of GOUMS in the form of an Excel file. In addition to the cause of death, this file also provided information about the demographic characteristics (age, gender) of the deceased.

Deaths records contain information about the number and cause of death from cities affiliated with GOUMS. These records are regularly compared to the information from the national organization for civil registration, and discrepancies are identified and followed up. In the present research, the International Statistical Classification of Diseases and Related Health Problems 10th Revision

(ICD-10) was used for disease classification and cause of death coding. Then, to qualitatively examine the death cause, the data were examined and modified in terms of causes of death inconsistent with sex and age, trivial conditions, and codes for ill-defined and unknown causes of death. Global Burden of Disease (GBD) 2010 and 2013 studies were used to modify the codes of inconsistent and trivial causes of death [18-20]. As for ill-defined and unknown causes of death, it was assumed that each code, at any age and sex, contains the cause of death that follows the distribution of causes of death within that age and sex group [21].

After qualitative correction of the data, the population of the research i.e., the total number of deaths were extracted for the period 2014-2018. The total population of Golestan Province was 1,777,014 and 1,868,819 people in 2011 and 2016, respectively, according to the population and housing census. Population growth rate and population information by sex and age group were used to calculate population estimates for years between censuses. The following equation was used to estimate the population size (Equation 1):

1. $P_{(t+n)}=P_t(1+r)^n$

where is the population size in the 2nd census, is the population size in the 1st census, is the difference between the two censuses, and is the annual population growth rate.

In this study, the methodology used in GBD 2002 was used to maintain comparability [22], and the Standard Expected Years of Life Lost (SEYLL) was adopted to calculate Years of Life Lost (YLL). This measure uses the expectation of life at each age based on an ideal standard derived from a model life table to estimate YLL associated with death [23]. The difference in survival between men and women was determined to be 2.5 years, and the Coale and Demeny regional model life tables (Family Model West, level 26) for men and women were used to determine life expectancy in different age groups. These were calculated with the following formula using age and sex patterns from the original GBD Project in the Excel format as well as the weighting scheme from GBD 2000, which is consistent with the views of Iranian experts (Equation 2) [23, 24]:

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

where:

N=Number of deaths for a given age and sex;

L=Standard life expectancy for the same age and sex;

r=Discount rate (GBD standard value is 0.03);

ß=Age-weighting function (GBD standard value is 0.04);

C=Age-weighting correction constant (GBD standard value is 0.1658).

After modifying and cleaning the data, WinPepi 11.65 was used to calculate the rates, and Microsoft Excel version 2016 was used for frequency distributions and line graphs.

3. Results

During the period 2014-2018, 2,462 deaths due to respiratory diseases have been recorded in Golestan Province, of which 1,416 people (57.5%) were men and 1,046 people (42.5%) were women. In terms of residence, 1,304 cases (53.5%) were rural and 1,132 cases (46.5%) were in the urban population. The average age of death was 62.28±26.29 years, with an average of 62.56±25.32 years for men and 61.90±27.56 years for women.

The crude death rate due to respiratory diseases during these 5 years was 26.34 per 100,000 population, with a higher rate in men (30.17 per 100,000 population) than in women (22.49 per 100,000 population). The highest and lowest crude death rates due to respiratory diseases were 33.14 per 100,000 population in 2018 and 20.74 per 100,000 population in 2014 (Table 1).

The trend of mortality due to respiratory diseases during these 5 years indicates that deaths per 100,000 population have been increasing in both men and women, although it remained constant between 2014 and 2015 (Figure 1).

Table 2 presents the frequency and percentage of deaths due to respiratory diseases based on age group and cause of death during 2014-2018. The highest and lowest deaths due to respiratory diseases were in the age groups 80 years and above (29.7%) and 5-14 years (1.7%), respectively. Most deaths caused by acute upper respiratory tract infections, chronic lower respiratory diseases, and influenza and pneumonia were in the age group of 80 years and older. Also, the highest number of deaths in age groups was due to chronic lower respiratory diseases (918 cases), followed by influenza and pneumonia.

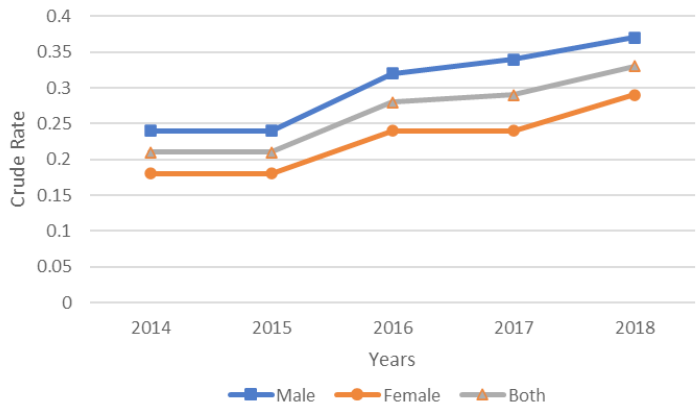
Table 1. Crude death rate due to respiratory diseases during 2014-2018

Year	Gender	No.	Population	The Death Rate per 100,000 Population
2013	Male	218	918000	23.75
	Female	162	913000	17.74
	Both	380	1832000	20.74
2014	Male	222	929000	23.90
	Female	164	921000	17.81
	Both	386	1850086	20.86
2015	Male	296	938327	31.55
	Female	224	930492	21.07
	Both	520	1868819	27.83
2016	Male	322	948649	33.94
	Female	222	938866	23.65
	Both	544	1887741	28.82
2017	Male	358	959084	37.33
	Female	274	947316	28.92
	Both	632	1906856	33.14
2018	Male	1416	4693060	30.17
	Female	1046	4650674	22.49
	Both	2462	9345502	26.34

JRH

The highest number of deaths due to respiratory diseases in all the studied years was related to men and women aged 80 years and above (28.7% and 31.1%, respectively). Table 3 presents the frequency and percentage of deaths due to respiratory diseases by sex and age group during 2014-2018.

Table 4 presents the YLL due to respiratory diseases in Golestan Province by age group and gender during 2014-2018. Approximately 6,864 YLL existed due to premature death during this period, with men (3,511 years, 7.2 per 1,000) contributing more than women (3,353 years, 7.2 per 1,000). The highest number of YLL due to respiratory diseases was in the age groups 80 years and above (42.8 per 1,000) and 69-60 years (16.3 per 1,000) in men, and age groups 80 years and above (40.7 per 1,000) and 79-70 years (23.2 per 1,000) in women.



.ure 1. The trend of -mortality due to respiratory diseases per 100,000 population during 2014-2018

JRH

Table 2. No. (%) of deaths due to respiratory diseases by age group and cause of death during 2014-2018

Cause of Death	No. (%)								
	0-4	5-14	15-29	30-44	45-59	60-69	70-79	≥80	Total
Acute upper respiratory tract infections	16(16.8)	2(2.1)	5 5.3)	6(6.3)	16(16.8)	13(13.7)	14(14.7)	23(24.2)	95(100)
Influenza and pneumonia	78(12.8)	15(2.5)	20(3.3)	27(4.4)	64(10.5)	84(13.8)	106(17.4)	214(35.2)	608(100)
Other acute lower respiratory tract infections	10(8.5)	3(2.5)	6(5.1)	9(7.6)	17(14.4)	21(17.8)	24(20.3)	28(23.7)	118(100)
Other upper respiratory tract diseases	6(8.0)	1(1.3)	6(8.0)	4(5.3)	7(9.3)	13(17.3)	19(25.3)	19(25.3)	75(100)
Chronic lower respiratory diseases	10(1.1)	4(0.4)	18(2.0)	34(3.7)	130(14.2)	200(21.8)	246(26.8)	275(30.0)	918(100)
Other lung diseases that mainly affect the interstitial tissue	3(10.0)	2(6.7)	1(3.3)	2(6.7)	1(3.3)	2(6.7)	13(43.3)	6(20.0)	30(100)
Purulent discharge and tissue death (necrosis) of the lower respiratory tract	2(8.3)	0(0.0)	1(4.2)	2(8.3)	3(12.5)	2(8.3)	6(25.0)	8(33.3)	24(100)
Other diseases of the pleura	9(47.4)	0(0.0)	1(5.3)	0(0.0)	2(10.5)	3(15.8)	3(15.8)	1(5.3)	19(100)
Other respiratory diseases	92(16.0)	15(2.6)	15(2.6)	25(4.3)	76(13.2)	78(13.6)	114(19.8)	157(27.3)	575(100)
Total causes	226(9.2)	42(1.7)	73(3.0)	109(4.4)	316(12.9)	416(16.9)	545(22.1)	731(29.7)	2462(100)

Table 3. No. (%) of deaths due to respiratory diseases by age group during 2014-2018

Year	Gender	No. (%)							
		0-4	5-14	15-29	30-44	45-59	60-69	70-79	≥80
2014	Male	17(7.9)	4(1.9)	8(3.7)	12(5.5)	34(15.6)	35(16.1)	54(24.8)	52(23.9)
	Female	15(9.4)	2(1.3)	6(3.7)	8(4.9)	16(9.9)	29(17.9)	35(21.6)	49(20.2)
	Both	32(8.5)	6(1.6)	14(3.7)	20(5.3)	50(13.2)	64(16.8)	89(23.4)	101(26.6)
2015	Male	32(14.4)	2(0.9)	6(2.7)	11(5.0)	27(12.2)	34(15.3)	57(25.7)	53(23.9)
	Female	21(12.8)	3(1.8)	4(2.4)	9(5.5)	25(15.2)	26(15.9)	34(20.7)	42(25.6)
	Both	53(13.7)	5(1.3)	10(2.6)	20(5.2)	52(13.5)	60(15.5)	91(23.6)	95(24.6)
2016	Male	25(8.4)	4(1.4)	8(2.7)	10(3.4)	44(14.9)	56(18.9)	64(21.6)	85(28.7)
	Female	35(15.6)	8(3.6)	6(3.6)	7(3.1)	19(8.5)	33(14.7)	45(20.1)	69(30.8)
	Both	60(11.5)	12(2.3)	16(3.1)	17(3.3)	63(12.1)	89(17.1)	109(21.0)	154(29.6)
2017	Male	21(6.5)	3(0.9)	8(2.5)	15(4.7)	51(15.8)	53(16.5)	70(21.7)	101(31.4)
	Female	15(6.8)	3(1.4)	4(1.8)	4(1.8)	28(12.6)	38(17.1)	57(25.7)	73(32.9)
	Both	36(6.6)	6(1.1)	12(2.2)	19(3.5)	79(14.5)	91(16.7)	127(23.3)	174(32.0)
2018	Male	21(5.9)	7(2.0)	11(3.1)	18(5.0)	48(13.4)	65(18.2)	73(20.4)	115(32.1)
	Female	24(8.8)	6(2.2)	10(3.6)	15(5.5)	24(8.8)	47(17.2)	56(20.4)	92(33.6)
	Both	45(7.1)	13(2.1)	21(3.3)	33(5.2)	72(11.4)	112(17.7)	129(20.4)	207(32.8)
Total	Male	116(8.2)	20(1.4)	41(2.9)	66(4.7)	204(14.4)	243(17.2)	318(22.5)	406(28.7)
	Female	110(10.5)	22(2.1)	32(3.1)	43(4.1)	112(10.7)	173(16.5)	227(21.7)	325(31.1)
	Both	226(9.2)	42(1.7)	73(3.0)	109(4.4)	316(12.8)	416(16.9)	545(22.1)	731(29.7)

Table 4. Years of life lost (YLL) due to respiratory diseases by age groups and gender during 2014-2018

Year	Gender		No.								
			0-4	5-14	15-29	30-44	45-59	60-69	70-79	≥80	Total
2014	Male	YLLs	515	118	217	292	635	478	450	253	2957
		YLL/1000	5.8	0.8	0.7	1.4	5.4	14.7	22.9	32.9	3.2
	Female	YLLs	457	60	165	193	307	449	349	267	2247
		YLL/1000	5.4	0.4	0.6	0.9	2.5	11.8	18.1	35.3	2.5
2015	Male	YLLs	968	59	167	265	505	473	489	258	3185
		YLL/1000	10.9	0.4	0.6	1.3	4.2	14.4	24.6	33.3	3.5
	Female	YLLs	640	89	110	220	500	400	347	212	2518
		YLL/1000	7.4	0.6	0.4	1.0	1.4	10.4	17.8	27.7	2.7
2016	Male	YLLs	756	118	218	245	812	754	567	410	3881
		YLL/1000	7.7	0.8	0.9	1.0	6.1	18.0	30.3	43.6	4.1
	Female	YLLs	1067	238	224	174	367	493	459	380	3403
		YLL/1000	11.4	1.6	1.0	0.7	2.7	10.4	23.0	44.4	3.7
2017	Male	YLLs	636	88	217	357	956	719	620	483	4077
		YLL/1000	6.4	0.6	0.9	1.5	7.1	17.0	32.8	50.9	4.3
	Female	YLLs	457	90	110	98	565	564	595	382	2860
		YLL/1000	4.8	0.6	0.5	0.4	1.4	11.8	29.5	44.3	3.0
2018	Male	YLLs	636	207	299	430	882	875	661	558	4548
		YLL/1000	5.8	1.2	1.4	1.6	5.8	16.7	35.3	48.4	4.5
	Female	YLLs	731	178	276	370	473	706	576	472	3782
		YLL/1000	7.0	1.1	1.4	1.3	3.1	12.3	27.1	48.4	3.8
Total	Male	YLLs	3511	590	1118	1589	3792	3299	2787	1962	18647
		YLL/1000	7.2	0.8	0.9	1.4	5.7	16.3	6.0	42.8	3.7
	Female	YLLs	3353	655	885	1055	2213	1612	2325	1712	14810
		YLL/1000	7.2	0.9	0.7	0.9	3.3	11.4	23.2	40.7	3.2

JRH

4. Discussion

Mortality is the most objective measure of health problems, especially in low- and middle-income countries, such as Iran [25]. This study investigated the mortality rate and YLL due to respiratory diseases in northern Iran.

The results indicated that the mortality rate due to respiratory diseases was higher in men than women during the studied period. In a study in Erbil, Iraq, the mortality rate due to respiratory diseases was 42.43 per 100,000 population, which is higher than the present research. Also, consistent with present findings, this study found that the mortality rate was higher in men than in women [26].

The results showed that mortality due to respiratory diseases increased in these 5 years. In a study conducted in Khorramabad's hospital by Mahmoudi et al., respiratory diseases were identified as the Second leading cause of death [27], and in another study, the mortality rate caused by respiratory diseases in the elderly population was 10.3% [28]. A study in India showed an increase in the incidence of chronic obstructive pulmonary disease (COPD) from 1990 to 2016 [29]. Also, a study in Mazandaran Province found that respiratory diseases were the leading cause of death in children under five years of age [30]. The spread of COVID-19 in Iran and the world is a global epidemic that is the cause of severe infectious lung disease. This virus can be transmitted through direct contact with the respiratory droplets of an infected person (cough and sneeze). Its infection can lead to pneumonia, serious respiratory problems, and eventually, lead to the death of infected patients [31]. However, the main complications observed in most of these patients are respiratory, and both parts of the upper and lower respiratory tract can be affected by this virus [32].

According to the results, the highest number of deaths in all age groups was due to chronic lower respiratory diseases, followed by influenza and pneumonia. One study showed

that the prevalence of asthma was higher in adults than children and in boys than girls, and after adolescence, the prevalence of this disease was higher in women than men [33]. Influenza is an acute respiratory infectious disease caused by the influenza viruses [34]. Influenza viruses are mainly transmitted from person to person through droplets produced while coughing or sneezing. Influenza infects 5%-15% of the world's population in annual epidemics, resulting in hundreds of thousands of deaths each year [35]. Some studies have found that the incidence of influenza is higher in women than in men [36, 37]. Pneumonia is an infection of the lung parenchyma that presents not only as a disease but also as a clinical syndrome. It is the sixth leading cause of death in the United States and the most common cause of death due to infection, accounting for more than 50% of outpatient visits [38, 39]. Acute respiratory infections cause 4.5 million deaths among children each year, the vast majority of which occur in developing countries. Pneumonia unassociated with measles causes 70% of these deaths [40].

According to the results, the number of years lost due to respiratory diseases increased during the studied period and was higher in men than women, with the highest rate belonging to the elderly. Torkashvand et al. found that YLL due to respiratory diseases among the elderly increased from 2011 to 2017 [41]. Given that the elderly population is projected to increase in Iran as well as worldwide, this reality has to be acknowledged and the Iranian health system should change its policy goals to meet the needs of the elderly population [42].

Due to the increased exposure to the risk factors for respiratory diseases, including smoking, exposure to pollutants, allergens, occupational exposures, unhealthy diet, obesity, and physical inactivity, among others [43], and given the rapid population growth, Chronic Respiratory Diseases (CRDs) are becoming a more significant problem in all regions of the world. Therefore, it seems necessary to conduct more comprehensive research throughout Iran, and an in-depth and expert approach is essential for planning the country's future health.

Recent data from Germany show that 12.3% of all deaths are caused by respiratory diseases [44] and the direct costs of treating respiratory disorders amount to €14.7 billion [9]. Millions of people die due to lack of access to vaccinations and medications or the inability to access care in the health care system, which can be avoided. Immunization programs can effectively prevent many deadly infectious diseases, including measles, influenza, pertussis, and common bacterial pneumonia. However, many countries do not have certain vaccines in their national immunization programs [45].

In addition, this study was designed before the onset of the COVID-19 pandemic, and due to changes that this pandemic has caused in the mortality rate in Golestan province, therefore it is recommended to investigate the trend of mortality by respiratory diseases during this pandemic.

5. Conclusion

As a result, the findings of the study showed that during 2014-2018, 2,462 deaths due to respiratory diseases were recorded in Golestan Province, with a higher prevalence in men than women, which subsequently resulted in a higher number of YLL due to respiratory diseases in men than women. The average age of death was over 60 years in both men and women. The mortality rate due to respiratory diseases was 26.34 per 100,000 population and has increased during these 5 years.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the ethical committee of Golestan University of Medical Sciences (GOUMS) (Ethic Code: IR.GOUMS.REC.1398.329).

Funding

This study was financially supported by Golestan University of Medical Sciences (GOUMS) (Grant No.: 111277).

Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

This research would not have been done without the cooperation of the Health Management and Social Development Research center in Gorgan City, Iran.

References

[1] Ferkol T, Schraufnagel D. The global burden of respiratory disease. Ann Am Thorac Soc. 2014; 11(3):404-6. [DOI:10.1513/AnnalsATS.201311-405PS] [PMID]

[2] Global Burden of Disease 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 dis-eases and injuries, 1990-2015: A systematic analysis for the glob-al burden of disease study 2015. Lancet. 2016; 388(10053):1545-602. [DOI:10.1016/S0140-6736(16)31678-6] [PMID]

[3] Khaltaev N. GARD, a new way to battle with chronic respiratory diseases,from disease oriented programmes to global partnership. J Thorac Dis. 2017; 9:4676-89. [DOI:10.21037/jtd.2017.11.91] [PMID] [PMCID]

[4] World Health Organization (WHO). Global status report on noncommunicable diseases. Geneva: World Health Organization; 2014. [Link]

[5] World Health Organization (WHO). A Manual for estimating disease burden associated with seasonal influenza. Geneva: World Health Organization ; 2015. [Link]

[6] World Health Organization (WHO). International statistical classification of diseases and related health problems (ICD). Geneva: World Health Organization; 2014. [Link]

[7] Glezen P, Denny FW. Epidemiology of acute lower respiratory disease in children. N Engl J Med. 1973; 288(10):498-505. [DOI:10.1056/NEJM197303082881005] [PMID]

[8] Ruuskanen O, Lahti E, Jennings LC, Murdoch DR. Viral pneumonia. Lancet. 2011; 377(9773):1264-75. [DOI:10.1016/S0140-6736(10)61459-6] [PMID]

[9] Don M, Valent F, Korppi M, Canciani M. Differentiation of bacterial and viral community-acquired pneumonia in children. Pediatr Int. 2009; 51(1):91-6. [DOI:10.1111/j.1442-200X.2008.02678.x] [PMID]

[10] Pavia AT. Viral infections of the lower respiratory tract: Old viruses, new viruses, and the role of diagnosis. Clin Infect Dis. 2011; 52 Suppl 4(Suppl 4):S284-9. [DOI:10.1093/cid/cir043] [PMID] [PMCID]

[11] Buda S, Prahm K, Preuß U, Schweiger B, Biere B, Wedde M, et al. [Report on the epidemiology of influenza in Germany for the 2015/16 season (German)]. Rober Kokh Institute; 2016. [DOI:10.17886/rkipubl-2016-010]

[12] Lee D, Rundle-Thiele S, Wut TM, Li G. Increasing seasonal influenza vaccination among university students: A systematic review of programs using a social marketing perspective. Int J Environ Res Public Health. 2022; 19(12):7138. [DOI:10.3390/ijerph19127138] [PMID] [PMCID]

[13] World Health Organization (WHO). Global surveillance, prevention and control of chronic respiratory diseases: A comprehensive approach. Geneva: World Health Organization; 2013. [Link]

[14] Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the global burden of disease study 2010. Lancet. 2012; 380:2224-2260. [DOI:10.1016/S0140-6736(12)61766-8] [PMID]

[15] World Health Organization (WHO). Pneumonia: The forgotten killer of children. Geneva: World Health Organization; 2006. [Link]

[16] World Health Organization (WHO). Chronic respiratory disease, asthma. Geneva: World Health Organization; 2020. [Link]

[17] Heidari A, Kabir MJ, Khatirnamani Z, Jafari N, Gholami M, Hosseinzadeh S, et al. [Epidemiological study of registered deaths in Golestan province; In 2018 (Persian)]. Sci J Nurs Midwifery Paramed Fac. 2020; 6(2):69-80. [Link]

[18] Naghavi M, Makela S, Foreman K, O'Brien J, Pourmalek F, Lozano R. Algorithms for enhancing public health utility of national causes-of-death data. Popul Health Metr. 2010; 8(1):1-4. [DOI:10.1186/1478-7954-8-9] [PMID] [PMCID]

[19] Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the global burden of disease study 2010. lancet. 2012; 380(9859):2095-128. [DOI:10.1016/S0140-6736(12)61728-0] [PMID]

[20] World Health Organization. Analyzing mortality level and cause of death. Geneva: World Health Organization; 2013. [Link]

[21] Naghavi M, Jafari N. Report of death in Iran. Tehran: Ministry of Health and Medical Education; 2007.

[22] Mathers CD, Bernard C, Iburg KM, Inoue M, Ma Fat D, Shibuya K, et al. Global burden of disease in 2002: Data sources, methods and results. Geneva: World Health Organization. 2004. [Link]

[23] World Health Organization (WHO). Global program on evidence for health policy: National burden of diseases: A practical Guide. Genava: World Health Organization; 2001. [Link]

[24] Ayatollahi SM, Hassanzadeh J, Ramezani AA. [The burden of traffic accidents in South Khorasan Province, Iran in 2005 (Persian)]. Iran J Epidemiol. 2009; 4(3-4):51-7. [Link]

[25] Moradi-Lakeh M, Sepanlou SG, Karimi SM, Khalili N, Djalalinia S, Karimkhani C, et al. Trend of socio-demographic index and mortality estimates in Iran and its neighbors, 1990-2015; findings of the global burden of diseases 2015 study. Arch Iran Med. 2017; 20(7):419-28. [Link]

[26] Zangana A, Al-Banna H, Al-Hadithi T. Mortality trends in Erbil, Iraq, 2007-2011. East Mediter Health J. 2019; 25(5):315-21. [DOI:10.26719/emhj.18.042] [PMID]

[27] Mahmoudi GA, Astaraki P, Anbari K, Khayat Pisheh S. Epidemiolgical survey of mor-tality rate in patients admitted to Shohada Hospital of Khorramabad in 2011 (Persian)]. J Forensic Sci Med. 2014; 20(4 and 1):393-400. [Link]

[28] Mardani M, Keshtkar JM, Mir Eshghi M. Evaluating infectious etiologies of hospitalization in elderly population of Iran. Middle East J Age Ageing. 2006; 4(2). [Link]

[29] Salvi S, Kumar GA, Dhaliwal RS, Paulson K, Agrawal A, Koul PA, et al. The burden of chronic respiratory diseases and their heterogeneity across the states of India: The global burden of disease study 1990–2016. Lancet Glob Health. 2018; 6(12):e1363-74. [DOI:10.1016/S2214-109X(18)30409-1] [PMID]

[30] Naghibi SA, Moosazadeh M, Shojaee J. [Epidemiological features of under 5 year children mortality in Mazandaran (Persian)]. J Health Res Community. 2015; 1(1):11-9. [Link]

[31] Moazen H, Nazmiah H, Fallah Tafti T, Kabirzadeh A, Gholami S. [Evaluation of risk factors related to life status of patients with covid-19 hospitalized in Yazd (Persian)]. Toloo-e-behdasht. 2022; 21(2):85-98. [DOI:10.18502/tbj.v21i2.10343]

[32] Hosseini P, Afzali S, Karimi M, Zandi M, Zebardast A, Latifi T, et al. The coronavirus disease 2019 and effect on liver function: A hidden and vital interaction beyond the respiratory system. Rev Med Microbiol. 2022; 33(1):e161-79. [DOI:10.1097/MRM.0000000000000267]

[33] De Marco R, Locatelli F, Sunyer J, Burney P, European Community Respiratory Health Survey Study Group. Differences in incidence of reported asthma related to age in men and women: A retrospective analysis of the data of the European respiratory health survey. Am J Respir Crit Care Med. 2000; 162(1):68-74. [DOI:10.1164/ajrccm.162.1.9907008] [PMID]

[34] Brankston G, Gitterman L, Hirji Z, Lemieux C, Gardam M. Transmission of influenza A in human beings. Lancet Infect Dis. 2007; 7(4):257-65. [DOI:10.1016/S1473-3099(07)70029-4]

[35] World Health Organization (WHO). Influenza (seasonal). Geneva: World Health Organization; 2018. [Link]

[36] Haghshenas MR, Babamahmoodi F, Jafarian E, Tabrizi A, Nandoost Kenari S, Alizadeh- Navaei AR. [Prevalence of Influenza A/H3N2 in the North of Iran (Mazandaran) During 2011-2013 (Persian)]. Caspian J Intern Med. 2015; 6(2):116-9. [PMID] [PMCID]

[37] Haghshenas MR, Mousanejad P, Aarabi M, Rabie-Rudsari M, Rasouli-Larmaei S. [Prevalence of influenza A/H1N1 virus in north of Iran, 2013 to 2017 (Persian)]. J Mazandaran Univ Med Sci. 2019; 29(177):148-56. [Link]

[38] Kumar A, Robbins SL, Fausto N, Mitchel RN. Robbins Basic Pathology. Philadelphia: Saunders/Elsevier; 2007. [Link]

[39] No author. 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. The Lancet. Respiratory Medicine. 2017; 5(9):691. [DOI:10.1016/S2213-2600(17)30293-X] [PMID]

[40] Berman S. Epidemiology of acute respiratory infections in children of developing coun-tries. Reviews of infectious diseases. 1991. 13(Supplement_6):S454-462. [DOI:10.1093/clinids/13.Supplement_6.S454] [PMID]

[41] Torkashvand Moradabadi M, Abbasi M. [An epidemiological study of mortality among elderly in Iran using years of life lost (YLL) index during 2011 to 2017 (Persian)]. Payesh. 2020; 19(1):85-97. [DOI:10.29252/payesh.19.1.85]

[42] Alavi SS, Naemi H, Hosseinzadeh A. [Investigating of frequency distribution of dying elderly people in Sabzevar in terms of as-sociated risk factors in years 2011 to 2013 (Persian)]. J Sabzevar Univ Med Sci. 2016; 23(4):626-33. [Link]

[43] Bousquet J, KaltaevN. Global surveillance, prevention and control of chronic respiratory diseases: A comprehensive approach/edited by Jean Bousquet and Nikolai Khaltaev. Geneva: World Health Organization; 2007. [Link]

[44] World Health Organization (WHO). Age-standardized mortality rate (per 100 000 population). Geneva: World Health Organization; 2023. [Link]

[45] Bryce J, Black RE, Walker N, Bhutta ZA, Lawn JE, Steketee RW. Can the world afford to save the lives of 6 million children each year? Lancet. 2005; 365(9478):2193-200. [DOI:10.1016/S0140-6736(05)66777-3.] [PMID]

This Page Intentionally Left Blank