Mortality Rate and Years of Life Lost Due to COVID-19 in Iran, Fars Province.

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Abstract

Introduction: Corona became a public health threat worldwide in late 2019, in which its main target is lower airway. The aim of this study was to calculate the mortality rate and years of life lost due to COVID-19 in Iran.

Method: All definite deaths due to COVID-19 from February 20, 2020 to the February 12, 2021 have been used. Descriptive analyzes included mean and standard deviation of age at death, the number and sex ratio of deaths. Then the age and sex-specific mortality rate were calculated. YLL were calculated using the standard life expectancy based on the 2015 WHO life-table.

Results: During the study period, 3169 (58.78% men and 41.22% women) definite coronary deaths occurred. The mean age at death was higher in women than men. The fatality rate of the disease was 1.83%. The highest number of years of life lost, according to both methods of YLL calculation, was in the age group of 69-60 years and the lowest was in the age group of 10-19 years.

Conclusion: This study showed that due to the high mortality of this disease, decision makers should focus on reducing mortality in the start of the next waves of COVID-19.

Introduction

Coronavirus is one of the main pathogens that primarily targets the human respiratory system. In late December 2019, a number of patients were admitted to hospital with an initial diagnosis of pneumonia of an unknown cause. These patients were epidemiologically related to a wholesale market of marine animals in Wuhan, Hubei Province, China(1, 2). As a result, coronavirus disease became a public health threat to people around the world in late 2019. The lower airway is the main target of this infection, and pneumonia is always present in patients with severe COVID-19 (3–6). The first reported case of coronavirus 2019 (COVID-19) was observed in Wuhan, China. COVID-19 spread rapidly throughout China and involved many other countries, despite global efforts to prevent its spread (6–8).

In a study of COVID-19 in South Korea, the total burden of COVID-19 was 2531 years, of which 89.7% were the years of life lost (YLL) and 10.3% were the years lived with disability (YLD) share. The highest DALY per 100,000 population was in the age group over 80 years (9).

Health system decision-makers face challenges in preventing and controlling common diseases. While they are also responsible for predicting future priorities. Ideally, such decisions should be based on summary population health metrics. Summary health metrics, such as premature deaths, are intended to discuss future health system priorities. They are a way to monitor and evaluate changes in community health status and help health care providers identify priorities (10).

COVID-19 has different characteristics than other respiratory infections such as SARS and the flu. Knowledge about the natural history of coronavirus is limited, but it has created a significant burden in

Iran and Fars province. According to the report of the World Health Organization on August 9, 2020, the definitive cases of COVID-19 in Iran are 1,550,142 cases and 59,264 deaths. According to these statistics, Iran is ranked 15th and 11th in the world in terms of morbidity and mortality, respectively(11). So, basic measures need to be taken in Iran to prevent morbidity and mortality, and identification of priorities. Calculating the years of life lost due to COVID-19 will help health care providers make better decisions and identification of priorities for control of the disease. Therefore, the aim of this study was to calculate the mortality rate, age and sex-specific mortality rate and years of life lost due to COVID-19 during February 20,2020 to the February 12, 2021 in Fars province.

Method

Study design and data collection

In this cross-sectional study, all deaths due to COVID-19 that occurred from the February 20,2020 to the February 12, 2021 in Fars province were investigated. Mortality data were obtained from the statistics unit of the provincial health center. Trained physicians in various organizations in Iran first reported deaths and then codify the causes of death, according to the national protocol and the international classification of diseases. Hospitals, local health centers and cemeteries then report the data to the death registration committee on a monthly basis. These reports are compared with the data of the country's forensic organization. The total population of Fars province has been estimated using databases of health centers and national census data and based on annual growth. The population of Fars province in 2020 was equal to 4,900,000 people.

Statistical analysis

Descriptive analyzes included mean and standard deviation of age at death, the number of deaths and sex ratio of deaths. Then the mortality rate and the age and sex-specific mortality rates were calculated. In addition to crude rates, age-standardized rates (ASR) were used for comparison using the 2013 standard population for low- and middle-income countries (12).

The World Health Organization (WHO) has introduced three YLL calculation methods in the second edition of the practical handbook for burden of disease calculation, published in 2001 (13). In this study, two methods, the simplest and the most complex, are used to calculate the years of life lost, and their results are compared.

Method A: SEYLL = N * L

Method B: SEYLL = $N\,Ce^{(ra)} / (\beta + r)^2\,[e^{-(\beta+r)(L+a)}\,[-(\beta + r)(L + a)-1]- e^{-(\beta+ r)a}\,[-(\beta + r)a-1]$

In these methods, N is the number of deaths at a certain age and sex. L is the standard life expectancy of the deceased people in the same age and gender. r is the discount rate and is considered equal to 0.03. β is the weight of age and is considered equal to 0.04. C is the weighted age correction factor and is equal to 0.165. a is the age at the time of death and e is a fixed value equal to 2.71828.

First, the years of life lost are calculated separately for the 5 sex and age groups, and then the age groups are divided into 0–9, 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79 and over 80 years. The analysis of the years of life lost due to COVID-19 was performed using the 2015 **YLL template** developed by the WHO in Excel spreadsheet version 2007. Descriptive analyzes were performed using SPSS19 software.

The protocol of this study was approved by the ethics committee of Shiraz University of Medical Sciences with the ethics code of IR.SUMS.REC.1399.458 and all aspects of the study were done according to the ethical considerations.

Results

During the study period, 3169 deaths due to COVID-19 (58.78 % men and 41.22% women) occurred in Fars province. The sex ratio was 1.42 (male to female). The mean age at death was 68.59 ± 18.21. The number of COVID-19 cases with positive RT-PCR test was 173,082 and the fatality rate of the disease was 1.83%. The highest mortality rate was in the age group over 80 years and the lowest was in the age group of 10–19 years (Table 1).

years of life lost due to COVID-19

The total years of life lost based on two YLL calculation methods are listed in Table 1. In the first method, the years of life lost in men was 1.23 times than the women and in the second method is 1.27 times that of women.

The highest number of years of life lost, based on both methods of YLL calculation, in both sexes in the age group of 69 – 60 years and the lowest in both sexes in the age group of 10–19 years (Table 1).

Table 1
Mortality rate and years of life lost due to COVID-19 by age and sex groups.

Age group/sex		Number of death	Mortality rate (per 100,000)	Method A		Method B	
				Number of YLL	YLL (per 1,000)	Number of YLL	YLL (per 1,000)
Male	0–9	8	1.91	612	1.46	240	0.57
	10–19	6	1.88	389	1.22	172	0.54
	20–29	20	4.68	1099	2.57	538	1.26
	30–39	67	12.27	2989	5.47	1646	3.01
	40–49	114	34.47	4010	12.12	2474	7.48
	50–59	223	93.58	5756	24.15	3998	16.88
	60–69	467	318.30	8021	54.67	6251	42.60
	70–79	421	754.66	4390	78.69	3760	67.40
	+ 80	537	1369.72	2715	69.25	2509	63.99
	Total	1863	73.94	29981	11.90	21588	8.56
	ASR	74.16		12.12		8.83	
Female	0–9	8	2.01	641	1.61	243	0.61
	10–19	4	1.33	271	0.90	116	0.38
	20–29	13	3.24	753	1.88	357	0.89
	30–39	46	8.62	2188	4.10	1165	2.18
	40–49	77	23.88	2973	9.22	1759	5.45
	50–59	156	67.48	4498	19.45	3005	13.00
	60–69	335	215.50	6764	43.51	5061	32.55
	70–79	339	572.20	4228	71.36	3516	59.34

	+ 80	328	945.38	1932	55.68	1760	50.72
	Total	1306	53.66	24248	9.96	16982	6.97
	ASR	52.88		9.91		7.00	
All	0–9	16	1.96	1253	1.53	483	0.59
	10–19	10	1.61	660	1.06	288	0.46
	20–29	33	3.98	1852	2.23	895	1.08
	30–39	113	10.47	5177	4.79	2811	2.60
	40–49	191	29.25	6983	10.69	4233	6.48
	50–59	379	80.73	10254	21.84	7003	14.91
	60–69	802	265.41	14785	48.93	11312	37.43
	70–79	760	660.69	8618	74.91	7276	63.25
	+ 80	865	1170.50	4647	62.88	4269	57.76
	Total	3169	63.98	54229	10.94	38570	7.78
	ASR	63.49		11.01		7.91	

Discussion

The calculation of disease burden, based on the DALY index (YLL, YLD) since its development in the 1990s, has been widely used to estimate the impact of lower respiratory system infections (14, 15). In this study, the years of life lost based on COVID-19 were investigated.

The results of our study showed that the mean age of men at the time of death due to COVID-19 was 66 years and in women was 67 years and the sex ratio was 1.5 (men/women). The mean age at death for men and women in Italy was 79.5 and 106 years, respectively(16). Another study conducted in Italy(17) showed that the mortality rate was higher in men than women, which is consistent with our study. This difference may be due to reasons such as immunological differences between men and women, differences in lifestyle (e.g. more smoking in men) and more presence of men in society.

Mortality rate

The results of our study showed that the mortality rate due to COVID-19 was 63.98 per 100,000 people, which has been steadily increasing with age. The mortality rate varies from region to region. Estimates show that worldwide mortality rate due to COVID-19 is about 3% (18). Studies shown that mortality rate in China is 7.3, in uk 8.8, Japan 10.7 and India 7.3 per 1000 (19). Based on other study in china, mortality rate is 3.6%(20). In Italy, the rate varied from 3–24% (in the elderly) (21). Generally mortality rate due to covid 19 is very different in different countries and the lowest and highest mortality rates of 1.2% and 12% are in Qatar and Nigeria, and on average in world 8% respectively (19).

The mortality rate in Iran is consistent with other countries and is almost in the middle of estimates reported in other countries. The reasons for these differences may be due to several factors, such as differences in data quality, differences in data recording, differences in age groups, and so on.

YLL by age and gender groups

The results of our study showed that the highest YLL due to COVID-19 in men and women was in the age group of 70–79 years. In both genders, the lowest YLL was in the age group of 10–19 years (Fig. 2).

In a study conducted to determine Years of Life Lost Attributable to COVID-19 in High-incidence Countries showed that YLLs due to COVID-19 were higher among males than among females and higher in those aged ≥ 60 years than in younger individuals (22).

In Korea, the highest YLL for men and for women occurred in the age group of 70–79 and over 80 years, respectively (9). In Italy, the highest and lowest YLL was in the age group of 70–79 and 10–19 years for both genders (17).

According to a meta-analysis study, in most countries the death rate is higher for men than for women. In some countries, the death rate from men to women is six times higher. But in some countries, such as Ethiopia, the death rate is higher for women than for men. Overall, the overall mortality rate from COVID-19 is 1.4 in men compared to women (23).

The results of the mentioned studies are consistent with the lowest age group that had the lowest YLL, but in terms of age group with the highest YLL. This means that the Iranian population (Fars province as a representative of the Iranian population) had the highest morbidity and mortality at younger ages (60–69 years). The reasons for this may be due to the greater presence of men in society and the economic activity of men at this age. The results of the mentioned studies are in line with our study in terms of age group with the lowest YLL, but not in terms of age group with the highest YLL. This means that the Iranian population at the younger age (69 – 60 years) had the highest morbidity and mortality.

The strengths of the study are discussed as follows. First, in this study, we used two methods to calculate the years of life lost to COVID-19. Second, we calculated age standardized rates. Third, there were no missing cases in this study.

Conclusion

In Conclusion, this is one the first study to characterize the years of life lost due to COVID-19 in Iran. The methodological framework used in this study can be applied to other countries. **T**his study showed that due to the high mortality of this disease, decision makers should focus on reducing mortality in the start of the next waves of COVID-19.

Declarations

Founding: no

Conflict of interest: no

Ethics approval: The protocol of this study was approved by the ethics committee of Shiraz University of Medical Sciences with the ethics code of IR.SUMS.REC.1399.458 and all aspects of the study were done according to the ethical considerations.

Consent to participate: Not applicable

Consent for publication: All authors have read the latest manuscript of the article and agree to publish it.

Availability of data and material: All data are available in the data center of Shiraz University of Medical Sciences.

Code availability: The common SPSS program was used to analyze the data.

Author contribution:

1. Data collection: Habibollah Azarbakhsh ,Alireza Mirahmadizadeh, Haleh Ghaem,sanaz amiri,

2. Analysis: Habibollah Azarbakhsh ,Alireza Mirahmadizadeh,sanaz amiri, Ali Mohammad Mokhtari

3. Writeing manuscript: Mehrzad Lotfi, Mohammadreza karimi ,Abdolrasool Hemmati

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Figures

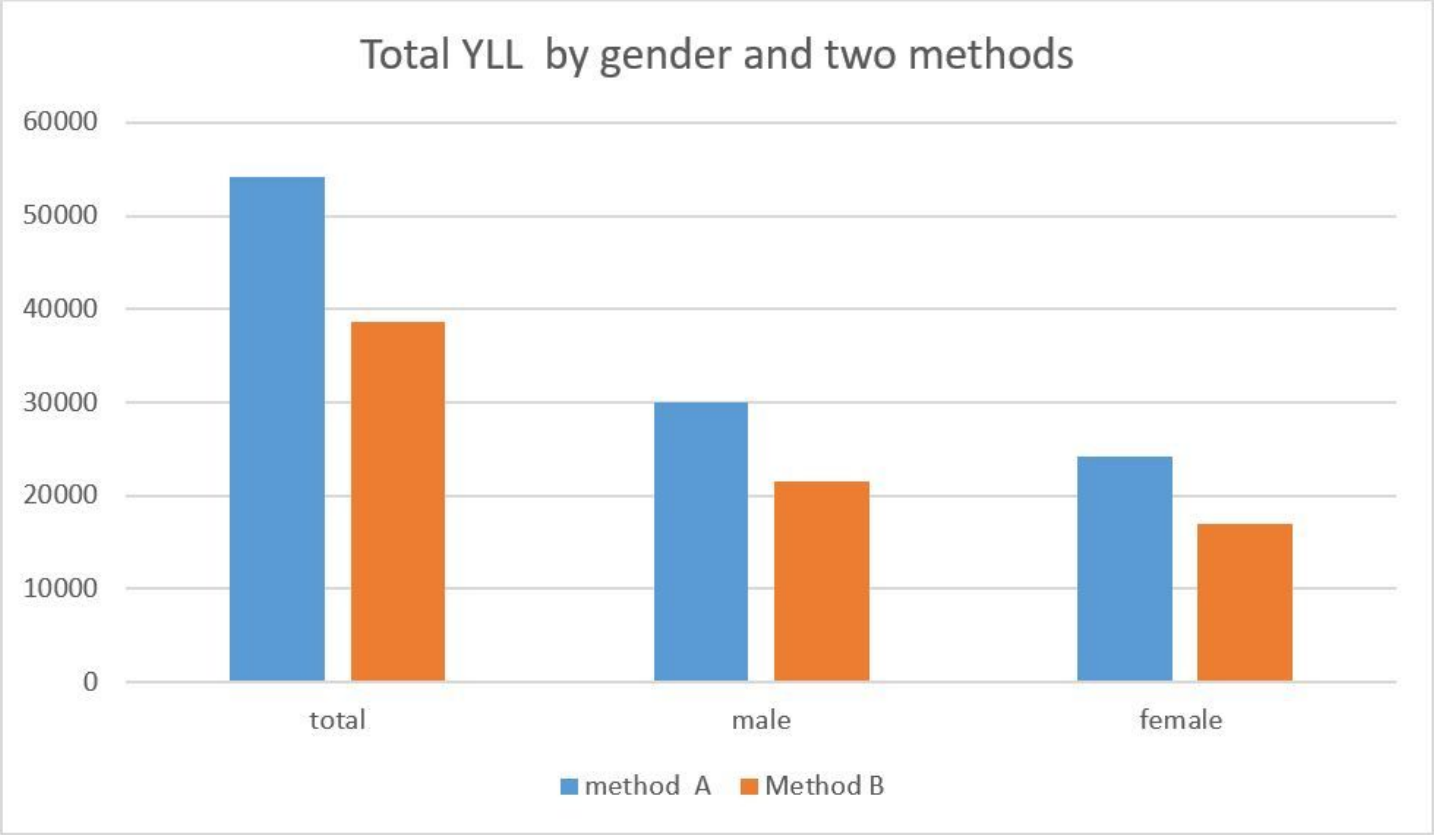

Figure 1

Total years of life lost due to COVID-19 by sex and methods.

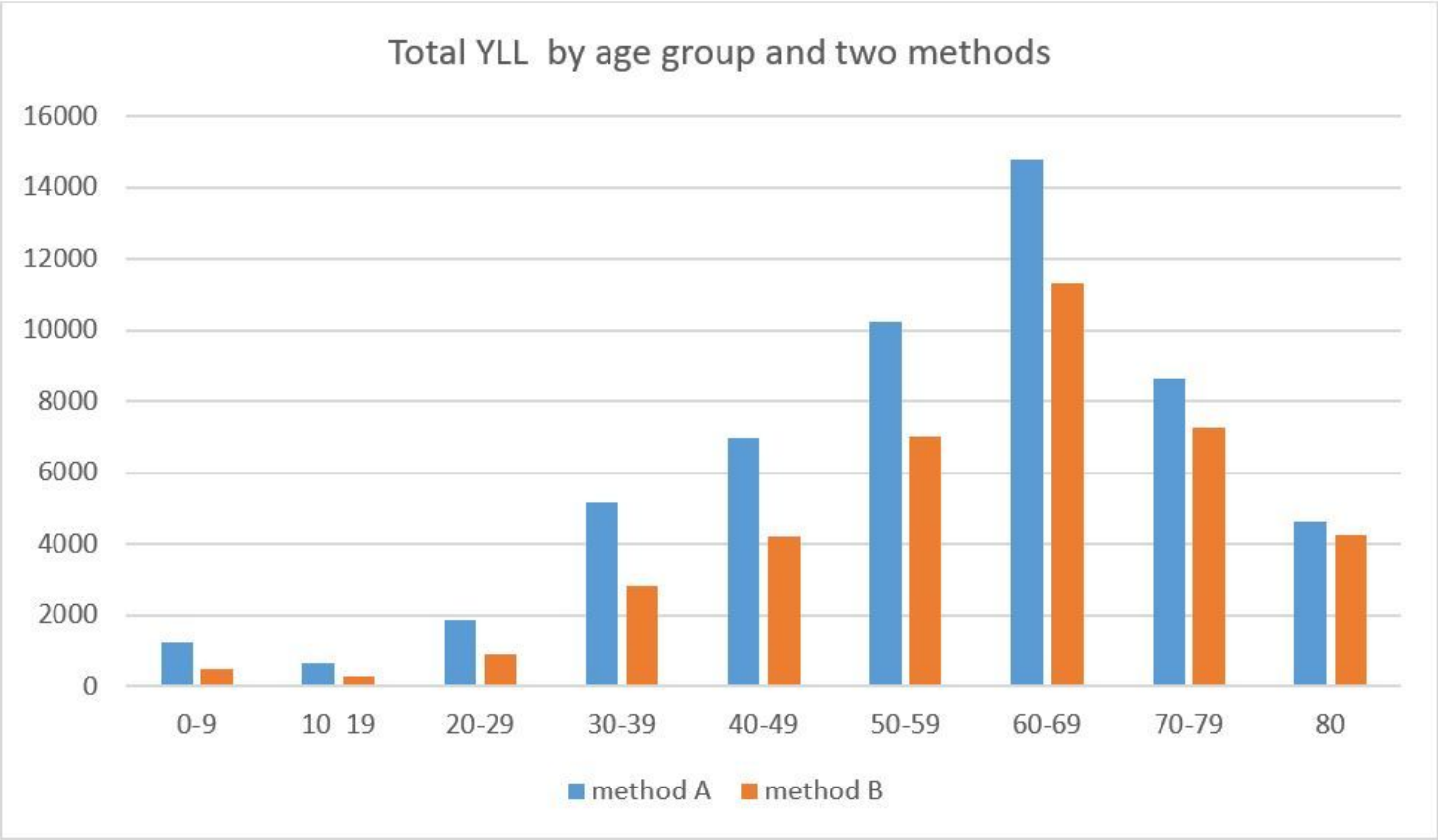

Figure 2

Total years of life lost due to COVID-19 by age and methods.