

The Mortality Rate and Years of Life Lost due to COVID-19 in Southwestern Iran

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Abstract

Background: COVID-19 emerged in China for the first time, and spread rapidly in the world and in Iran. It caused the death of many people. This study was performed to estimate the years of life lost due to COVID-19 in southwestern Iran.

Methods: In this cross-sectional study, deaths due to COVID-19 were investigated from February 20, 2020 to November 20, 2020 in southwestern Iran. Descriptive analyses included: sex ratio of deaths, mean and standard deviation of quantitative variable of age at the time of death, and specific ages-sex mortality rates. Years of life lost due to COVID-19 were estimated using standard life expectancy and lifetime table of the World Health Organization in 2015.

Results: The number of deaths due to COVID-19 was 938 cases. The sex ratio of mortality (male to female) was 1.2, and the people over the age of 80 years had the highest mortality rates in both sexes. The total number of years of life lost was 13205 years, and the 60-69 age group had the highest years of life lost.

Conclusion: Based on the findings of our study, health policymakers need to implement timely strategies and plans to reduce deaths especially for the possible advent of the next wave of COVID-19.

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Introduction

At the end of 2019, after several years of the emergence of various epidemics of family, a coronavirus unknown disease of this family of viruses spread rapidly in China. It was introduced as an international emergency worldwide.¹⁻⁵ Coronaviruses are divided into four families, alpha, beta, delta, and gamma, which account for 10% of acute respiratory infections.⁶ The World Health Organization named the disease COVID-19 (WHO),⁷ which spread from China to 33 countries, including Iran, Japan, Korea, Italy, and Singapore in less than 2 months.⁸

Older people with a history of chronic diseases such as cardiovascular disease, diabetes, hypertension, and respiratory disease have a higher risk of complications and more severe form of the disease; however, no age group is safe from this disease.⁹⁻¹¹

In a study conducted in South Korea, the total burden of disease was estimated 2531 years, 89.7% of which was related to years of life lost (YLL) and 10.3% to years lived with disability (YLD). The age group over 80 years had the highest burden of the disease.¹²

Indicators such as premature mortality are used to evaluate the changes and monitor the health of community. These indicators help the policymakers in healthcare to identify health priorities in the health system.¹³ With regard to the widespread prevalence of COVID-19 in the world, Iran, and consequently in all provinces and due to the importance of this disease and its huge impact on the whole world, in this study we aimed to investigate the mortality rate of this disease because it is an important epidemiological indicator for planning and determining the status of the disease. In addition, we calculated the YLL due to COVID-19 because we need these indicators to determine specific

policies and guidelines to promote health.

Methods

Study Design and Data Collection

This is a cross-sectional study, which has investigated all deaths due to COVID-19 epidemic, from February 20, 2020, to November 20, 2020. The required information was extracted from the Department of Health of Abadan University of Medical Sciences and from the medical records of patients. In this study, only definitive deaths from COVID-19 were investigated and suspicious and unspecified deaths did not enter the analysis. This study was performed on patients from three cities of Abadan, Khorramshahr, and Shadegan, which are located in the southwest of Khuzestan province. The population of this region according to the national census was 627970 in the year 2020 (Figure 1).

The study was reviewed and approved by Medical Ethics Committee of Abadan University of Medical Sciences (Code: IR.ABADANUMS.REC.1399.051).

Statistical Analysis

First, we calculated descriptive statistics such as number, mean, and standard deviation of quantitative variable of age at the time of death; then, we calculated the specific age-sex mortality rate and the sex ratio of death (male to female). After calculating the raw rates, the Age Specific Rates (ASR) were calculated using the standard population of 2013 for countries with low and middle-income.¹⁴ The following formula (Eq. 1) was used to calculate the years of life lost (YLL) due to COVID-19.¹⁵

$$(Eq. 1) \quad SEYLL = N \cdot C e^{(ra)} / (\beta + r)^2 [e^{-(\beta + r)(L + a)} - (\beta + r)(L + a) - 1] - e^{-(\beta + r)a} [-(\beta + r)a - 1]$$

In this formula in equation 1, N shows the number of deaths at gender and certain age. L shows the

standard life expectancy for deaths at gender and the same age. r is equal to 0.03 that shows the discount rate. β is equal to 0.04, and it is the weight of age. C is equal to 0.165, and it is the correction factor of weight of age. a is the age at the time of death, and e is equal to 2.71828 and it is a constant value.

We calculated the YLL with age intervals of 5 years by sex groups; then, the age groups were merged as 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and over 80 years old. Analysis of the number of YLL, due to premature death due to COVID-19, was performed using the YLL template of the WHO in 2015. The analyses were performed in Excel spreadsheet software, version 2007. Descriptive analyses were also performed using SPSS19 software.

Results

During the study period, 938 deaths occurred due to COVID-19 in southwestern Khuzestan province. 54.68% of deaths occurred in men and 45.31% in females, and the male to female ratio was 1.2 (Figure 2). The mean age at death of total individuals under study was 63.82 ± 17.3 ; in the males and females, it was 62.73 ± 17.65 and 65.14 ± 16.84 , respectively. The highest mortality rate in both sexes was seen in people over 80 years, and the lowest mortality rate in males and females was seen in the age group of 0-9 years and 10-19 years, respectively (Table 1).

The total number of YLL due to COVID-19 was 7134 years in men (23.15 per 1000 persons), 6071 years in females (18.98 per 1000 people), and 13205 years in both sexes (21.02 per 1000 persons). (Figure 3) The sex ratio of the number of YLL (male to female) was 1.17. The highest number of YLL of individuals under study was seen in the age group of 69-60 years; also, in males and females, the highest percentage belonged to the age group of 50-59 and 69-60 years, respectively (Table 1).

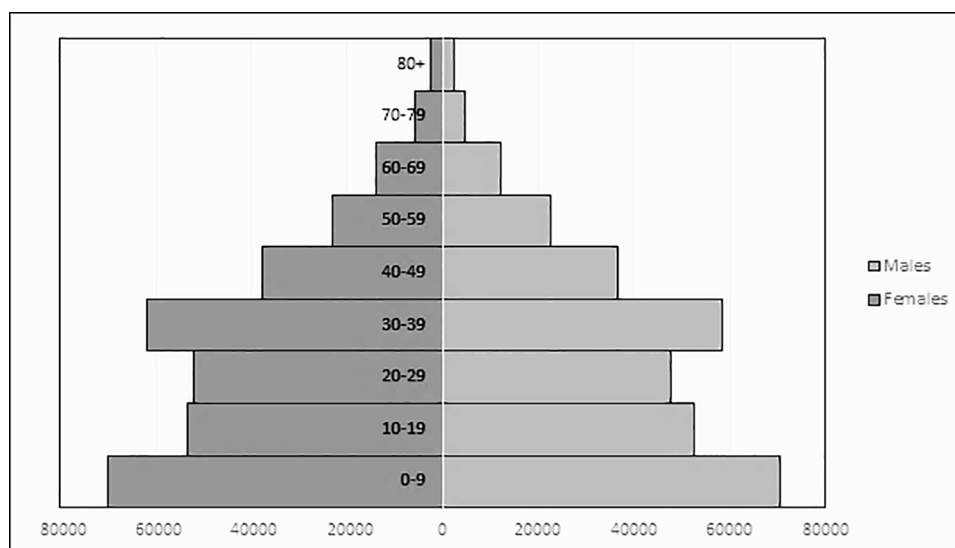


Figure 1: Age and sex distribution of the population in the southwest of Khuzestan province.

Table 1: Mortality rate and years of life lost due to COVID-19 by groups of age and sex in the southwest of Khuzestan province from February 20, 2020 to November 20, 2020

Age group/sex		Number of death	Mortality rate (per 100,000)	Number of YLL	YLL* (per 1,000)
Male	0-9	4	5.67	120	1.70
	10-19	6	11.39	172	3.26
	20-29	11	22.99	296	6.18
	30-39	31	52.93	776	13.25
	40-49	55	150.08	1197	32.66
	50-59	87	383.97	1557	68.71
	60-69	118	956.39	1582	129.42
	70-79	115	2452.02	1039	221.53
	+80	86	3544.93	395	162.81
	Total	513	166.47	7134	23.15
	ASR	242.48			
Female	0-9	4	5.71	121	1.72
	10-19	0	0	0	0
	20-29	8	15.41	219	4.21
	30-39	24	38.84	608	9.83
	40-49	33	87.74	754	20.04
	50-59	64	279.62	1231	53.78
	60-69	119	849.02	1801	128.49
	70-79	82	1405.31	858	147.04
	+80	91	3460.07	479	182.12
	Total	425	132.89	6071	18.98
	ASR	180.27			
All	0-9	8	5.69	241	1.71
	10-19	6	5.66	172	1.62
	20-29	19	19.05	515	5.16
	30-39	55	45.69	1384	11.49
	40-49	88	118.50	1951	26.27
	50-59	151	331.53	2788	61.21
	60-69	237	903.23	3383	128.93
	70-79	197	1871.73	1897	180.23
	+80	177	3500.79	874	172.86
	Total	938	149.37	13205	21.02
	ASR	209.25			

*Years of Life Lost

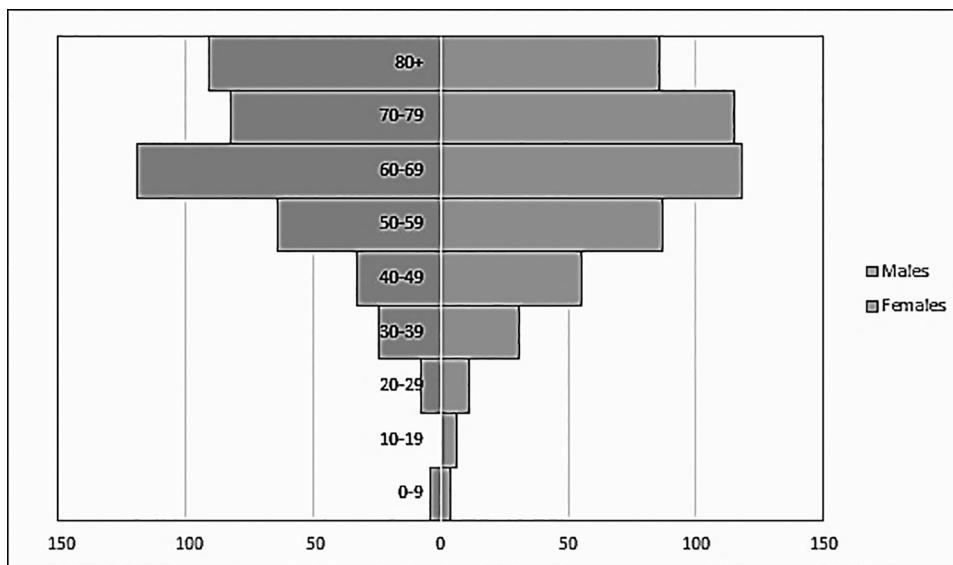


Figure 2: Distribution of the number of deaths by groups of age and sex in the southwest of Khuzestan province.

Discussion

The present study was conducted to investigate the number of years of life lost due to COVID-19 from

February 20, 2020, to November 20, 2020 in the southwest of Khuzestan. The total number of deaths due to COVID-19 was 938 cases. The total number of YLL was 13205, which were equal to 21.02 per 1000

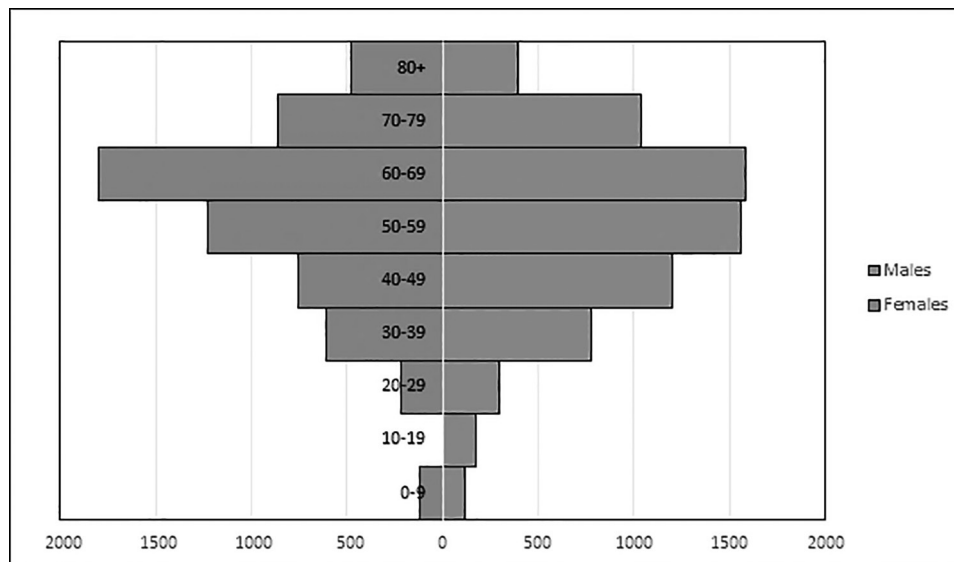


Figure 3: Distribution of YLL (Years of Life Lost) by groups of age and sex in the southwest of Khuzestan province.

population. It was higher in men than in females (7131 years vs. 6071 years). The higher number of YLL in men corresponded to the higher mortality rate in them. These results were consistent with those of others studies.^{12, 16, 17} In Ahvaz (Iran), YLL was seen more in men than women.¹⁸ In another study conducted in Germany, the results showed that the number of YLL is higher in men than women.¹⁹ In another study carried out in Portugal, it was shown that the number of years of life lost due to COVID-19 was 60% higher in men than women.²⁰

The higher number of death and YLL in men may be due to various factors, including genetic, gender, and immunological differences, which needs further investigation in this regard. Also, it should be noted that men are more likely than females to be exposed to the Corona virus and to infection with COVID-19; because of their work, they go out more often than women; therefore, they have more contact with more people. However, it should be noted that in our study, the sex ratio of male to females was 1.2, which indicates that there is not much difference between females and males. This can be due to the high infectivity of the disease, which causes men to transmit the disease to females at home if health and safety tips are not followed.

In the present study, the highest mortality rate in males and females was seen in the age group over 80 years, and the highest number of YLL in individuals under study was in the age group of 60 to 69 years. In another study in Ahvaz, the highest number of YLL was reported in the age group of 60- 69 years and the lowest in the age group of 0- 9 years.¹⁸ In a study conducted in Korea, the highest number of deaths was seen in people over 80 years and then in people 70 to 79 years old.¹² The other studies have shown that the number of death increases with increasing age.²¹⁻²³ A study in Germany also showed that the number of years lost in people over 70 was 9.6 years.¹⁹

The result of a study that examined YLL in 26 countries showed that two-thirds of the number of YLL were in people over 75 years.¹⁷ The results of all these studies show that mortality rate is higher in the elderly, which may be due to the fact that these people have a weaker immune system and are usually suffering from multiple underlying diseases; these factors predispose them to COVID-19 infection. Nevertheless, the number of YLL is shorter in the elderly than in the youth, but their death imposes a lot of social and personal harm on society and families.

YLL in our study was 23.15 per 1000 males and 18.98 per 1000 females, which was similar to the results of a study conducted in Korea.¹² However, it should be noted that because the disease affects more elderly people than young people, the number of YLL is shorter. However, we must keep in mind that COVID-19 is a disease that changes rapidly, and sometime after the onset of the disease, we see more involvement of young people. If this trend continues, its case fatality rate among young people will also increase; consequently, the YLL also increases, which will have very destructive effects on the economy and productivity of the society. For calculating this index, not only the number of deaths is calculated, but also each case of death is given a weight as a function of age at the time of death, which reflects that the YLL is higher in the youth than in the elderly.

The effect of COVID-19 on the public health of the population depends on various factors such as the number of fatal cases, severity of the disease, and duration of the disease during the epidemic.¹⁹ The YLL index is essential for public health assessments.¹⁸ COVID-19 has imposed a lot of pressure on human resources and the health sector because of its contagious and serious nature. However, the capacity of the healthcare system of each country is different in dealing with this pandemic.²⁰ Thus, calculation of the

burden of disease provides information to control the current pandemic and subsequent outbreaks.¹⁹

Limitations

One of the limitations of our study is that the results of this study are not conclusive because the epidemic is still going on. Therefore, it is necessary to wait until the end of the epidemic for better planning to determine the exact YLL caused by COVID-19. However, this is one of the first studies conducted in Iran on YLL due to premature death from COVID-19, and the results of this study could help the healthcare system decision-makers to identify better priorities and plan to reduce death from the disease in subsequent waves of the COVID-19 epidemic.

Conclusion

YLL is one of the most important health indicators, which is used to assess the health status of people and shows the burden imposed on society, which is caused by death from an illness. This indicator helps health policymakers to determine precise strategies, provide the facilities including equipping ICU units, and increase the number of healthcare providers. In particular, increased care in high-risk groups, including the elderly, to prevent deaths and social and personal injuries and also to reduce the YLL.

Availability of Data and Material

The data for the current study will not be shared public.

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Conflicts of interest: None declared.

References

- 1 Moftakhar L, Seif M. The Exponentially Increasing Rate of Patients Infected with COVID-19 in Iran. *Archives of Iranian medicine*. 2020;23(4):235-8. <https://doi.org/10.34172/aim.2020.03>
- 2 Moftakhar L, Mozghan S, Safe MS. Exponentially Increasing Trend of Infected Patients with COVID-19 in Iran: A Comparison of Neural Network and ARIMA Forecasting Models. *Iranian Journal of Public Health*. 2020;49:92-100. <https://doi.org/10.18502/ijph.v49iS1.3675>
- 3 Honarvar M, Roshandel G, Shirzad-Aski H, Tabarraei A, Tahamtan A, Ghelichi-Ghojogh M, et al. Epidemiological and clinical characteristics of the COVID-19 epidemic and associated factors for mortality in Golestan province, Iran: A retrospective cohort study. *Journal of Preventive Medicine and Hygiene*. 2021;2(62):E298-E304. <https://doi.org/10.15167/2421-4248/jpmh2021.62.2.1910>
- 4 Kalteh EA, Sofizadeh A, Fararoei M, Ghojogh MG, Aljalili S. Measures of Mortality in Coronavirus (COVID-19) Compared with SARS and MERS. *Journal of Cellular and Molecular Anesthesia*. 2020;5(2):97-101. <https://doi.org/10.22037/jcma.v5i2.30220>
- 5 Khezri R, Valizadeh R, Nozad P. Achieving Vaccine for COVID-19: Hope for AIDS and Hepatitis C Vaccine? *Journal of Cellular and Molecular Anesthesia*. 2021;6(1):106-7. <https://doi.org/10.22037/jcma.v6i1.34265>
- 6 Hassan SA, Sheikh FN, Jamal S, Ezech JK, Akhtar A. Coronavirus (COVID-19): a review of clinical features, diagnosis, and treatment. *Cureus*. 2020;12(3):e7355. <https://doi.org/10.7759/cureus.7355>
- 7 Leung C. Clinical features of deaths in the novel coronavirus epidemic in China. *Reviews in Medical Virology*. 2020(30):e2103. <https://doi.org/10.1002/rmv.2103>
- 8 Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. *Radiology*. 2020:200642. <https://doi.org/10.1148/radiol.20200642>
- 9 Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, et al. Estimates of the severity of coronavirus disease 2019: a model-based analysis. *The Lancet infectious diseases*. 2020;20(6):669-77. [https://doi.org/10.1016/S1473-3099\(20\)30243-7](https://doi.org/10.1016/S1473-3099(20)30243-7)
- 10 Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, et al. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. *International journal of infectious diseases*. 2020;9712(20). <https://doi.org/10.1016/j.ijid.2020.03.017>
- 11 Huang X, Wei F, Hu L, Wen L, Chen K. Epidemiology and clinical characteristics of COVID-19. *Archives of Iranian medicine*. 2020;23(4):268-71. <http://doi.org/10.34172/aim.2020.09>
- 12 Jo M-W, Go D-S, Kim R, Lee SW, Ock M, Kim Y-E, et al. The Burden of Disease due to COVID-19 in Korea Using Disability-Adjusted Life Years. *Journal of Korean Medical Science*. 2020;35(21). <https://doi.org/10.3346/jkms.2020.35.e199>
- 13 Sankoh O, Sharrow D, Herbst K, Whiteson Kabudula C, Alam N, Kant S, et al. The INDEPTH standard population for low-and middle-income countries, 2013. *Global health action*. 2014;7(1):23286. <https://doi.org/10.3402/gha.v7.23286>
- 14 Organization WH. Handbook on health inequality monitoring: with a special focus on low-and middle-income countries: World Health Organization; 2013.
- 15 Gènova-Maleras R, Catalá-López F, de Larrea-Baz NF, Álvarez-Martín E, Morant-Ginestar C. The burden of premature mortality in Spain using

- standard expected years of life lost: a population-based study. *BMC public health*. 2011;11(1):787. <https://doi.org/10.1186/1471-2458-11-78>
- 16 Nurchis MC, Pascucci D, Sapienza M, Villani L, D'Ambrosio F, Castrini F, et al. Impact of the Burden of COVID-19 in Italy: Results of Disability-Adjusted Life Years (DALYs) and Productivity Loss. *International Journal of Environmental Research and Public Health*. 2020;17(12):4233. <https://doi.org/10.3390/ijerph17124233>
- 17 Arolas HP, Acosta E, López-Casasnovas G, Lo A, Nicodemo C, Riffe T, et al. Years of life lost to COVID-19 in 81 countries. *Scientific reports*. 2021;11(1):1-6. <https://doi.org/10.1101/2020.06.19.20136069>
- 18 Azarbakhsh H, Mirahmadizadeh A, Rostami M. Mortality Rate and Years of Life Lost, Due to Premature Death Caused by COVID-19, In Iran, Ahwaz Jundishapur University of Medical Sciences. 2020. <https://orcid.org/0000-0001-7733-2116>
- 19 Rommel A, von der Lippe E, Plass D, Ziese T, Diercke M, an der Heiden M, et al. The COVID-19 Disease Burden in Germany in 2020: Years of Life Lost to Death and Disease over the Course of the Pandemic. *Deutsches Ärzteblatt International*. 2021;118(9):145. doi: 10.3238/arztebl.m2021.0147
- 20 Vieira A, Ricoca VP, Aguiar P, Sousa P, Nunes C, Abrantes A. Years of life lost by COVID-19 in Portugal and comparison with other European countries in 2020. *BMC public health*. 2021;21(1):1-8. <https://doi.org/10.1186/s12889-021-11128-6>
- 21 Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The lancet*. 2020;118(9):145–51. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)
- 22 Chowell G, Mizumoto K. The COVID-19 pandemic in the USA: what might we expect? *The Lancet*. 2020;395(10230):1093-4. [https://doi.org/10.1016/S0140-6736\(20\)30743-1](https://doi.org/10.1016/S0140-6736(20)30743-1)
- 23 Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *Jama*. 2020;323(18):1775-6. doi:10.1001/jama.2020.4683