

# Mortality Rate and Years of Life Lost, Due to Premature Death Caused by COVID-19, In Iran, Ahwaz Jundishapur University of Medical Sciences

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## Research article

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# Abstract

**Background:** The emerging and evolving situation of COVID-19 threatens the health of all human beings. The aim of this study is to measure the mortality rate and years of life lost, due to premature death caused by COVID-19 in Iran, Ahvaz Jundishapur University of Medical Sciences.

**Materials and Methods:** In this study, all definite deaths due to COVID-19 were used. First, descriptive analysis including mean and standard deviation and number were performed, then raw and age-standardized (ASR) mortality rates were calculated. The analysis of the number of years of life lost due to premature death due to COVID-19 was performed using the YLL template of 2015, from the World Health Organization, in the Excel spreadsheet software version 2007.

**Results:** During the study period (from March 2020 to June 2020), 629 definite deaths due to COVID-19 occurred (men 59.14% and women 40.86 %). The mortality rate due to COVID-19 in men and women was 16.24 and 17.17 per 100,000 persons, respectively. Total years of life lost (YLL) during the study period was 4722 (3.06 per thousand persons) in men, 3691 (2.46 per thousand persons) in women and 8413 (2.77 per thousand persons) in both sexes.

**Conclusion:** This study is one of the first studies to measure the years of life lost due to COVID-19 in Iran. The results of this study show that due to the high mortality of this disease, decision makers should focus on reducing mortality in order to stop the possibly next waves of COVID-19.

## Background

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. The patients were epidemiologically linked to a marine animal wholesale market in Wuhan, Hubei Province, China [1, 2]. This emerging and evolving situation, threatens the health of all human beings and the WHO describes the risk of COVID-19, "very high" globally [3–5]. The first reported case of coronavirus 2019 (COVID-19) was in Wuhan, China. At the end of 2019, it rapidly spread across China, and despite global efforts to prevent its spread, it is causing other cases [6–8]. According to the latest report of the World Health Organization on August 17, 2020, the number of cases and deaths in the world are 21900054 and 774394, respectively, and in Iran, 345450 and 19804, respectively [8].

In a study in 2020 titled The Burden of COVID-19 in South Korea, the total burden of COVID-19 related disease, was 2531 years, of which 89.7% was YLL and 10.3% was YLD. The highest DALY per 100,000 population was in the age group over 80 years [9].

The current epidemic of the new coronavirus-2019 worldwide is still severe and worrying and has become a clinical threat to the general population and healthcare professionals all around the world [10]. As a result, considering that this disease has caused many cases and deaths in Iran and consequently in all regions of Iran, it is vital to take the necessary measures to control and prevent this disease and to

prioritize control measures. Therefore, summary measures such as premature mortality can be helpful in identifying priorities. Thus, this study aims to measure the rate of mortality and years of life lost due to premature death from COVID-19 in areas under the cover of Ahvaz Jundishapur University of Medical Sciences.

## Materials And Methods

### Study design and data collection:

This study includes all definite deaths due to COVID-19 that occurred during March 2020 to the end of June 2020 in Khuzestan province and in the cities covered by Ahvaz Jundishapur University of Medical Sciences. Mortality data are taken from the statistics unit of the provincial health deputy. Trained physicians in different organizations in Iran, first report 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 monthly. These reports are then matched and compared with the data of the country's forensic medicine organization. The population of the cities covered by Ahvaz Jundishapur University of Medical Sciences using the databases of health centers and national census data in 2020 is 3035827 people.

### Statistical Analysis:

First, descriptive analysis including the number of deaths, the sex ratio of deaths and then the age-specific mortality rate were calculated. Raw rates were calculated first, then for comparison, standardized age rates (ASR) were used, using the 2013 standard population for low- and middle-income countries (11).

The World Health Organization (WHO) has introduced three YLL calculation methods in the second edition of its Practical Disease Burden Calculation Handbook, published in 2001 (12). In this study, the third method is used to calculate the years of life lost. The formula is given below.

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

N = the number of deaths at a certain age and gender

L = the standard living of the deceased in the same age and gender

r = equal to the discount rate and is considered 0.03

$\beta$  = the age weight and is considered equal to 0.04

C = is considered equal to the age weight correction factor and is 0.165.

a = is the age of death

e = is a constant value equals to 2.71828.

First, the lost years of life are calculated separately for the 5 sex and age groups, and then the age groups merge as 9 – 0, 19 – 10, 29 – 20, 39 – 30, 49 – 40, 59 – 50, 69 – 60, 79 – 70 and over 80 years old.

The analysis of the number of years of life lost due to premature death due to COVID-19 was performed using the YLL template of 2015, from the World Health Organization, in the Excel spreadsheet software version 2007. Descriptive analysis were performed using SPSS19 software.

The protocol of this study was studied and approved by the ethics committee of Ahvaz University of Medical Sciences with the ethics code IR.AJUMS.REC.1399.207. And all aspects of the study, have been done according to the code of ethics of the university.

## Results

During the study period (March 2020 to the end of June 2020), 629 definite deaths due to COVID-19 occurred in Khuzestan province. (59.14% men and 40.86% women). The sex ratio was 1.44 (male to female). The mean age at death was 14.75 96 65.96 in men, 15.32 65 65.19 in women and 15.01 65 65.60 in both sexes.

### Mortality rate due to COVID-19:

The mortality rate of COVID-19 in men and women was 24.16 and 17.17 percent per thousand, respectively. The highest death rate in men and women was in the age group over 80 years and the lowest was in both sexes in the age group of 0–9 years (Table 1).

### YLL caused by COVID-19:

Total years of life lost (YLL) during the study period 4722 (3.06 per thousand persons) in men, 3691 (2.46 per thousand persons) in women and 8413 (2.77 per thousand persons) for both sexes. Sex ratio (male to female) was 1.27 years. The highest number of years of life lost was in both sexes in the age group of 69 – 60 years and the lowest in both sexes was in the age group of 0–9 years (Table 1 and Fig. 1).

Table 1

mortality rate and years of life lost due to premature death due to COVID-19 by age and sex groups during March 2020 to the end of June 2020.

Age group/sex		Number of death	Mortality rate (per 100,000)		
				Number of YLL	YLL (per 1,000)
Male	0-9	0	0	0	0
	10-19	1	0.45	29	0.13
	20-29	7	2.52	188	0.67
	30-39	12	3.88	296	0.95
	40-49	37	19.72	802	4.27
	50-59	48	40.03	847	7.06
	60-69	107	150.60	1437	20.76
	70-79	90	373.64	786	32.63
	+80	70	438.67	337	21.11
	Total	372	24.16	4722	3.06
	ASR	33.34		4.03	
Female	0-9	0	0	0	0
	10-19	2	0.95	57	0.27
	20-29	2	0.71	55	0.19
	30-39	9	2.95	230	0.75
	40-49	27	14.97	611	3.38
	50-59	49	42.27	934	8.05
	60-69	63	88.68	954	13.43
	70-	57	223.27	592	23.18

	79				
	+ 80	48	353.95	258	19.02
	Total	257	17.17	3691	2.46
	ASR	22.68		3.12	
All	0-9	0	0	0	0
	10-19	3	0.69	86	0.19
	20-29	9	1.61	243	0.43
	30-39	21	3.42	526	0.85
	40-49	64	17.40	1413	3.84
	50-59	97	41.13	1781	7.55
	60-69	170	121.21	2391	17.04
	70-79	147	296.27	1378	27.77
	+ 80	118	399.75	595	20.15
	Total	629	20.71	8413	2.77
	ASR	27.95		3.57	

## Discussion

To evaluate potential policy measures, it is essential to appreciate the full health influence of the COVID-19 pandemic. The present study analyzed the COVID-19 mortality effect by obtaining Iranian life-year losses. From a public health perspective, life year loss is essential as it evaluates the life cut for the disease-affected individuals. The COVID-19 burden was measured through the initial COVID-19 outbreak wave during March-June in Khuzestan Province via YLL. In the incorporated period, a total of 8413 COVID-19 attributable YLLs were identified. The COVID-19 YLL per 100,000 in the initial wave was found to account for a total of 2.77 (3.06 for males and 2.46 for females).

It is required to understand these findings for a continuing pandemic and after implementing unheard policy measures. The available estimations of the counterfactual of zero policy responses indicate significantly greater death tolls and YLL. Among the 243 diseases, the COVID-19 was found in the rank of 85 in the YLLs and of 172 in the YLDs. The COVID-19 burden was found to have a greater YLL percentage (i.e., 89.7%) and a smaller YLD percentage (i.e., 10.3%). YLLs had a greater proportion than the mean of

communicable diseases (i.e., 72.0%), suggesting the larger impact of the COVID-19 on premature death [11, 12].

Concerning age and sex, males had a higher YLL than females, which enhanced with age. It was observed that the maximum absolute YLL count occurred at the age of 60–69. However, the YLL per 100,000 populations indicated the largest value at the age of 70–79 in the development group. This suggests that individuals of higher ages are of higher exposure to the COVID-19 development risk and death. This is in line with earlier studies investigating age-specific mortality within other countries [13–16].

In comparison to other communicable diseases in the KNBD 2016 investigation, the burden of the COVID-19 during January 20–April 24 was 1.39 times as high as influenza, 1.16 times as low as pneumococcal pneumonia, and 5.18 times as low as upper respiratory infections. The COVID-19 YLDs, however, were smaller than influenza and upper respiratory infections, and larger than influenza type B pneumonia, Haemophilus, and pneumococcal pneumonia. Furthermore, the YLLs were smaller than those that could be attributed to pneumococcal pneumonia and were higher than those that could be attributed to the three other diseases. Despite the limitations of comparison to the diseases of similar symptoms instead of similar epidemiological characteristics, the COVID-19 incidence rate and cases were relatively small. The DALY contribution, on the other hand, was found to be rather high due to the greater fatality rate.

The present work encountered a number of limitations. The findings of the present study cannot be considered to be the final results since the pandemic continues to infect. The COVID-19 YLLs were calculated, despite the continuance of the pandemic as it is vital to realize the exact COVID-19 burden for informed decision-making. After the end of the COVID-19 pandemic, the final COVID-19 disease burden could be estimated. It might be beneficial in the future to make annual estimations of the COVID-19 burden. Furthermore, COVID-19 victims are probably a population at risk, whose remaining lifetime expectancy is smaller than the average expected lifetime. This methodological concern is probably valid. As a result, the presented total COVID-19 YLL estimate can be considered as an overestimation.

## Conclusion

In summary, the present study is the first to examine the COVID-19 burden in Iran through YLL. Determining of the COVID-19-attributable YLLs in other countries may lay the ground to make international comparisons and prioritize healthcare resources for the control of the pandemic. Most of the COVID-19 disease burden was extracted from YLL. This suggests that decision-makers need to make a focused effort to decrease fatality to be prepared for the next COVID-19 wave.

## Abbreviations

COVID-19: Coronavirus Disease 2019

SARS: Severe Acute Respiratory Syndrome

YLL: years of life lost

YLD: years lived with disability

DALY: Disability-Adjusted Life Year

ASR: Age standardized rates

WHO: World Health Organization

## **Declarations**

### **Ethics approval and consent to participate**

This study was conducted under the approval of the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences and was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. All participants gave consent and signed the form. (IR.AJUMS.REC.1399.207)

### **Consent for publication**

Not applicable.

### **Availability of data and material**

All data is available upon request.

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### **Competing interests**

The authors declare that they have no competing interests.

### **Authors' contributions**

MV is lead author and guarantor. MV, HA, AM, and MR planned the study and led the drafting and revising of the manuscript. HA contributed to interpreting the data and drafting and revising the manuscript. All authors approved the submitted version of the manuscript.

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# Figures

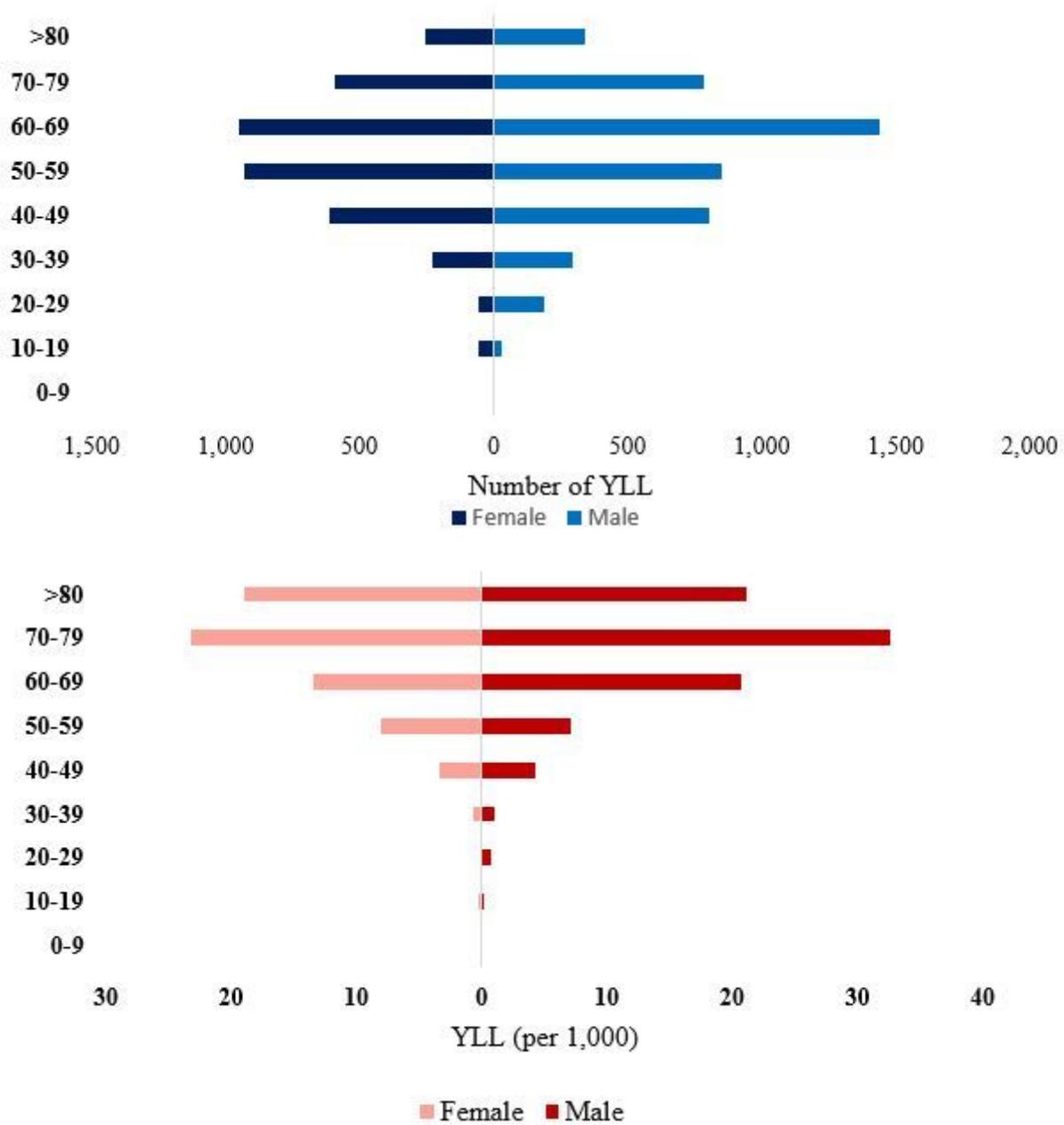


Figure 1

YLL for coronavirus disease 2019 by sex and age group. (A) YLL; (B) YLL per 100,000 population. YLLs = Years of Life Lost.