Death from COVID-19 in Iraq, and its associated risk factor: a three-month situation analysis

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ABSTRACT

INTRODUCTION: COVID-19 has distributed all over the world. The disease has a diverse clinical presentation ranging from mild to critical with few deaths. Elderly, men, and those with immunocompromised state or associated comorbidities are prone to have more severe symptoms and associated with higher risk of death.

OBJECTIVE: To present the case fatality rate of COVID-19 in Iraq and in each Iraqi province registered from 24 February to 24 May 2020 and to find an association between age, gender, and some comorbidities on death from COVID-19.

METHODS: A cross sectional study was conducted to show the epidemiology of cases died of COVID-19 which were diagnosed by RT PCR and registered at the National Registry of the Public Health Directorate, Ministry of Health in Iraq during the first three months of pandemic. We calculated the case fatality rate of each Iraqi province. Then we studied an association between death and age, gender, having coronary artery disease, hypertension, diabetes mellitus, cancer, chronic respiratory disease, and travel history.

RESULTS: Out of 4469 confirmed cases with COVID-19, 160 have died with a case fatality rate of 3.6 %. Diyala and Babylon were recorded the highest CFR; 5/45 (11.1 %) and 5/49 (10.2 %) respectively. Mean age in years, gender, having coronary artery disease, hypertension, diabetes mellitus, cancer, chronic respiratory disease were statistically associated with death from COVID-19, while travel history did not.

CONCLUSION: CFR of COVID in Iraq is in the middle rank compared to the neighbour countries and about half of the average of the world. Being a male, elderly, and having a chronic medical illness is statistically associated with death.

Key words: COVID-19, Iraq, case fatality rate.

INTRODUCTION

In December 2019, a cluster of pneumonia of unknown aetiology appeared in Wuhan City, in Hubei Province, China. Several of the initial patients visited a wet seafood market where other wildlife species were also sold.[1] The virus, which is called SARS-CoV-2 is an RNA virus of subgenus Sarbecovirus and of the genus Betacoronavirus, 60-140 nm in size, and has about 80 % similarity to severe acute respiratory syndrome.[2]

Although the outbreak is likely to have started from a zoonotic transmission, it soon became clear that efficient person-to-person transmission was also occurring.[3] Transmission of infectious diseases must rely on sources of infection, routes of transmission, and susceptibility of hosts.[4] Transmission of COVID-19 is through respiratory droplets either directly or indirectly as it is in SARS-CoV, MERS-CoV, and highly pathogenic influenza.[5] Duration of incubation period of an infectious disease and ways of transmission is important to determine the type and the duration of isolation and physical distancing. For COVID-19 incubation period is on average 5-6 days, however can be up to 14 days.[6,7]

Patients with COVID-19 vary from being asymptomatic to respiratory failure due to acute respiratory distress syndrome. Fever,

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cough, and dyspnea is the commonest presenting signs and symptoms.[8]

Although the vast majority of patients with COVID-19 cure completely, a few have died. Case fatality ratio (CFR), which is the proportion of those died from the disease to the all (asymptomatic and symptomatic) infected cases is the tool used to measure the mortality of a disease.[9]

The world case fatality is 5.9 %, but this figure differs among different countries; the highest rate is in France 15.2%, Italy 14.3%, and UK at 14.1%.[10] Excess deaths from the COVID-19 pandemic might arise both in those infected (direct effects), as well as those affected (indirectly, not infected) by altered access to health care services; the physical, psychological, and social effects of distancing; and economic changes.[11]

Older age, cardiovascular disease, diabetes, chronic respiratory disease, hypertension, and cancer were all associated with an increased risk of death.[12]

Gender plays a role in acquiring infection and its mortality. Males are affected more than female also case fatality in male is higher than female. Females contain more antibodies as compared which comparatively boost their immune system relative to the male. Again, females possess oestrogen as sex hormone, which gives them an upper hand than male. Studies suggest that oestrogen acts as a shield against lots of viral infections. In another study, females also own two X chromosomes. Consequently, they attain an extra copy of gene so as to elevate the immune system.[13]

In this report and based on the National Registry of COVID-19 of Ministry of Health in Iraq, we are reporting the case fatality rate of COVID-19 in Iraq and in each province registered during the first three months of the pandemic in Iraq; from 24 February to 24 May 2020. We also compare our data to that of other Eastern Mediterranean countries. And to find any association between mortality and age, gender, and some chronic comorbidities.

METHODS

Setting and Design: This cross-sectional study was based on the national registry of confirmed COVID-19 cases at Ministry of Health in Iraq. The data of the registry is gathered, unified, and analysed centrally at the Public Health Directorate in Baghdad in collaboration with sections of communicable diseases control in Health Directorates of all Iraqi Provinces. The study covered the period of the first three months of pandemic from 24 February to 24 May 2020.

Ethical consideration: The use of this data was approved by the Public Health Directorate, in accordance with the regulations of the Ministry of Health in Iraq.

Definition of the cases: Confirmed cases of COVID-19 is any person tested positive by a real time PCR on a nasopharyngeal and/or oropharyngeal swab exclusively in governmental laboratories in Baghdad and other health directorates. Devices and kits for COVID-19 diagnosis that have been used were of varying makers and versions.

Variables of the study: we are reporting the confirmed cases, number of cases cured and number of cases died. CFR for each province and for Iraq in general was calculated. Age, gender, travel history, and presence of coronary artery disease (CAD), hypertension, diabetes mellitus, cancer, chronic respiratory disease were reported and their association to the mortality were tested. For the sake of this study we define:

Active case: Any patient who was confirmed COVID-19 and persistently shows positive results by real time PCR by 24 May 2020.

Cure case: A confirmed Patient with COVID-19 is considered cured when he/she turns negative on the PCR in two consecutive tests done 24 hours apart.

Cure rate: is the total number of cure cases divided by the total number of confirmed cases as recorded on 24 May 2020.

Age specific case fatality: Total number of deaths over the total number of confirmed cases within the same age group.

Death Case: For surveillance purposes, we used the WHO definition of death for COVID-19 " a death resulting from a clinically compatible disease in a probable or confirmed case of COVID-19, unless there is a clear alternative

Table 1 | COVID-19 cases and indicators by province in Iraq, 24 February – 24 May 2020

Province	Confirmed	Active	Death	Cure	CFR %	Cure rate %	Population	Incidence rate/100,000
Baghdad	2,233	1,195	97	941	4.3 %	42%	8,558,625	26.09
Basra	747	151	18	578	2.4 %	77%	3,063,059	24.39
Najaf	318	13	6	299	1.9 %	94%	1,549,788	20.52
Muthanna	117	18	4	95	3.4 %	81%	857,652	13.64
Erbil	242	30	1	211	0.4 %	87%	1,953,341	12.39
Kerbala	153	27	8	118	5.2 %	77%	1,283,484	11.92
Sulaymaniya	215	38	4	173	1.9 %	80%	2,277,171	9.44
Missan	52	5	2	45	3.8 %	87%	1,171,802	4.44
Thi-Qar	96	20	4	72	4.2 %	75%	2,206,514	4.35
Kirkuk	72	11	2	59	2.8 %	82%	1,682,809	4.28
Wassit	59	17	3	39	5.1 %	66%	1,452,007	4.06
Diyala	45	19	5	21	11.1 %	47%	1,724,238	2.61
Babylon	49	5	5	39	10.2 %	80%	2,174,783	2.25
Dahuk	26	7	0	19	0.0 %	73%	1,361,211	1.91
Diwaniya	15	3	1	11	6.7 %	73%	1,359,642	1.1
Salah-Addin	13	4	0	9	0.0 %	69%	1,680,015	0.77
Ninewa	12	6	0	6	0.0 %	50%	3,928,215	0.31
Anbar	5	2	0	3	0.0 %	60%	1,865,818	0.27
Total Iraq	**4469**	**1571**	**160**	**2738**	**3.6 %**	**61%**	**40,150,174**	**11.13**

cause of death not related to COVID-19 (for example, trauma). There should not be a period of complete recovery between illness and death".[14]

Statistical analysis: data was shown by tables and graphs using Microsoft Excel software 2019. To calculate the statistical significance of an association, we used t-test used for age, Chi square for travel history and comorbidities (cardiovascular, hypertension, diabetes mellites, chronic respiratory diseases), and Fischer Exact test for cancer. The association is considered statistically significant if the p value is ≤ 0.05.

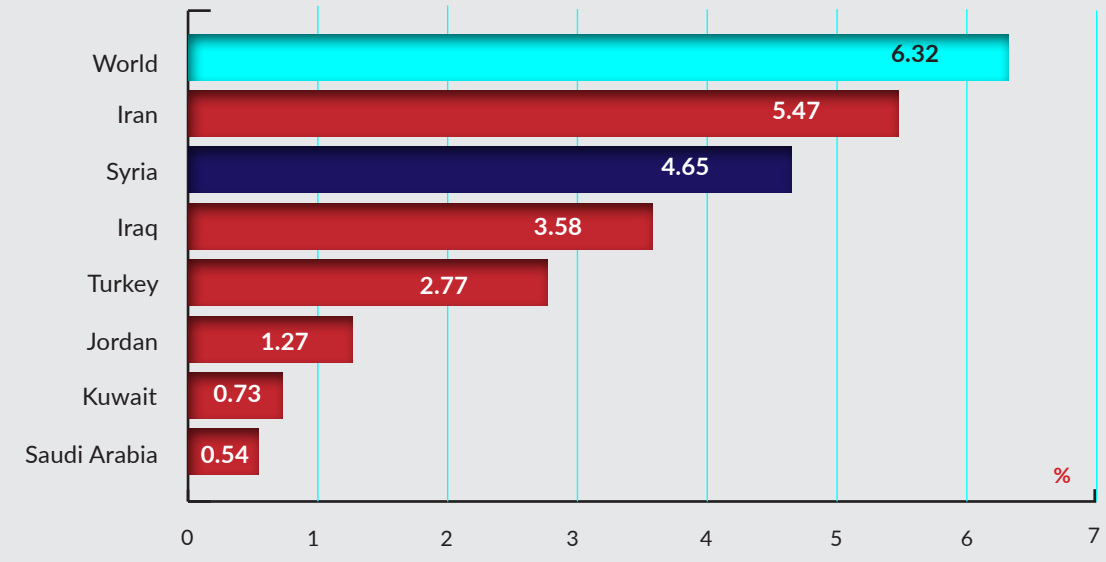

Figure 1 | COVID-19 case fatality rate in the world, Iraq and neighbor countries, till 24 May 2020

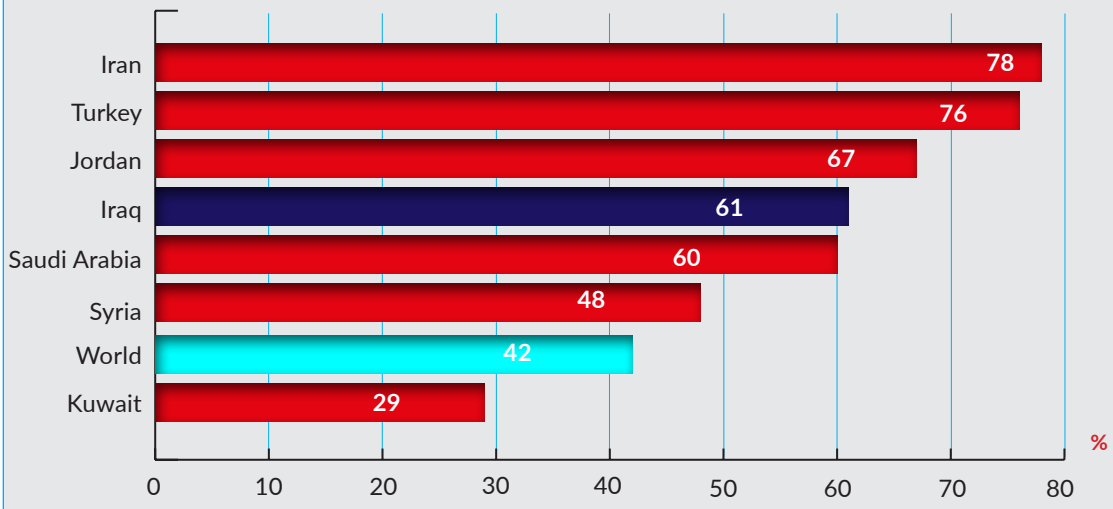

Figure 2 | COVID-19 cure rate in the world, Iraq and neighbour countries, till 24 May 2020

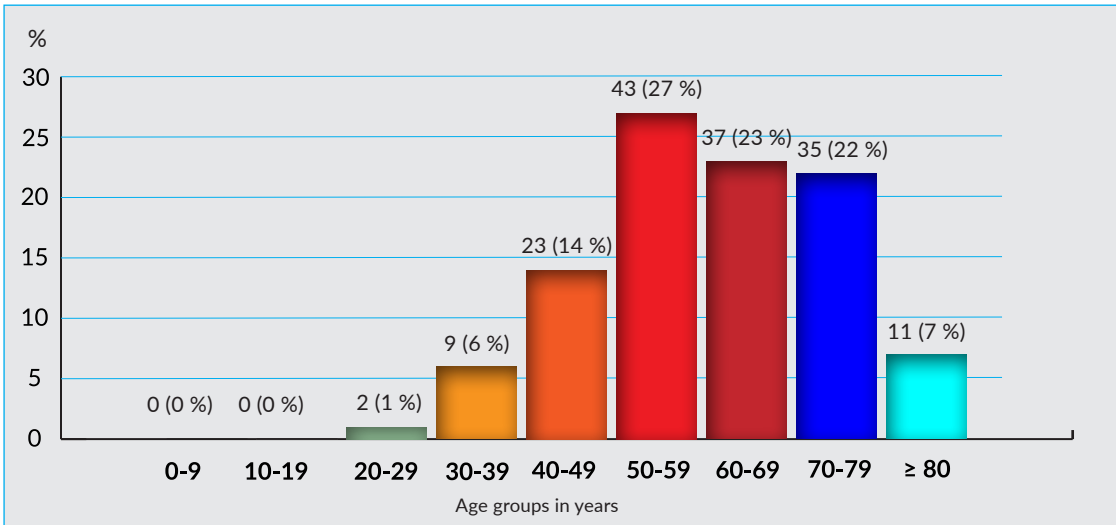

Figure 3 | Proportionate Age specific COVID-19 fatalities in Iraq 24 May 2020

RESULTS

In the first three months of the COVID-19 pandemic, Iraq has registered 4469 confirmed cases of COVID-19. Out of this number, 160 patients have died with a CFR of 3.6 %. **Table 1** shows the distribution of confirmed cases, their outcomes among different Iraqi provinces. Diyala has the highest CFR 5/45 (11.1 %) followed by Babylon 5/49 (10.2%). Dahuk, Salahaddin, Ninewa, and Anbar did not report any death from COVID-19 with a zero CFR.

Figure 1 and 2 show the comparison of Iraqi CFR and cure rate to that of neighbour countries and the average record of the world up to May 2020. CFR and cure rate are ranking Iraq in the middle among his neighbours.

Age group 50-59 years has included the larger number of death 43/160 (27 %), and the age between 50-80 include about 70 % of the total deaths from COVID-19. **See figure 3**

Figure 4 shows the distribution of the closed cases (recovered or dead) in age groups. In those who were over age of 80 years 40.7 have died and 59.3 have recovered. No death were recorded in people younger than 20 years.

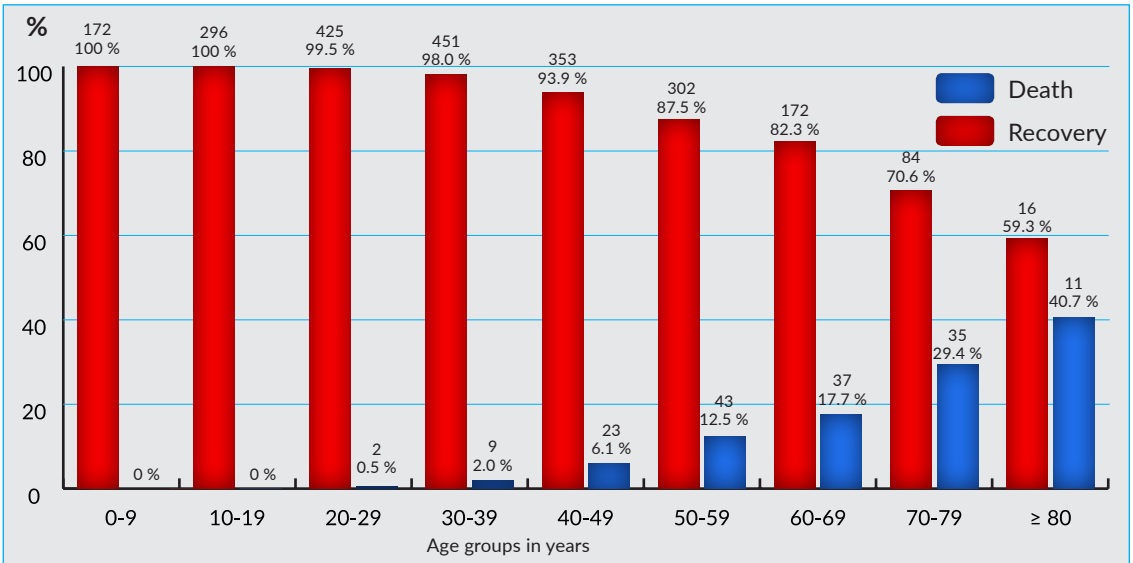

Figure 4 | COVID-19 closed cases outcome distributed by age group in Iraq 24 May 2020

Men died more common than women, 110 (69 %) versus 50 (31 %) **see figure 4**. **Table 2** shows that mean age in years, gender and having hypertension, coronary artery disease, diabetes mellitus, cancer, and chronic respiratory illness have associated with death all of them with a p value of 0.0001.

DISCUSSION

Death is very dreadful event in any disease. Since the emergence of COVID-19 in December 2019, death was the most fearful fate. The disease is highly contagious but fortunately less fatal.[15] The leading cause of death in patients with COVID-19 is respiratory failure from acute respiratory distress syndrome.[16] renal, liver, cardiac, coagulopathy, and septic shock might be other causes.[17]

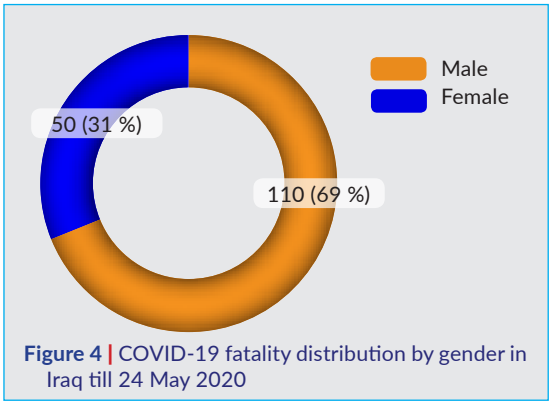

Figure 4 | COVID-19 fatality distribution by gender in Iraq till 24 May 2020

Since the first confirmed case of COVID-19 in Iraq in late February 2020, we registered 4469 patients proved to have the disease up to 24 May 2020 with an incidence rate of 11.13 per 100,000 population. (**For more details about the epidemiology of these cases see the article on pages 85-92 of this issue**). Of those diagnosed, 160 patients have unfortunately died with a case fatality rate of 3.6 % ranking Iraq as the ninth among the Eastern Mediterranean Countries, and it is the third among Arabic Asian countries after Yemen and Syria; however, it is much better compared to the world average, 6.3 %.[18] The CFR differs among different provinces in Iraq. The highest is in Diyala and Babylon, 5/45 (11.1 %) and 5/49 (10.2 %) respectively, while the lowest is in Duhok, Salah-Addin, Anbar, and Ninawa , all zero rate, (**see table 1**). The cause for this variability might be due to the number of confirmed cases in these provinces increasing the possibility of death due to an increased number of confirmed cases,

CFR is estimated to be 5.5% based on World Health Organization data as of 18 June 2020. The CFR varies considerably between countries; for example, it is currently higher in countries such as the UK, France, Italy, and Spain, and significantly lower in countries such as Russia, the US, Germany, Australia, Turkey,

Table 2 | association between some demographic factors and co-morbidities with recovery or death

Factor	Death		Recovery		p value
	No.	%	No.	%	
Gender					
Male	110	8%	1202	92%	<0.0001
Female	50	4%	1095	96%	
Age in years					
Mean±SD	59.56±13.22		35.71±18.45		<0.0001
CVD					
Yes	19	53%	17	47%	<0.0001
No	141	6%	2280	94%	
Hypertension					
Yes	43	53%	38	47%	<0.0001
No	117	5%	2259	95%	
Diabetes Mellitus					
Yes	34	50%	34	50%	<0.0001
No	126	5%	2263	95%	
Cancer					
Yes	2	50%	2	50%	
No	158	6%	2295	94%	
Chronic respiratory disease					
Yes	8	53%	7	47%	<0.0001
No	152	6%	2290	94%	
Travel history					
Yes	9	6%	137	94%	0.86
No	151	7%	2160	93%	

Iceland, Singapore, and middle east.[19]

We need to be cautious in interpreting these figures as CFRs in pandemics might start high and then declining as more statistics become available. For example, at the start of the 2009 H1N1 influenza pandemic the CFR varied from 0.1% to 5.1% (depending on the country), but the mortality rate ended up being around 0.02%.[20]

The variability of the CFR among countries and in the same country over different time might be due to the changing definitions of both parameters affecting the calculation of CFR; the number of death and number of infected patients. Asymptomatic or mildly symptomatic patients might not be included in the calculation because many of them are not within the scope of surveillance adopted especially in early days of the pandemicity where most of the countries have suffered from the lack of enough number of kits to do wide range surveillance. Also it may be attributed to the fact that COVID-19 related deaths, at least initially, are not clearly defined in the international reports available so far, and differences in definitions of what is or is not a COVID-19–related death might explain variation in case-fatality rates among different countries.[21] One can not ignore the effect of politics and immaturity of some health systems on this variability.

Age was seen in our study to be directly related to case fatality rate and indirectly related to cure rate. The more the age was, the more the case fatality and the less the recovery rate were. About 126 (79 %) of deaths were 50 years and above. As seen in **figure 3** the mean age of those died from COVID-19 was 59.56±13.22 while the mean for recovered patients was 35.71±18.45, p value <0.0001.

Studies from many countries have agreed with our results regarding the age. The majority of deaths in China have been in patients aged 60 years and older.[22] In Italy, the CFR was 8.5% in patients aged 60 to 69 years, 35.5% in patients aged 70 to 79 years, and 52.5% in patients aged ≥80 years.[23] In the US, the CFR was highest among patients aged ≥ 85 years (10% to 27%), followed by those aged 65 to 84 years (3% to 11%).[24]

The susceptibility of elderly patients to have severe infection, development of ARDS and high mortality can be attributed to their low immunity and high rate of comorbidities.[25, 26]

In Iraq during the first three months of pandemicity of COVID-19, Males were mildly predominant than female in the number of confirmed cases, 2430 (54 %) versus 2039 (46)[18]; however, the mortality is remarkably higher in males, 110 (69%) versus 50 (31 %), p value <0.0001. Most of the preliminary reports have shown similar results. In Italy, the male to female ratio was 3:1.[27] Similarly, the weekly surveillance reports of all European countries issued by the WHO office for Europe has shown that death from COVID-19 in men were 68 %, 61 %, and 58% in epi week 14, 17, and 22 respectively.[28] However, a study from Wuhan in China has shown that 52 % of deaths were women but this was statistically non-significant.[29]

Although the final data about the effect of gender on the COVID-19 and its mortality have not reached yet, many explanations were made. The explanations can be grouped

into three, the ***first*** is the genetic differences between male and female. The ***second*** is the behavioural differences between them and the ***third*** is the difference in the chances of exposure. The second and the third might not has a strong base to be defeated but the first has scientific bases. Several studies have proposed plausible mechanisms for the protective effect of female sex hormone in sepsis.[30] Males and females respond differently to many RNA and DNA virus infections, in general, males generate less robust immune responses and are more susceptible to a variety of infectious agents. In contrast, females mount stronger innate and adaptive immune responses and are relatively resistant to virus infections.[31]

We studied any association between mortality and having hypertension, coronary artery disease, diabetes mellitus, cancer and chronic respiratory disease. All have shown a statistically significant association with mortality, p value of < 0.0001. Specific comorbidities have been reported to be associated with increased risk of infection, its severity, and worse outcomes including mortality. The most common comorbidities in one report were hypertension (30%), diabetes (19%), and coronary heart disease (8%).[32] Similarly in Italy, the commonest three comorbidities associated with death from COVID-19 were hypertension (69%), diabetes (32%), ischemic heart disease (27%).[33] Another study revealed that hypertensive COVID-19 patients tend to show higher mortality. Previous clinical studies on SARS and Middle East respiratory syndrome showed that hypertension is a risk factor for increased mortality in infected patients, the imbalance of cytokines may be considered an explanation for the correlation between hypertension and severe COVID-19.[34] DM was associated with mortality, severe COVID-19, ARDS, and disease progression in patients with COVID-19, Yan et al have shown that patients with diabetes and severe covid-19 have higher proinflammatory cytokines and a worse survival rate than non-diabetics.[35, 36]

CONCLUSION

CFR of COVID in Iraq is in the middle rank as compared to the neighbour countries and about half of the average of the world. Diyala and Babylone have reported the highest CFR in Iraq, while Dahuk, Salahaddin, Ninawa, and Anbar have reported no deaths so far. Being a male, elderly, and having a chronic medical illness is statistically associated with death.

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Abbreviations list: Acute respiratory distress syndrome (**ARDS**), Case fatality rate (**CFR**), Coronary artery disease (**CAD**), Coronavirus disease 2019 (**COVID-19**), Deoxyribonucleic acid (**DNA**), Middle east respiratory syndrome corona virus (**MERS-CoV**), Polymerase chain reaction (**PCR**), Ribonucleic Acid (**RNA**), Severe acute respiratory syndrome corona virus (**SARS-CoV**), Severe acute respiratory syndrome coronavirus 2 (**SARS-COV-2**), United Kingdom (**UK**).

Conflict of interest: Authors have nothing to declare.

Funding: Authors received no funds to complete this study a part from self funding.