ABSTRACT

The trend of COVID-19 in Iraq showed 2 peaks, August-October 2020 and March-July 2021, with males being more affected by morbidity, mortality, and fatality. The main challenge faced by the Iraqi health system was the rapid increase of COVID-19 cases with limited bed capacity and medical equipment.

Keywords: COVID-19, trend, mortality, Iraq

Many disasters (natural and man-made) have been occurred worldwide in the last decades, causing major disruption to life and health. The unpredictable nature of these disasters urged the health professionals to be adapted to the resulted rapid and unprecedented changes of the environment.\(^1\) Pandemics have a memorable occurrence in the history of populations via causing them to live in a state of anxiety and fear, and disrupt the natural flow of their life.\(^2\) Contrastive to natural disasters, which usually have a known onset and size of population affected, pandemics usually start insidiously and propagate rapidly depending on the route of transmission, virulence of the agent, and other human and environmental circumstances.\(^3\)

The first rising of coronavirus disease-19 (COVID-19) cases was around the end of December 2019 or early January 2020.\(^4,5\) The rapid increase in infections and deaths resulted in anxiety, panic, stigma, mistrust, and rumor-mongering among people. This
The data analysis was carried forced governments to adopt unfamiliar measures in features of this highly infectious and fatal disease have psychological, social, and economic sequels. morbidity and mortality, it has major adverse public awareness and panic, as in addition to the superimposed the health impact. increasing unemployment, attributed to COVID-19, differences.

genetic factors of the host, and demographic a multifactorial combination of viral immunogenicity, (UK), and 3.5% in Italy. This difference could be due to in India, 4.7% in Iran, 3.4% in the United Kingdom (UK), and 3.5% in Italy. This difference could be due to a multifactorial combination of viral immunogenicity, genetic factors of the host, and demographic differences. The reduction in workforces and the increasing unemployment, attributed to COVID-19, caused a significant economic burden worldwide that superimposed the health impact.

Coronavirus disease-19 pandemic made a global public awareness and panic, as in addition to the morbidity and mortality, it has major adverse psychological, social, and economic sequels. The features of this highly infectious and fatal disease have forced governments to adopt unfamiliar measures in most countries, such as declaring a state of emergency, general incarceration of the population, imposition of social distancing, and the application of restrictive social (and health care) visiting policies.

The purpose of this study was to recognize the epidemiological trend of COVID-19 in Iraq, the distribution of cases by age, gender, and governorates, and to assess the burden on the health system by estimating the morbidity, mortality, and case fatality rate, in addition to the health authorities’ opinion on the obstacles emerged in dealing with this pandemic.

Methods. This study was designed as 2 main parts; first, as a biometric descriptive study that involves treatment and processing of already available data from the Ministry of Health and related facilities to sketch the epidemiological trend of COVID-19 including: distribution, morbidity, mortality, and CFR in a 17-month-period (March 2020 through July 2021). The second part was designed as a qualitative study to throw light on the burden of the pandemic on the health system via interviewing the decision makers in the Ministry of Health and Baghdad health directorates. A semi-structured questionnaire (with some open-ended questions) was distributed to a number of decision makers regarding the health system challenges that have been faced during this pandemic, such as health resources, people’s commitment to health authorities’ instructions, availability of vaccine, the main reasons for recurrent peaks in the disease trend, and the possible solutions for any future scenarios, including the plans to overcome any emerging situation.

The challenges include comprehensiveness of the health services, access (geographic accessibility, acceptability, and affordability), referral systems, vertical integration and coordination of health services, and continuity of care.

Data were categorized by age and gender, then plotted against time to see the trend of the disease for each age group and gender. Data were examined and triple checked for missed information and conformed to WHO reports.

This study did not include human or any sort of intervention. Hence, the ethical considerations were not needed apart from the approvals of the Ethical Committee in the College of Medicine, Mustansiriya University, Baghdad, Iraq, and the permissions from the Ministry of Health. However, the participants were assured that the information they declare would not be used for any purpose other than research work.

Statistical analysis. The data analysis was carried out using Statistical Packages for Social Sciences,
version 26.0 (IBM Corp, Armonk, NY, USA). Data were presented in simple measures of frequency and percentages. Linear regression was used to sketch the trend of the disease.

**Results.** Figures 1 & 2 show the trend of COVID-19 in Iraq during the period from March 2020 through July 2021. There are 2 peaks; a moderate one (August-October 2020) and a high one (March-July 2021). Figures 2 & 3 show the trend of mortality during the same period. Figure 4 demonstrates that males are affected more than females, 55.1% of the cases were among males, with the predominant age group for both genders (67.5%) being 30-60 years. The trend of deaths is illustrated in Figure 5 with a predominance of male gender. Mortality was also predominant among males (62.7%) and 50.0% of the deaths were among the age group >50 years. Case fatality rate was 1.2%; again higher among males than females (1.3% versus 1.1%). A comparison between the number of cases and deaths in each governorate showed that Diyala, Anbar, Wasit (Middle region) have low numbers of deaths compared to cases; while Sulaimaniyah (North) has a high number of deaths (not tabulated).

Table 1 describes the challenges and obstacles that faced the Iraqi health system during this pandemic and the possible reasons stated by decision makers in the Ministry of Health and health directorates, the main challenges were: shortage of health personnel, limited bed capacity due to old buildings of hospitals, and insufficient oxygen supply.

**Discussion.** More than half of the cases were males, and two-third aged 30-60 years. This goes with a study in Victoria, Australia regarding the age group of cases, although the vulnerable age group for death was ≥60 years, but it disagreed with a study in India where male constituted 65.4%, with age group 18-35 years formed 37.5% of the cases.18 The results of meta-analysis in 8 countries showed that the highest frequency of cases (in Germany, Chile, Portugal, South Korea, New Zealand, Turkey, Canada, and USA) was in the age group 20-39 years; while in Italy, Netherlands, and UK the highest frequency was among the age group >80 years.19 The differences in the access of COVID-19 testing could be the main reason, rather than in the actual number of cases, as testing the elderly was a priority. They were labeled as a high risk group, due to the severe complications they might face, taking in consideration the limited capacities in testing at the beginning of the pandemic. However, younger age groups began to receive a parallel consideration as testing capacities improved especially with increasing numbers of asymptomatic patients in most populations that may facilitate the transmission of the infection.19,20

Two-third of the total deaths were males, half of whom age more than 60 years. Certain groups especially those age groups above 65 years or those with previous medical illnesses are more affected by COVID-19 complications and can result in more fatalities. Physiological effect due to aging process, such as waning of the immune system, dysfunction, and degeneration of body tissues can be the leading cause for deterioration and death.21 Coronavirus infection is now labeled as “the third leading cause of death for children and adults (697.5 deaths/million)”, that comes only after heart problems (1287.7 deaths/million) and cancer (1219.8 deaths/million).22

Gender could play a part in vulnerability to coronavirus disease, however, this is still unclear. Several reports have indicated that men have a higher

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**Figure 1** - Coronavirus disease-19 cases in Iraq (March 2020- July 2021).
**Figure 2** - Coronavirus disease-19 incidence and mortality (MR) rates in Iraq (March 2020-July 2021).

**Figure 3** - Coronavirus disease-19 cases and deaths by month in Iraq (March 2020-July 2021).

**Figure 4** - Distribution of coronavirus disease-19 cases in Iraq by age and gender.
Table 1 - Main challenges and obstacles faced by the Iraqi health system during the pandemic.

| Obstacles                                                                 | Reasons                                                                                                                                  |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Sudden flare up in number of patients beyond hospitals capacity            | Poor adherence to health instructions and delayed closure of borders with neighboring countries                                        |
| Rapid turnover of decision makers in                                      | Inexperience, panic, overwork, pressure from other governmental unprofessional parties                                                 |
| Discredit the role of epidemiologists in controlling the pandemic         | Lack scientific approach in the treatment (no randomized trials)                                                                            |
| Uncertainty in decision making                                            | Overload on HCWs and burden on health system                                                                                               |
| Miss management due to lack of knowledge about the virus                  | Poor planning and deficient experience                                                                                                    |
| Depending on passive rather than active surveillance                     | Poor planning and limited amounts of vaccine                                                                                            |
| Lack of periodic medical examination for frontline HCWs                   | Panic, listening to rumors and negative effect of some religious and community leaders                                                 |
| Weak implementation of vaccination campaigns especially house to house    |                                                                                                                                          |
| Poor public cooperation                                                   |                                                                                                                                          |
| Challenges:                                                               |                                                                                                                                          |
| Shortage of HCWs                                                          | Migration of doctors due to the unfavorable security condition                                                                             |
| Deficient supply of medicines                                             | Domination of certain companies over the governmental supply                                                                            |
| Problems in maintaining PPE                                              | Lack of national budget                                                                                                                   |
| Limited bed capacity                                                     | old buildings of hospitals with no extension/renovation                                                                               |
| Insufficient oxygen supply                                               | Depending on oxygen cylinders                                                                                                             |
| Inadequate training of HCWs                                               | Lack of continuing medical education                                                                                                     |
| Insufficient amount of PCR                                                | Restricted to the Central Laboratory of Ministry of Health                                                                             |
| Delayed supply of vaccination                                             | Logistic problems                                                                                                                         |

HCWs: healthcare workers, PPE: personal protective equipment, PCR: polymerase chain reaction
number of infection and case fatality rates than women. Reasons behind that might include variability in gender norms and habits, or differences in social roles in each society. Islam et al attributed that to several factors, such as occupational and lifestyle that may increase the likelihood of exposure among men or differences in underlying comorbidities between both genders.

The disease trend in the current study showed 2 peak; a moderate one (August-October 2020) following “Eid al Fitr” celebration, and a higher one (March-July 2021), while Saudi Arabia reported a single peak (June-July 2020). In Egypt, there the highest peak was in June 2020 with 2 moderate peaks in January 2021 and in June 2021. Iran experienced 2 moderate peaks in November 2020 and in April 2021, and a highest peak in August 2021. Although large gatherings of people like religious ceremonies with massive overcrowding can participate in the disease trend fluctuation, small and informal social gatherings are thought to be an important source of transmission; birthdays, wedding, and funeral occasions can empirically quantify the impending role of small social gatherings in COVID-19 spread.

Case fatality rate seems to be relatively low in the current study compared to other countries, a study that included 20 European countries (severely affected with COVID-19), in addition to USA and Canada, concluded that the country-specific CFR showed a broad spectrum, ranging from 0.6 (Iceland) to 18.1% (France). However, CFR in the current study was higher among males, which was consistent with most of the countries in Hoffmann and Wolf’s study. Many heterogeneous reasons related to country-specific differences in cases and deaths have been evaluated, including genetic, socioeconomic, and environmental factors.

Coronavirus disease-19 cases distribution, deaths, and CFR by months during the period of the study showed that the highest number of deaths was in July 2020, and the maximum number of cases was in July 2021, whilst the CFR reached its peak at the beginning of the pandemic. These results were in line with WHO COVID-19 weekly global report, in which the elevated trend in the last 2 months (Jun-July 2021) was largely attributed to increase number of cases in the Western Pacific region (14.0% increase) and the Americas (8.0% increase), while at the country level, the peak numbers of new cases in the same period were reported by USA, Iran, and India.

The highest global death rate reported by WHO was in January 2021, while the highest global CFR was in April 2020. Hasan et al in a meta-analytic study concluded that the weekly worldwide coronavirus CFR got a top at 7.2% during the 17th epidemiological week (April 22-28, 2020). The topmost 5 countries with coronavirus CFR were Yemen (28.9%), Italy (13.2%), UK (12.4%), Belgium (11.6%), and France (11%). Case fatality rate is a key measure of disease burden that is crucial for effective pandemic monitoring and control. However, many reasons restrict obtaining an accurate estimate of CFR and Mortality rate by COVID-19.

The decline in CFR in this study was consistent with other studies in USA (New York), where the death rate among inpatients declined 18-20.0% in a 3-4 months period, from 25.6% in March to 7.6% in June 2020. In another study in England, the death rate decreased among patients that were admitted in May related to those admitted in March 2020 (from 11.2% to 9.0%). The relative drop in CFR could be due to some reasons, such as: increased public awareness, widespread testing that detects even asymptomatic or mild cases, precision of severely ill patients’ management, favorable outcomes for infection of younger people, and experience gained by health professionals.

The morbidity and mortality statistics by governorates demonstrated that the highest incidence rates were in Wasit, Duhok, and Baghdad, whilst Sulaimaniyah recorded the highest mortality and case fatality rates. Despite the geographical variability between Iraqi governorates, it is generally expected that increased population density rises the susceptibility of some regions to get infection due to the high occurrence of social and economic interactions. Population density is certainly a crucial hint in studying virus spread, however, limited access to medical services due to a shortage of health personnel, hospitals beds (especially intensive care units) and intensive care beds, testing intensity and access to testing, in addition to low income level in more closely inhabited areas could be possible factors.

The main challenges faced by the Iraqi health system during this pandemic as stated by decision makers in the Ministry of Health were shortage of medical personnel as a result of migration of doctors due to unfavorable security condition, also the limping health system and services represented by shortage of medicines and insufficient oxygen supply. In a study in Nepal, the most challenging aspects were the availability of testing kits, medical supplies, and personal protective equipment. In a study in France, the main challenges were increase health workers’ awareness regarding management of suspected and confirmed cases, preparedness by education, and training that have been regularly organized for frontline health workers.
Moreover, the burden on the healthcare system was also attributed to the rapidly increasing number of cases. Governments have to take several measures to improve the capacity of the health system in order to tackle the prevailing healthcare crises, some healthcare professionals advise that the government should actively work on the security of the health workers. Lockdowns must be focused on places where clusters of cases are detected.38

Many obstacles emerged during the process of the pandemic control, especially the sudden flare up in the number of cases beyond hospitals’ capacity (due to poor adherence of people to health instructions), in addition to the delay in closing the borders with the neighboring countries, and the slow and weak implementation of vaccination campaigns. The main reasons for loss of people’s role and cooperation during the pandemic were economic problems in making a living especially among those with daily work, which contributed to a negative outcome, in addition to panic that is fed by rumors from the social media especially with respect to vaccination. People generally rely on social media to gain information on the virus.39,40

The interviewed decision makers made some suggestions to overcome the obstacles such as: establish modern hospitals in accordance with international health standards, intensify community sensitization, and engagement to encourage COVID-19 vaccine demand and uptake. Organizational, and institutional efforts and coordination approaches are compulsory for management of any global health crisis.40

Important suggestions to overcome psychological problems that affect people or health personnel were also raised, such as psychological education of health workers, in addition to periodic home visits of psychiatrists to the patients to provide psychological/social support.

The findings of this study form a baseline information that would be helpful for quality improvement and governmental work for improving medical services.

Study limitation. We depended in the data collection on the numbers from the surveillance system of the Ministry of Health, there might be a sort of underestimation as many people with COVID-19 may not go to the health facilities, especially if the disease is not severe, because they were afraid of being (or their family contacts) quarantined.

In conclusion, the trend of COVID-19 in Iraq showed 2 peaks (August-October 2020 and March-July 2021), with males being more affected by morbidity, mortality, and CFR. The main challenge faced by Iraqi health system was the rapid increase of coronavirus cases with limited bed capacity, and medical equipment, while the main obstacle was poor compliance of the people. Enhancing the number and quality of critical care units and hospital beds capacity to cope for the increasing numbers of patients is an urgent need.

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