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Characteristics and outcomes of COVID-19 home monitoring in Saudi Arabia during the second and third waves

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ABSTRACT

Introduction: As severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) spread around the world, patient care was shifted to outpatient care and home monitoring. This paper describes the characteristics and outcomes of patients with coronavirus disease 2019 (COVID-19) treated at home during the second and third waves in Saudi Arabia.

Materials and methods: Descriptive evaluation of the characteristics and outcome of COVID-19-positive cases enrolled in the home monitoring programme.

Results: This study included 14,970 SARS-CoV-2-positive patients (52.6% male). The mean age was 30.8 [standard deviation (SD) 19.9] years. Among the confirmed cases, 14,234 had documented vaccination status; of these, 3943 (27.7%) had not received any doses of COVID-19 vaccine, 1452 (10.2%) had received one dose, 4882 (34.3%) had received two doses, and 3957 (27.8%) had received three doses. The mean number of days in the home monitoring programme was 8.3 (SD 3.5) days. The mean interval from the last vaccine dose until SARS-CoV-2 infection was 116.6 (SD 75.5) days in 7975 patients. The presence of comorbidities was as follows: chronic kidney disease, 340 (2.3%); hypertension, 2569 (17.2%); chronic pulmonary disease, 2539 (17%); smoking, 1711 (11.4%) of 9269 with documented smoking histroy; coronary artery disease, 854 (5.7%); and diabetes mellitus, 1531 (10.3%). The hospitalization rate was 1.8%, and the case fatality rate was 5% of admitted patients, accounting for 0.11% of all cases. The mean age of patients who died was 76.6 (SD 17.7) years, which was higher compared with the mean age of those who survived [30.8 (SD 19.9) years] ($P<0.001$).

Conclusion: Utilization of a home monitoring programme was effective and safe for patients with COVID-19 who were either asymptomatic or had mild symptoms.

Introduction

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic began in December 2019 in Wuhan, China [1,2]. Such a pandemic had not been seen in decades, and it only took 3 months for the first cases of coronavirus disease 2019 (COVID-19) to be reported in Arabian Gulf countries, including the Kingdom of Saudi Arabia (KSA) [3–5]. The initial COVID-19 wave overwhelmed healthcare organizations, prompting the implementation of various strategies, including the isolation and de-isolation of patients with COVID-19 [6,7]. Home monitoring or remote patient monitoring is one strategy to alleviate the tremendous pressure on healthcare systems. One study of remote patient monitoring of high-risk patients found that patient engagement was a key factor in lower hospitalization and death rates [8]. A previous study of a home monitoring programme during the first COVID-19 wave in KSA showed it was effective and safe for asymptomatic patients and those with mild symptoms [5]. Subsequently, additional COVID-19 waves were documented, including the Omicron wave which led to a significant increase in the number of cases globally and locally [9]. This study was designed to describe the characteristics and outcomes of patients with COVID-19 in the home monitoring programme during the second (Delta) and third (Omicron) COVID-19 waves.

Abbreviations: SARS-CoV-2, severe acute respiratory syndrome coronavirus-2; COVID-19, coronavirus disease 2019; KSA, Kingdom of Saudi Arabia.

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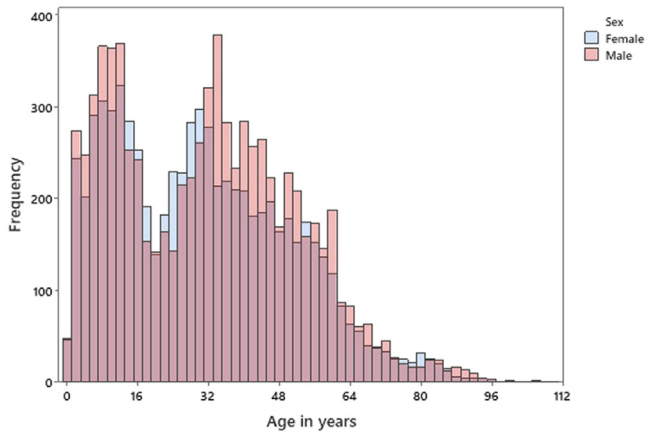

Figure 1. Ages of male and female subjects diagnosed with coronavirus disease 2019 (n=14,970).

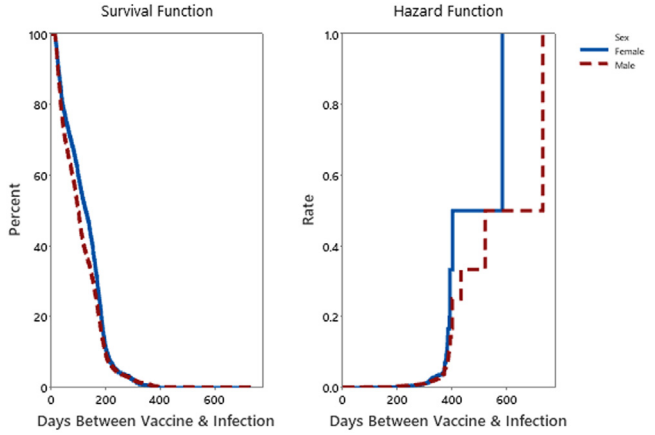

Figure 2. Survival and hazard curves of time from last vaccine dose to severe acute respiratory syndrome coronavirus-2 infection for males and females.

Materials and methods

This observational study included SARS-CoV-2-positive cases who were enrolled in the home monitoring programme from 1 February 2021 to 31 March 2022. The following data were collected and analysed: gender, age, result date, duration of home isolation, clinical presentation, comorbidities, and outcome status (discharged, transferred to hospital, death), as described previously [5]. The case-management admission team used pre-defined criteria to evaluate each patient for appropriateness of the home monitoring programme. Patients with chronic conditions were evaluated specifically for home monitoring on an individual basis, and they were followed-up regularly to ensure that they remained stable and suitable for home monitoring. According to the time-based isolation, the majority of patients were assessed on the first day of enrolment and on day 10 or day 7 in the second wave and third wave, respectively [6]. The institutional review board approved the study.

Statistical analysis

Statistical analysis was performed using Minitab Version 17 (Minitab Ltd, State College, PA, USA). In the documented cases, categorical variables were presented as frequencies and percentages, and continuous variables were presented as means and standard deviations (SD). A binary logistic regression analysis was performed for factors associated with death. A P-value ≤0.05 was considered to indicate significance.

Results

In total, there were 14,970 patients in this study (52.6% male). The mean age of the included patients was 30.8 (SD 19.9) years (Figure 1). There were 3324 (22.2%) cases in 2021 and the others were reported in 2022. Vaccine status was documented for 14,234 cases; of these, 3943 (27.7%) had not received any doses of COVID-19 vaccine, 1452 (10.2%) had received one dose, 4882 (34.3%) had received two doses, and 3957 (27.8%) had received three doses. Thus, 10,291 (72.3%) of the 14,234 patients with documented vaccine status had received at least one dose of COVID-19 vaccine prior to the development of SARS-CoV-2 infection. The mean interval from the last vaccine dose to infection was 116.6 (SD 75.5) days (Figure 2). The mean number of days in the home monitoring programme was 8.3 (SD 3.5) days. The presence of comorbidities was as follows: chronic kidney disease, 340 (2.3%); hypertension, 2569 (17.2%); chronic pulmonary disease, 2539 (17%); smoking, 1711 (11.4%) of 9269 with documented smoking histroy; coronary artery disease, 854 (5.7%); and diabetes mellitus, 1531 (10.3%). Two hundred and seventy (1.8%) patients required hospitalization; of these, the case fatality rate was 5% (0.11% of all cases). Mean age was significantly

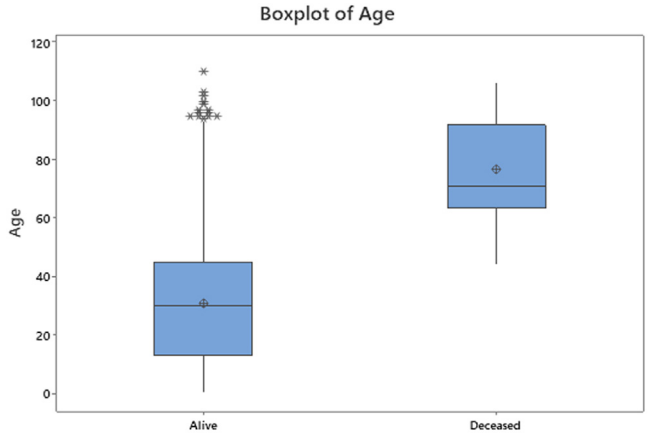

Figure 3. Patient age and outcome (survived vs died).

higher among patients who died compared with those who survived [76.6 (SD 17.7) years vs 30.8 (SD 19.9) years] (P<0.001) (Figure 3).

Discussion

During the second (Delat) and third (Omicron) waves of the COVID-19 pandemic in KSA, a large number of patients were cared for using the home monitoring programme. This study demonstrated the safety and effectiveness of this strategy. The proportion of patients who had received at least one dose of COVID-19 vaccine before infection was 72.3%, and vaccination had a positive role. Previously, during the third (Omicron) wave, a study from KSA showed that the hospitalization rate was inversely related to the number of doses of COVID-19 vaccine [9]. The authors' previous study confirmed that the home monitoring programme bridged the gap between the need to care for and monitor mild COVID-19 cases and the need to care for severe cases of COVID-19 and non-COVID-19 cases [5,10].

This study provides a framework for the care of such patients in the event of occurrence of future outbreaks or pandemics. Another study found that a home monitoring programme was safe and could be integrated into primary care clinics for continued access during the COVID-19 pandemic [11]. Home monitoring programmes have the following advantages: participant acceptance, feasibility, safety, and resource conservation [12]. Other benefits include avoiding hospitalization, reducing the burden on healthcare systems, and potentially alleviating the mental impact of isolation [5]. This model could certainly be used for future pandemics [13], as well as post-pandemic times and after hospital discharge [14].

According to the study data, 1.8% of patients with COVID-19 required hospitalization. Only 1.9% of 173 patients in a smaller study who were monitored remotely required hospitalization [15]. A previous study of remote monitoring showed an admission rate of 0.35% among 3701 symptomatic patients with COVID-19 [16].

When compared with the Delta period, the Omicron period had a hazard ratio of hospitalization rate of 0.41 (95% CI: 0.39–0.43) [17]. One study showed that 2–3% of patients with COVID-19 required readmission [18], and another study showed a hospitalization rate after discharge of 7.6% [19]. These two studies, however, are not comparable due to differences in their design and the patient characteristics.

Verified cases of COVID-19 had significantly higher rates of concomitant diseases. Hypertension (14.34%), diabetes mellitus (9.65%) and respiratory disease (3.6%) were found to be the most prevalent comorbidities among all patients with COVID-19 in a previous study of a home monitoring programme during the first wave of the pandemic in KSA [5]. Among the common comorbidities, a meta-analysis showed the presence of diabetes mellitus in 11% of patients and cardiovascular disease in 5.8% of patients [20]. In another systematic review, comorbidities were found to be more prevalent among patients who died (74.37%) compared with total cases (40.8%) [21]. Diabetes and hypertension were the most common comorbid conditions in patients admitted to hospital in KSA during the Omicron wave, with rates of 10.5% and 7.5%, respectively [9].

The mean number of days in the home monitoring programme in the second and third waves was 8.3 (SD 3.5) days, compared with 10 days during the first wave [5]. One study, however, found a median of 8 days [15], and another study of 83 patients found that the average number of days in the home monitoring programme after discharge from the emergency room was 21.8 (range 1–42, median 18) days [22]. As the pandemic progressed, the differences in the number of days in the home monitoring programme reflected changes in the isolation time required after diagnosis [6].

In this study, the case–fatality rate was 5% of admitted patients, accounting for 0.11% of all positive cases during the Delta and Omicron waves. This finding is in contrast to a smaller study from KSA during the Omicron wave which showed no deaths among admitted patients [9]. A meta-analysis found that the mortality rate for Omicron cases was 0.33 [95% confidence interval 0.19–0.56] which was lower than for Delta cases [23]. A subsequent study found a lower median mortality rate of 3.04 [interquartile range (IQR) 1.87–7.48) during the Omicron period compared with 8.56 (IQR 4.76–18.39) during the Delta period [24]. This was also confirmed in a third study [25]. According to a previous study from the USA, the in-hospital mortality rate of patients hospitalized primarily for COVID-19 decreased from 15.1% in the Delta period to 4.9% in the Omicron period. Furthermore, the majority (81.9%) of deaths occurred among adults aged >65 years [26]. Similarly, the mean age of the patients who died in this study was significantly higher than the mean age of the survivors. Although the mortality rate was lower during the Omicron wave, the Omicron variant was associated with increased stress [27–29] and continued vaccine hesitancy. One study from KSA showed that 57.2% of surveyed parents were unwilling for their children (aged 12–18 years) to receive an additional booster vaccine [30].

In conclusion, the implementation of a home monitoring programme for patients with COVID-19 who were either asymptomatic or had mild symptoms was effective and safe, thus laying the foundation for the use of this strategy in future pandemics or outbreaks.

Conflict of interest statement

None declared.

Funding

None.

Ethical approval

The Johns Hopkins Aramco Healthcare Institutional Review Board approved this study.

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