Correlation of racial effect with severity of disease and in-hospital outcome in individuals diagnosed with COVID-19

Abdullah Rashid Alotaibi1 | Tarek Ezzeldin1 | Intisar Ahmad Siddiqui2 |
Mosa Saeed Alzahrani1 | Mohammed Ahmed Alghamdi1 | Wijdan Hasan Alotaibi1 |
Malik Zwaid Almutairi1 | Naif Khalid Alqannas1

1Dammam Medical Complex, First Health Cluster in Eastern Province, Dammam, Saudi Arabia
2Dental Education, College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

Correspondence
Intisar Ahmad Siddiqui, Department of Dental Education, College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. Email: intisar26@gmail.com

Abstract
Introduction: There are many countries that inhibit diverse populations and hence, studies have been conducted to find the relation between ethnic and racial groups within a society and incidence or mortality because of coronavirus disease-19 (COVID-19).

Objectives: The purpose of this study was to evaluate the racial effect on the severity of disease and in-hospital outcomes in individuals diagnosed with COVID-19.

Patients and Methods: This retrospective study is based on records of 804 tested positive COVID-19 patients presented at Dammam Medical Complex and Braira quarantine from March 2020 to May 2020 was conducted after approval from the ethical board. Patient’s records included the routine patient’s consent statement about the explanation of all the investigations and procedures before being performed. Data were retrieved and included in the analysis were age, gender, country of origin, racial background (Arab, Caucasian, Asian, Black, Latin and Hispanic), the severity of COVID-19 and outcome.

Results: Out of total 804 confirmed patients of COVID-19, there were 647 (80.5%) male patients and 157 (19.5%) female patients (M:F ratio = 4.1:1). Male preponderance was seen in all racial groups and significantly higher amongst the Asians than the Middle Eastern race (91.2% vs. 70.3%, \( p = .000 \)). The mean age of Asians was significantly higher than the mean age of the Middle Eastern and Black and Caucasian races (42.8 ± 10.0 vs. 39.6 ± 16.3 vs. 37.0 ± 10.3, \( p = .003 \)). The proportion of deaths was considerably higher amongst Asians (5.4%) compared with Middle Eastern patients (1.2%) (\( p \) value = .001).

Conclusion: Severity and in-hospital outcome were varying considerably amongst the racial groups. East and South Asian COVID-19 patients had more severe symptoms and less recovery rate compared with other groups, late presentation may be a contributory reason. Hence, evaluation of the severity of COVID-19 in relation to the various racial groups along with demographic characteristics and other risk factors can provide baseline guidance to the clinical care providers to initiate earlier and appropriate treatment.
Severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) was declared as public health emergency of international concern on 8 January 2020. It started from Wuhan, Hubei Province, China and has afterwards spread around the globe. It is also considered the greatest challenge the world has faced since World War II. Since its emergence in Asia in December, the virus had spread all over the world infecting around half a million people every day.

As the outbreak of the disease, numerous studies have been conducted to explore the relation between the current pandemic with socio-demographic status, health status and other factors have also been studied and it is reported that age is one of the leading risk factors and severity of disease increases in the presence of comorbidities such as heart and lung diseases. There are many countries that inhibit diverse populations and therefore, studies have been conducted to find the relation between ethnic or racial groups within society and incidence or mortality because of COVID-19. According to the 2011 census, the proportion of ethnic minorities in the UK was 13%. Therefore, the study was conducted to study the incidence or outcome of COVID-19 patients in the ethnic groups in the UK. CDC and COVID-19-associated hospitalisation surveillance network examined that COVID-19 patients with race/ethnicity data found that 45% were Caucasian, 33% African American, 8% Hispanic, 5% Asian, <1% American Indian/Alaskan Native and 7.9% were of other or unknown races. Similarly, other studies have also reported the emerging impact of the pandemic across ethnicities in various settings including in the UK, the USA and Norway.

Saudi Arabia also inhibits various ethnic minorities. In the mid-2016, the total population of Saudi Arabia was 31.79 million in which population of ethnic minorities was 11.71 million which contributed 36.8% of the total population of the country. Although proportion of ethnic minorities is high in Saudi Arabia, however, to the authors’ best knowledge, literature is unable to provide any study conducted in Saudi Arabia which show the severity and outcome of the COVID-19 tested positive patients amongst racial groups. Hence, the present study was designed to evaluate the correlation of racial effect with the severity of disease and in-hospital outcomes in individuals diagnosed with COVID-19.

What’s known
In the current literature, the severity of novel coronavirus infection COVID-19 has been evaluated from many aspects including demographic characteristics, comorbidity, presenting symptoms and other clinical factors except racial effect which may be a potential confounding factor as Saudi Arabia is a country with a large number of skilled workers and labourers from variant country of origin, so this study will add correlation of various racial groups with the severity of COVID-19.

What’s new
Racial diversity in Saudi Arabia may be a potential confounding factor with regards to patient’s adaptation, family history, lifestyle and community norms. Hence, the severity of the novel coronavirus disease COVID-19 was evaluated in relation to the various racial groups along with demographic characteristics and other risk factors.
racial background, comorbid and severity of COVID-19 by taking in-hospital outcome poor or good outcome as a binary variable. The p value of ≤.05 was considered to be statistically significant.

3 | RESULTS

Out of total 804 confirmed patients of COVID-19, there were 647 (80.5%) male patients and 157 (19.5%) female patients (M:F ratio = 4.1:1). The mean age of patients was 41.1 ± 13.7 (ranging from 5 to 100) years, and the commonest age group was 31–45 years in which nearly half of the patients (47.4%) were seen. Fifty percent patients belonged to the Middle Eastern race followed by 388 (48.3%) Asian, 8 (1%) Black and only 1 (0.12%) Caucasian. Black and Caucasian races were merged because of smaller number of patients in order to evaluate racial effect on patient’s characteristics and outcomes.

Male preponderance was seen in all racial groups and significantly higher in Asians than the Middle Eastern race (91.2% vs. 70.3%, p = .000). The mean age of Asians was significantly higher than the mean age of the Middle Eastern and Black and Caucasian races (42.8 ± 10.0 vs. 39.6 ± 16.3 vs. 37.0 ± 10.3, p = .003). A significantly higher number of patients in the Middle Eastern race belonged to Saudi Arabia, that is 276 (67.8%) followed by 73 (17.9%) from Egypt, whereas major countrymen of Asians belonged to India (37.4%) followed by Bangladesh (25.5%), Philippines 66 (17%), Pakistan 41 (10.6%) and 23 (5.9%) from Nepal. Eight (88.9%) blacks belonged to Sudan and 1 (0.12%) Caucasian from Greece (Table 1).

Although, most of the patients had no comorbidities, even 88.9% Black and Caucasian group had no comorbidity (p = .092), some patients had more than one comorbidity. Diabetes mellitus was the commonest comorbidity higher in Asians than the Middle Eastern patients followed by hypertension also higher in Asians; however, other morbidities were higher in the Middle Eastern race. A considerable proportion of Asians than the Middle Eastern patients had moderate symptoms of COVID-19 disease (34.6% vs. 18.7%, p = .000), and the proportion of severe symptoms was also higher in Asians, whereas the majority of the Middle Eastern patients had mild symptoms. The proportion of patients having the course of disease 7–14 days was significantly higher in Asians, <7 days in the Middle Eastern patients and above 14 days in Black and Caucasian group (p = .000) as detailed in Table 2.

### TABLE 1 Correlation of racial effect with the demographic characteristics of COVID-19 patients

| Patient’s characteristics | Total (n = 804) | Middle Eastern (n = 407) | East and South Asian (n = 388) | Black and Caucasian (n = 9) | p-value |
|---------------------------|----------------|--------------------------|-------------------------------|-----------------------------|--------|
| **Gender**                |                |                          |                               |                             |        |
| Male                      | 647 (80.5)     | 286 (70.3)               | 354 (91.2)^\*                | 7 (77.8)                    | .000   |
| Female                    | 157 (19.5)     | 121 (29.7)               | 34 (8.8)                      | 2 (22.2)                    |        |
| **Age (in years)**        |                |                          |                               |                             |        |
| Below 18                  | 23 (2.9)       | 21 (5.2)                 | 2 (0.5)                       | 0 (0)                       | .000   |
| 18–30                     | 141 (17.5)     | 98 (24.1)                | 39 (10.1)                     | 4 (44.4)                    |        |
| 31–45                     | 381 (47.4)     | 181 (44.5)               | 196 (50.5)                    | 4 (44.4)                    |        |
| 46–60                     | 186 (23.1)     | 53 (13.0)                | 132 (34.0)                    | 1 (11.1)                    |        |
| Above 60                  | 73 (9.1)       | 54 (13.3)                | 19 (4.9)                      | 0 (0)                       |        |
| **Country of origin**     |                |                          |                               |                             |        |
| Saudi Arabia              | 280 (34.8)     | 276 (67.8)^\*           | 4 (1.0)                       | 0 (0)                       | .000   |
| India                     | 145 (18.0)     | 0 (0)                    | 145 (37.4)^\*                | 0 (0)                       |        |
| Bangladesh                | 99 (12.3)      | 0 (0)                    | 99 (25.5)^\*                 | 0 (0)                       |        |
| Egypt                     | 74 (9.2)       | 73 (17.9)                | 1 (0.3)                       | 0 (0)                       |        |
| Philippines               | 66 (8.2)       | 0 (0)                    | 66 (17.0)                     | 0 (0)                       |        |
| Pakistan                  | 42 (5.2)       | 1 (0.2)                  | 41 (10.6)                     | 0 (0)                       |        |
| Yaman                     | 29 (3.6)       | 29 (7.1)                 | 0 (0)                         | 0 (0)                       |        |
| Nepal                     | 23 (2.9)       | 0 (0)                    | 23 (5.9)                      | 0 (0)                       |        |
| Syria                     | 17 (2.1)       | 17 (4.2)                 | 0 (0)                         | 0 (0)                       |        |
| Sudan                     | 15 (1.9)       | 5 (1.2)                  | 2 (0.5)                       | 8 (88.9)^\*                 |        |
| Others                    | 14 (1.7)       | 6 (1.5)                  | 7 (1.8)                       | 1 (11.1)                    |        |

Note: Values given in parentheses are percentages.

^\*Significant difference of proportion at 5% level of significance. Mean age comparison was done by applying analysis of variance (F test).
A higher proportion of deaths from COVID-19 disease was found in Asians 21 (5.4%) than in the Middle Eastern patients 5 (1.2%) and no death in the Black/Caucasian group. These data reveal a significant correlation of racial effect with the in-hospital outcome of patients ($\chi^2 = 31.5$, $p = .001$) illustrated in Figure 1.

Totally 11 factors were evaluated to identify the predictors leading towards the severity of disease and in-hospital death that occurred because of COVID-19. Compared with female patients, male patients were about seven times more likely to have a poor outcome. The age groups 31–45 years and 46–60 years had more likely poor outcomes, respectively, by 4 times and 3 times than the younger age groups. Asian race had 4.36 times more likely to appear with the poor in-hospital outcomes than the Middle Eastern race ($p = .000$).

However, involvement of various comorbidities did not show any significance except diabetes mellitus 2.43 times more likely to expose a poor outcome. Severe symptoms compared with moderate symptoms have shown 10 times more likely to appear with the poor in-hospital outcomes than the Middle Eastern race ($p = .000$).

4 | DISCUSSION

After the distribution of the sampled population according to their race, it was found that a high proportion of COVID-19-positive patients belonged to East and South Asia. Furthermore, average age above 40 years, the prevalence of comorbidities, the appearance of moderate/severe symptoms and the poor outcome were also found dominating in this group. Studies reported that those in the younger age group, be women, and have fewer comorbidities had higher chances to survive in case if they got the virus. A study conducted in 14 different states of the USA and reported that COVID-19-related hospitalisation was higher amongst male patients than female patients (5.1 vs. 4.1 per 100 000 population). In addition, current data also suggested that minority groups may also be more susceptible to getting infected from COVID-19.

The general authority of statistics of Saudi Arabia reported that a high proportion of workers working in Saudi Arabia are from Asian countries in which men are in dominating numbers. The largest non-Arab workers in Saudi Arabia are from India, Pakistan, Bangladesh and Sri Lanka. Most of those are working as labourers who usually do not have many qualifications or even illiterate in some cases and hence, they have less access to healthcare facilities and low socioeconomic status which could be a reason for the high rate of prevalence of COVID-19. Furthermore, the educational barrier made them less aware of this current pandemic, precautions that need to be taken, how they can prevent themselves, etc. These could be the possible reasons of what we found in an analysis that patients in the Asian group had more prevalence of comorbidities, had moderate to severe symptoms and even poor outcomes.

### TABLE 2
Correlation of racial effect with the severity of disease in COVID-19 patients

| Patient's characteristics | Total (n = 804) | Middle Eastern (n = 407) | East and South Asian (n = 388) | Black and Caucasian (n = 9) | p-value |
|---------------------------|----------------|--------------------------|-------------------------------|----------------------------|---------|
| Comorbidity* | Without comorbidity | 578 (71.9) | 280 (68.8) | 290 (74.7) | 8 (88.9) | .092 |
| | With comorbidity | 226 (28.1) | 127 (31.2) | 98 (25.3) | 1 (11.1) | |
| | Diabetes mellitus | 139 (17.3) | 68 (16.7) | 71 (18.3) | 0 (0) | |
| | Hypertension | 134 (16.7) | 61 (15.0) | 66 (17.0) | 0 (0) | |
| | Ischaemic heart disease | 16 (2.0) | 12 (2.9) | 4 (1.0) | 0 (0) | |
| | Chronic kidney diseases | 25 (3.1) | 20 (4.9) | 5 (1.3) | 0 (0) | |
| | Chronic liver disease | 17 (2.1) | 15 (3.7) | 2 (0.5) | 0 (0) | |
| | Others | 56 (7.0) | 48 (11.8) | 7 (1.8) | 1 (11.1) | |
| Symptoms | Mild | 505 (62.8) | 293 (72.0) | 205 (52.8) | 7 (11.8) | .000 |
| | Moderate | 211 (26.3) | 76 (18.7) | 134 (34.6) | 1 (11.1) | |
| | Severity | 88 (10.9) | 38 (9.3) | 49 (12.6) | 1 (11.1) | |
| Course of disease (in days) | <7 | 402 (50.0) | 197 (48.4) | 201 (51.8) | 4 (44.4) | .000 |
| | 7-14 | 208 (25.9) | 87 (21.4) | 121 (31.2) | 0 (0) | |
| | >14 | 194 (24.1) | 123 (30.2) | 66 (17.0) | 5 (55.6) | |

Note: Values given in parentheses are percentages.

*There may be more than one comorbidity in one patient.

*Significantly higher proportions at 5% level of significance.
In the Middle Eastern racial group, 276 were Saudis out of 407 which showed that the majority were nationals and fewer were foreigners, secondly, the countries in this group had the same language—Arabic, whereas East and South Asian groups had 388 patients and all were foreigners and non-Arabs. Hence, it meant that the Asian group had a high proportion of foreigners than other

FIGURE 1  Correlation of racial effect with the in-hospital outcome of patients. *Significant correlation of racial effect with the in-hospital outcome of patients ($\chi^2 = 31.5, p = .001$)

TABLE 3  Predictors of in-hospital poor outcome related to the severity of COVID-19 disease

| Factors                  | In-hospital outcome | Crude odd ratio (95% CI) | p-value |
|--------------------------|---------------------|--------------------------|---------|
|                          | Poor (ICU/expired)  | Good (recovered)         |         |
|                          | (n = 80)            | (n = 724)                |         |
| Gender (male)            | 77 (96.2)$^*$       | 570 (78.7)               | 6.93 (2.16–22.3) | .001 |
| Age (31–45 years)        | 29 (36.2)$^*$       | 352 (48.6)               | 3.94 (1.57–9.91) | .003 |
| Age (46–60 years)        | 29 (36.2)$^*$       | 157 (21.7)               | 2.88 (1.44–5.77) | .003 |
| Age (above 60 years)     | 14 (17.5)           | 59 (8.1)                 | 1.29 (0.64–2.60) | .486 |
| Asian race               | 62 (78.5)$^*$       | 326 (45.5)               | 4.36 (2.50–7.61) | .000 |
| Comorbid (yes)           | 30 (37.5)           | 276 (38.1)               | 1.15 (0.71–1.85) | .570 |
| Diabetes mellitus        | 25 (31.2)$^*$       | 114 (15.7)               | 2.43 (1.46–4.06) | .001 |
| Hypertension             | 19 (23.8)           | 115 (15.9)               | 1.65 (0.95–2.87) | .078 |
| Severe symptoms          | 53 (66.2)$^*$       | 35 (4.8)                 | 10.3 (5.73–18.6) | .000 |
| Course of disease (7-14 days) | 37 (46.2)$^*$   | 171 (23.6)               | 5.58 (2.98–10.4) | .000 |
| Course of disease (>14 days) | 28 (35.0)$^*$     | 166 (22.9)               | 4.35 (2.26–8.36) | .000 |

Note: Values given in parentheses in second and third columns are percentages.

*Significantly higher proportions at a 5% level of significance.
groups. Hence, because of these differences in the two groups, health-seeking behaviour may vary between the groups. Late presentation to the hospital could be an important factor associated with hospital outcome\textsuperscript{20}; however, the authors of the present study were not able to consider this variable as a part of the collected data.

Racial labelling based on personal information on the national ID card of Saudi nationals and resident permits for expatriates may not be a valid source for an individual of multi-racial family background, which is the major limitation of this study. The language barrier and the low literacy rate of labour class were also neglected in this study to validate racial identity of the COVID-19 patients of critical care in this study.

5 | CONCLUSION

The prevalence of COVID-19 amongst different racial groups residing in Saudi Arabia was significantly different. Hence, the evaluation of the severity of COVID-19 in relation to the various racial groups along with demographic characteristics and other risk factors can provide baseline guidance to the clinical care providers to initiate earlier and appropriate treatment. Furthermore, male patients and the aged were found more infected from the virus which in quite in line with what had been reported in the literature. Educating those who are in low socioeconomic status and are less educated could help to practice preventive measures more effectively as well as to identify COVID-19 symptoms early which perhaps help to reduce the severity rate.

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DISCLOSURES

There is no conflict of interest of participants and no involvement of funding in this study.

AUTHORS’ CONTRIBUTION

All authors participated in this study and placed authorship as per their contribution in initiating the idea and proposal development, data collection, analysis, manuscript writing and review of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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