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RESEARCH ARTICLE

PREVALENCE AND ASSOCIATED RISK FACTORS OF COVID-19 IN SUSPECTED PATIENTS AND CLOSE CONTACT WITH CONFIRMED CASES IN MAKKAH, 2020

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ABSTRACT

Background: Makkah Al-Mokarramah, Saudi Arabia has a special consideration in Islamic religion as millions of people came to perform Umrah and Hajj during the year, gathering multi ethnicity and nationality. **Objectives:** To estimate the prevalence and associated risk factors of COVID-19 in suspected patients and close contact with confirmed cases in Makkah Al-Mokarramah, 2020. **Subjects and methods:** A cross-sectional study included all high score suspected patients and those confirmed contact with positive cases that were screened in 5 primary health care centers assigned as COVID-19 screening centers in Makkah Al-Mokarramah. Self-administration secondary data, that were uploaded from Health Electronic Surveillance Network were utilized. **Results:** A total of 143288 individuals were included. The overall difference between cases and control subjects as regards age distribution was statistically significant, p<0.001. Males represented 70.1% of cases and 66.8% of controls, p<0.001. The prevalence of COVID-19 among the study participants was 56.6%. Both cases and controls were more reported in June, 2020 compared to May, 2020 (70% and 59.8% vs. 30% and 40.2%). The prevalence of confirmed and suspected cases was 44.9% and 29.9%, respectively. Regarding the outcome, majority of cases (82.1%) recovered whereas case-fatality rate was 2%. Concerning symptoms, the most frequently reported were fever (88.4%), cough (88.3%), sore throat (73%) and running nose (56.7%). History of patients `admission was observed among 36.5% of them. Concerning the initial reason for admission, respiratory reasons ranked first (58.9%). **Conclusion:** COVID-19 was commonly reported among suspected patients and close contact with confirmed cases. Their hospital admission was relatively common and the case fatality rate was lower than others.

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INTRODUCTION

In December 2019 many cases were reported as "pneumonia of unknown etiology" in Wuhan, China (Li *et al*., 2020). After the outbreak the Chinese Center for Disease Control and Prevention (CDC) revealed the illness was due to novel virus belong to the Coronavirus (CoV) family (Cascella, 2022). Beside COVID-19 there are so many viruses belong to corona virus family, appeared in 1960's, most of them caused mild symptoms, but in early 2000's other types have showed to cause more severe symptoms like: severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 to 2003 and Middle East respiratory syndrome coronavirus (MERS-CoV) that was first reported in Saudi Arabia 2012 (Cascella, 2022).

After spreading across China and many countries, the World Health Organization (WHO) officially named the virus as COVID- 19 on February 2020, later on March 2020 announced that COVID- 19 is a worldwide pandemic (Gorbalenya, 2020). Even with the magnitude efforts and preventive measures to stop spreading covid-19, in April 20, 2020, the total number of infected people is over 2.5 million in over 212 countries (Alzahrani, 2020). After many cases were reported positive of COVID- 19 in Saudi Arabia in 2nd of March, the country forced a quarantine, curfew and banned traveling nationally & internationally. A previous studies were conducted revealed that the incidence of COVID-19 in adulthood was higher than childhood and in male more than female (Alsofayan, 2020; Suárez, 2020).

Also, it was noticed the presented clinical features were fever, cough, dyspnea, sore throat, runny nose, myalgia, headache and diarrhea (Alsofayan, 2020; Guan, 2020; Jiang, 2020). In this study we look for the associated risk factor in the spread of corona virus and determine high risk population in Makkah Al-Mokarramah due to its special consideration in Islamic religion, millions of people came to perform Umrah and Hajj during the year, gathering multi ethnicity and nationality. Saudi Arabia one of the lead countries that used Electronic-Health programs, Health Electronic Surveillance Network is data base program that concerns with pandemic diseases, vaccines, reporting and public health, we obtained the data that were uploaded in the period of May& June 2020.

MATERIAL AND METHODS

Retrospective cohort study was conducted in Makkah Al-Mukarramah, Saudi Arabia included all high score suspected patients and confirmed contacts with positive COVID-19 cases that were screened in five primary health care centers assigned as COVID-19 screening centers for high score suspected people and who confirmed contact with positive cases. Three of these centers are in Makkah and the other two in towns in the peripheries (Shara'i AL Mugahdin primary health care center (PHCC), AL-Mansur PHCC, AL-Khalidiyyah PHCC, Hadda PHCC and Abu 'Urwah PHCC. All patients of high risk as well as close contacts with positive patients that were screened for COVID-19 during the period of May and June 2020 were included. Self-administration secondary data was uploaded from Health Electronic Surveillance Network. We obtained the data from the program. Categorical variables were presented using numbers and percentages. The prevalence of COVID-19 positive cases has been compared with socio demographic characteristics by using Chi-square test. A P-value of 0.05 values were considered statistically significant. The data were analyzed using Statistical Packages for Social Sciences (SPSS) version 26 Armonk, NY: IBM Corp. Permissions from Makkah Al-Mokarramah joint program of family and community medicine and directorate of health affairs of Holy Capital Primary Health Care were obtained.

RESULTS

A total of 143288 individuals were included in this study. The sociodemographic characteristics of cases and their controls are summarized and compared in Table 1. Almost one-third of cases (32.8%) were in the age group 26-35 years and 19.6% were in the age group 36-45 years while 28.8% of control subjects were in the age group 26-35 years and 20.6% aged 18 years or less. The overall difference between cases and control subjects as regards age distribution was statistically significant, $p<0.001$. Males represented 70.1% of cases and 66.8% of controls, $p<0.001$. Similarly, Saudi nationals represented 66.9% of cases and 63.5% of controls, $p<0.001$. Majority of subjects in both groups were live inside Makkah (99.3% for cases and 99.6% for controls), $p<0.001$. Most of cases (38%) originated from BGI Facility Makkah while controls originated mainly from home isolation (14.9%), AL- Mansur PHCC (14.5%) and others (22.2%), $p<0.001$.

Prevalence of COVID-19: As illustrated from Figure 1, the prevalence of COVID-19 among the study participants was 56.6%. Both cases and controls were more reported in June, 2020 compared to May, 2020 (70% and 59.8% vs. 30% and 40.2%) as shown in Figure 2

Outcome and patient`s characteristics: As shown in Table 2, the prevalence of confirmed and suspected cases was 44.9% and 29.9%, respectively. Regarding the outcome, majority of cases (82.1%) recovered whereas case-fatality rate was 2%. As regards confirmatory results, 69.5% were negative whereas 29.2% were positive and 9.8% were previous positive. Concerning symptoms, the most frequently reported were fever (88.4%), cough (88.3%), sore throat (73%) and running nose (56.7%). Contact with cases was reported among 56.7% of the participants. Almost three-quarters (75.1%) of patients wee symptomatic and 9.8% travelled inside KSA. The most frequent reported provisional source of information was under (76.8%).

Patients' hospitalization: As seen in Table 3, history of patients admission was observed among 36.5% of them. Majority of them (88.2%) were hospitalized for COVID-19. Concerning the initial reason for admission, respiratory reasons ranked first (58.9%). Majority of patients (86%) were isolated. Healthcare facility visit was reported by minority of patients (4.9%). The patients were almost equally distributed between triage score four and five.

DISCUSSION

In the current study, more than 143,000 suspected patients and close contacts of COVID-19 confirmed cases were investigated to estimate the prevalence and associated risk factors of COVID-19 among them. The prevalence of COVID-19 was 56.6% among the participants. In a similar study carried out in China, one-third of the total cases were identified from contacts (Liua, 2020). These findings from the present study and that of China`s study indicated that application of tracing strategy for contracts of COVID-19 confirmed cases could play a vital role in decreasing the spreading of COVID-19. In the present study, the most frequently reported symptoms among cases were fever (88.4%), cough (88.3%), sore throat (73%) and running nose (56.7%). In a systematic review and meta-analysis done in China, the incidence of fever, cough, fatigue, and dyspnea symptoms were 85.6 %, 65.7 %, 42.4 % and 21.4 %, respectively (Hu, 2020). It was observed that cases were more likely to be older with an attack rate of 63% among those aged over 55 years. This finding agrees with others who showed that the highest attack rate highest in the group aged 60–69 years (Liua, 2020). Also, other studies reported that elderly contacts were more likely to have COVID-19 infection (Bi, 2020; Jing, 2020). This could be attributed to a relatively lower immunity at older age making them more vulnerable to infection. However, some others didn`t report increased risk among older contacts (Cheng, 2020). Our results observed that the highest rate of infection among contacts was among those in the age group 26-35 years as this group of individuals could have more physical activities than older individuals, and hence closer contact with COVID-19 cases for longer periods (Pang, 2003). The present study revealed that almost one-fifth of contacts were children. It has been reported that there is no consensus regarding vulnerability of children to COVID-19 infection (WHO, 2020; Lee, 2020). Furthermore, it has been documented that COVID-19 infection is usually less severe in

Table 1. Sociodemographic characteristics comparing between case and contact groups

Study variables	Overall N (%) (n=143288)	Case N (%) (n=81154)	Contact N (%) (n=62134)	P-value §
Age group				
•≤18 years	22669 (15.8%)	9861 (12.2%)	12808 (20.6%)	<0.001 **
•19 – 25 years	21587 (15.1%)	12663 (15.6%)	8924 (14.4%)	
•26 – 35 years	44515 (31.1%)	26631 (32.8%)	17884 (28.8%)	
•36 – 45 years	27793 (19.4%)	15908 (19.6%)	11885 (19.1%)	
•46 – 55 years	14540 (10.1%)	8409 (10.4%)	6131 (09.9%)	
•>55 years	12184 (08.5%)	7682 (09.5%)	4502 (07.2%)	
Gender				
•Male	98361 (68.6%)	56853 (70.1%)	41508 (66.8%)	<0.001 **
•Female	44927 (31.4%)	24301 (29.9%)	20626 (33.2%)	
Nationality				
•Saudi	93810 (65.5%)	54326 (66.9%)	39484 (63.5%)	<0.001 **
•Non-Saudi	49478 (34.5%)	26828 (33.1%)	22650 (36.5%)	
Region				
•Inside Makkah region	142520 (99.5%)	80625 (99.3%)	61895 (99.6%)	<0.001 **
•Outside Makkah region	768 (0.50%)	529 (0.70%)	239 (0.40%)	
Originating hospital				
•Shara'i AL Mugahdin PHCC	11897 (08.3%)	4489 (05.5%)	7408 (11.9%)	<0.001 **
•AL- Mansur PHCC	14940 (10.4%)	5931 (07.3%)	9009 (14.5%)	
•AL- Khalidiyyah PHCC	14462 (10.1%)	6916 (08.5%)	7546 (12.1%)	
•Hadda PHCC	8427 (05.9%)	3320 (04.1%)	5107 (08.2%)	
•Abu 'Urwah PHCC	4481 (03.1%)	2023 (02.5%)	2458 (04.0%)	
•Khulais Hospital	3861 (02.7%)	2095 (02.6%)	1766 (02.8%)	
•Home Isolation	15157 (10.6%)	5903 (07.3%)	9254 (14.9%)	
•BGI Facility Makkah	31898 (22.3%)	30849 (38.0%)	1049 (01.7%)	
•Makkah Medical Hospital	1848 (01.3%)	899 (01.1%)	949 (01.5%)	
•Hera General Hospital	3978 (02.8%)	2100 (02.6%)	1878 (03.0%)	
•King Abdulaziz Hospital Makkah	4214 (02.9%)	2278 (02.8%)	1936 (03.1%)	
•Others	28125 (19.6%)	14351 (17.7%)	13774 (22.2%)	

§ P-value has been calculated using Chi-square test. ** Significant at p<0.05 level.

Table 2. Outcome and other related characteristics of the patients

Variables	N (%)
Final classification	
•Confirmed	64271 (44.9%)
•Suspected	42807 (29.9%)
•Not a case	35266 (24.6%)
•Survey based	944 (0.70%)
Outcome	
•Recovered	30568 (82.1%)
•Fatality	727 (02.0%)
•Other	5916 (15.9%)
Confirmatory results	
•Positive	41839 (29.2%)
•Negative	99548 (69.5%)
•Probable	152 (0.10%)
•Rejected	1749 (01.2%)
Previous positive	
•Yes	14043 (09.8%)
•No	129245 (90.2%)
Symptoms *	
•Fever	14954 (88.4%)
•Cough	14048 (88.3%)
•Sore throat	4608 (73.0%)
•Runny nose	2262 (56.7%)
Case contacts	
•Yes	13598 (56.7%)
•No	10395 (43.3%)
Is the patient symptomatic?(n=23976)	
•Yes	18010 (75.1%)
•No	5966 (24.9%)
Travel inside KSA(n=23972)	
•Yes	2355 (09.8%)
•No	21617 (90.2%)
Fitting with case def Epi link(n=289)	
•Infection	102 (35.3%)
•Treated	59 (20.4%)
•Epidemiological	128 (44.3%)
Provisional source of information(n=1479)	
•Primary	289 (19.6%)
•Camel	54 (03.7%)
•Under	1133 (76.8%)

* Variable with multiple response answers.

Table 3. Characteristics of patients' hospitalization

Variables	N (%)
Was patient admitted?	
•Yes	8761 (36.5%)
•No	15216 (63.5%)
Was patient hospitalized for COVID?	
•Yes	7728 (88.2%)
•No	1032 (11.8%)
Initial reason for admission	
•Respiratory	5164 (58.9%)
•Renal	75 (0.90%)
•Cardiac	221 (02.5%)
•Liver	06 (0.10%)
•Malignancy	100 (01.1%)
•Other	3194 (36.5%)
Was patient isolated?	
•Yes	7533 (86.0%)
•No	1228 (14.0%)
Healthcare facility visit	
•Yes	1185 (04.9%)
•No	8601 (35.9%)
•Unknown	14187 (59.2%)
Triage score	
•Four	12054 (50.3%)
•Five	11920 (49.7%)

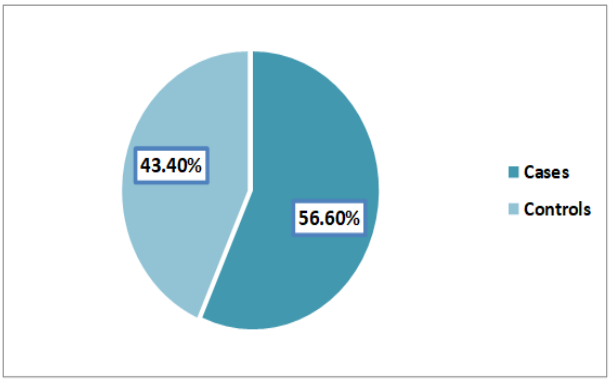

Figure 1. Prevalence of COVID-19 positive cases among study population

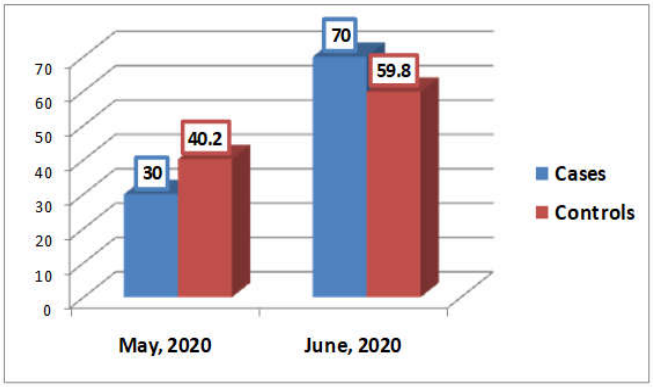

Figure 2. Comparison of the prevalence of COVID-19 cases between May and June 2020

children than adults, and many of cases are asymptomatic and thus less likely to be tested and diagnosed (Mehta, 2019). Contrary to what has been reported by others, (Bi, 2020; Jing, 2020) the present study revealed that male contacts were more likely to be infected by COVID-19 than female contacts. This could be attributed to the fact that males comprise a large proportion of front line health care workers who usually in closer contact with cases (Boniol, 2019). Therefore, we recommended more prevention measures specifically directed to protect males from COVI-19 pandemic. In the same context, the present study observed that Saudi contacts were more likely to be infected by COVID-19 than non-Saudi contacts. This could be attributed to the fact that Saudi nationals comprise a large proportion of front line health care workers who usually in closer contact with cases and also, the social gathering, which facilitates contact with index cases is a characteristic of Saudi culture than non-Saudi. The case fatality rate of COVID-19 in the present study was 2%. This figure is crude. A recent systematic review and meta-analysis included 39 studies revealed an overall pooled case fatality rate of COVID 19 as 10% (95% CI: 8-11); however, the rate in general population was 1% (95% CI: 1-3), in hospitalized patients was 13% (95% CI: 9-17), in patients admitted in intensive care unit (ICU) was 37% (95% CI: 24-51) and in patients aged over than 50 years was 19% (95% CI: 13-24).[21] In Italy and Spain, case fatality rate of COVID-19 were 9.26% and 4.21-6.16%, respectively.[22, 23] In Iran and Turkey, rates of 7.9% and 2% have been reported. [22, 23] Our rate was the same as that has been reported in Turkey while it was lower than others. This difference could be explained by difference in the target population. This study is strengthened by utilizing a huge data base, and its retrospective cohort nature which reduce the recall bias and provide information with accurate temporality of the cause-effect relationship. Despite of that, it has some important limitations including the fact that a considerable proportion of asymptomatic infections may be overlooked and their close contacts cannot be diagnosed. Also, as a result of low sensitivity of the RT-PCR test, some infections among close contacts may be not identified. In conclusion, elderly people, children, males and people live inside Makkah were more likely to be infected with COVId-19. Prevalence of COVID-19 among cases and contacts was higher in June compared to May 2020. The prevalence of COVID-19 was high among contacts of index cases with a considerable proportion of cases were admitted to hospitals due to COVID-19. However, the case-fatality rate was lower than those reported in most of other countries. Based on findings of this study, we recommended the following:

- Organizing and implementing prevention and control strategies to decrease the burden of the pandemic.
- Encouraging COVID-19 vaccination, particularly for contacts and suspected people
- Specific protective measures for elderly people is highly recommended.
- Proper tracing of contacts of index cases to reduce the spread of infection.
- Further study to assess the impact of implemented preventive measures as well as vaccination on the spread of infection.

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