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Research Article

Epidemiology of COVID-19 in Kish Island from February to August 2020

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Abstract

Background: In March 2020, the world health organization declared the outbreak of novel coronavirus disease 2019 (COVID-19) as a pandemic. COVID-19 is a highly contagious disease. Kish is a touristic island that is located in the south of Iran. The aim of the present study was to investigate the epidemiology of COVID-19 on Kish island.

Methods: In the present cross-sectional study, the residents of Kish Island, Iran, who were checked with COVID-19 polymerase chain reaction (PCR) test from February to August 2020 were included. The PCR test was obtained from symptomatic individuals or those people who had exposure to suspected COVID-19 cases. Data were collected from their medical records and analyzed based on their PCR test results.

Results: A total of 4859 individuals were checked with COVID-19 PCR test. The result was positive in 1251 (25.75%) cases and negative in 3608 (74.25%). The mean age was 37.32 years. The majority of the individuals were men. Most of the participants were office employees. The number of housewives was approximately double in COVID-19 positive patients compared with the patients with negative results. About 40% of the individuals with positive results had a history of exposure to suspected COVID-19 cases. The prevalence of exposure to suspected COVID-19 cases and recent travel was significantly higher among positive cases ($P<0.001$). There was a significant correlation between the delay between the onset of the symptoms and performing PCR. Longer delays were seen among the deceased patients.

Conclusion: It seems that more precise policies should be taken to avoid contact with symptomatic patients and people who had a history of travel to the island.

Keywords: COVID-19, Kish island, Iran, Epidemiology

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Background

In December 2019, a novel form of pneumonia caused by an unknown pathogen was reported (1). Later, at the beginning of 2020, the coronavirus disease 2019 (COVID-19) was discovered, and in March 2020, the World Health Organization (WHO) announced the outbreak of COVID-19 as a pandemic (2, 3). COVID-19 is a highly contagious disease, and each infected individual can infect other people on average (2, 3). According to the last reports, over 100 million people have been infected all over the world and over 2 million people have died. According to the last official reports from Iran, more than 2 million people have been infected and more than 60 000 have died (4). The most common symptoms of COVID-19 are fever, cough, body pain, and dyspnea. It is mainly transmitted by droplets that are projected during speech or cough. The incubation period ranged from 2 to 14 days; however, some studies have reported that it can be as long as 28 days (5,6). Wearing face masks and hand washing are two effective ways to control viral spread (7).

Epidemiologic studies lead to better management of such emerging infectious diseases (8). Many investigations have been performed on COVID-19; however, they have been mostly carried out in China.

Iran is one of the countries that experienced the second and third waves of the disease earlier than other countries. Despite the high prevalence of COVID-19 in southern Iran, there are limited studies available in this region. Kish is a touristic island in the Persian Gulf, southern Iran. The aim of the present study was to evaluate the epidemiology of COVID-19 on Kish Island, Iran, and to describe and clarify the main factors in disease distribution among island dwellers and tourists.

Materials and Methods

The present study was a cross-sectional and descriptive study that was carried out on Kish Island, Iran, from February to August 2020. All individuals (both children and adults) who had COVID-19 polymerase

chain reaction (PCR)tests during the mentioned time were investigated. The PCR test was obtained from symptomatic patients and from those individuals who had contact with a COVID-19 positive patient. The baseline characteristics of the patients were obtained from their medical records, including age, gender, city of residence, occupation, history of exposure to a suspected COVID-19 case, recent travel, and underlying diseases. Some essential dates were recorded, including the dates of the onset of the symptoms (if the patient was symptomatic), PCR test, admission, and discharge (or death). The clinical data, including signs and symptoms, the setting of receiving health care service (outpatient department, ward, or intensive care unit), and outcome (discharged, deceased, etc) were also collected from the medical records. The individuals with incomplete data were excluded from the study.

The diagnosis of COVID-19 was confirmed using real-time (RT) PCR. The tests were performed according to the WHO criteria (9). The sample was obtained from the oropharyngeal and nasopharyngeal areas with swap and tested for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). All laboratory processes were performed under biological safety cabinets and according to infection control guidelines. RNA of the samples was extracted using the Notch CS automated DNA and RNA extraction system (SUNSURE, China). Then, the copy number of COVID-19 gene was calculated using the SLAAN96 real-time PCR (SUNSURE, China). After 45 cycles, the graphs were reviewed, and the rise before cycle 32 was considered as a positive test result.

Quantitative data were presented as mean ± standard deviation and qualitative data as frequency and percentage. The difference among the variables was examined using the student's *t*-test and the Kruskal-Wallis test. Chi-square test was also conducted to examine associations among nominal variables. All statistical analyses were performed using SPSS version 21.0 (SPSS, Chicago, Illinois). P value < 0.05 was considered to be statistically significant.

Results

Of all 4859 studied individuals, 1251 (25.70%) patients had positive PCR results for COVID-19, and others [3608 (74.31%)] were negative (Table 1). The mean age of infected patients was 37.32 years old (ranging between 4 days and 99 years). Most of the patients were men (70.54%). The proportion of women was higher among the positive cases (33.49%) than among the negative cases (28.16%) ($P < 0.001$). The age of the majority of the cases ranged from 30 to 40 and 40 to 50 years old, and few people were younger than 20 or older than 70 years old (Figure 1). Although the majority of the participants were office employees in both positive and negative cases, it was more prominent among the negative ones (58.09% vs. 39.17%). The number of housewives in positive cases was double (17.99%) compared to negative cases (7.65%) ($P < 0.001$). The history of exposure to a suspected person (38.61%) was more prevalent in positive cases than in negative cases (28.13%) ($P < 0.001$). The history of recent travel (12.31%) was significantly more prevalent among the positive cases ($P < 0.001$). Hypertension (25.00%), pregnancy (18.42%), pulmonary disease (15.79%), and diabetes mellitus (11.84%) were the most prevalent underlying diseases among the population, which were generally more common among the positive cases ($P < 0.001$). The percentage of positive test result was equal in travellers and Kish residents (Figure 2). The most common destination for travel was Tehran (Table 2). So the most COVID-19 PCR positive test result was from traveller from Tehran (Figure 3). The mean length of hospitalization for COVID-19 was 5 days. The mean delay between symptoms presentation and requesting PCR test was 3 days (Table 3). There was an association

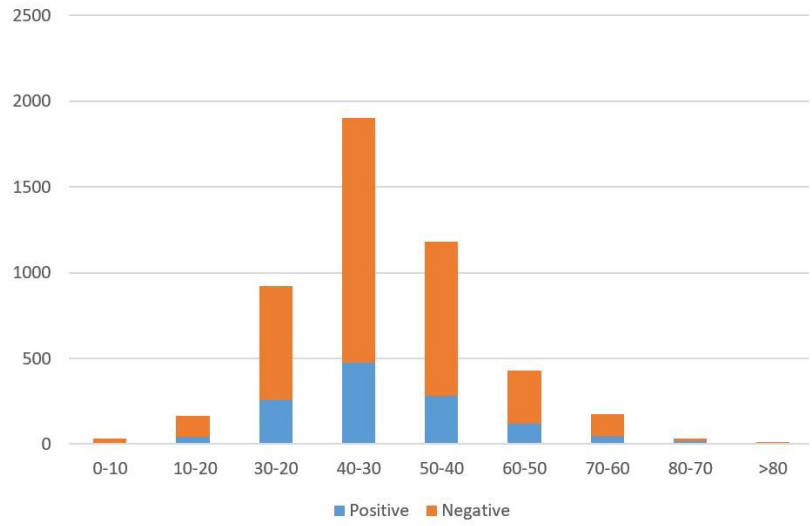


Figure 1. Distribution of Positive and Negative COVID-19 PCR Test Results among the Residents of Kish Island by Age

Table 1. Baseline Characteristics of the Kish Island Residents Tested for COVID-19 During Investigation Period

Variable	COVID-19 PCR Result			Chi-square Statistic	*P* Value
	Positive (n=1251)	Negative (n=3608)	Total(N=4859)		
Age (mean±SD)	37.32±12.01	37.32±11.32	37.32±11.51	13.52*	0.09
Gender, No. (%)					
Male	832 (66.51)	2592 (71.84)	3424 (70.47)		
Female	419 (33.49)	1016 (28.16)	1435 (29.53)	12.69	<0.001
Total	1251 (100)	3608 (100)	4859 (100)		
Occupation, No. (%)					
Employee	490 (39.17)	2096 (58.09)	2586 (53.22)		
Small private business	425 (33.97)	1001 (27.74)	1426 (29.35)		
Retired	21 (1.68)	45 (1.25)	66 (1.36)		
Unemployed	86 (6.87)	180 (4.99)	266 (5.47)	178.37	<0.001
Housewife	225 (17.99)	276 (7.65)	501 (10.31)		
Unknown	4 (0.32)	10 (0.28)	14 (0.29)		
Total	1251 (100)	3608 (100)	4859 (100)		
Exposure to an infected person, No. (%)	483 (38.61)	1015 (28.13)	1498 (30.83)	44.17	<0.001
Recent travel, No. (%)	154 (12.31)	270 (7.48)	424 (8.73)	27.17	<0.001
Place of residence, No. (%)					
Kish	1179 (94.24)	3370 (93.40)	4549 (93.62)		
Other places	72 (5.76)	238 (6.60)	310 (6.38)	1.10	0.294
Total	1251 (100)	3608 (100)	4859 (100)		
Medical comorbidity, No. (%)					
Chronic lung diseases	12 (0.96)	3 (0.08)	15 (0.31)		
Pregnancy	14 (1.12)	0 (0.00)	14 (0.29)		
Diabetes mellitus	9 (0.72)	4 (0.12)	13 (0.27)		
Hypertension	19 (1.52)	7 (0.19)	26 (0.54)		
Hypertension and diabetes mellitus	6 (0.48)	0 (0.00)	6 (0.12)	150.06	<0.001
Others	16 (1.28)	7 (0.19)	23 (0.47)		
All patients with underlying conditions	76 (6.08)	21 (0.58)	97 (2.00)		
All patients without underlying conditions	1175 (93.92)	3587 (99.42)	4762 (98.00)		
Total	1251 (100)	3608 (100)	4859 (100)		

* *t* test statistic

Table 2. The City of Origin of Kish Island Residents Tested for COVID-19 During Investigation Period

City	COVID-19 PCR Test Result		
	Positive (n=1251) No. (%)	Negative (n=3608) No. (%)	Total N=4859
Kish	1179 (94.24)	3370 (93.40)	4549 (93.62)
Tehran	18 (1.44)	53 (1.47)	71 (1.46)
Ahvaz	5 (0.40)	32 (0.89)	37 (0.76)
Siri	9 (0.72)	20 (0.55)	29 (0.60)
Mashhad	0 (0.00)	18 (0.50)	18 (0.4)
Shiraz	4 (0.32)	12 (0.33)	16 (0.37)
Others	36 (2.88)	103 (2.85)	139 (2.86)

Table 3. The Time Interval (Days) Between Presentation of the Symptoms and Performing COVID-19 PCR Test Among COVID-19 Positive Patients with Different Conditions

Severity of Disease	Time Interval Between Presentation of the Symptoms and Getting PCR Test (days)			Chi-square Statistic	*P* Value
	Median	Minimum	Maximum		
Managed in an outpatient setting	2 (4)	1	21		
Admitted	4 (5)	1	67	33.53	<0.001
Deceased	7 (4)	3	8		

between delay in requesting a PCR test and the severity of the disease. Delay was found to be longer among those patients with more severe conditions ($P<0.001$).

According to Table 4 and Figure 4, although the frequency of positive cases was higher among Iranians, the percentage was higher among non-Iranians (26.67%) compared with Iranian people (25.73%).

The frequency of positive results was higher in men. Additionally, more COVID-19 test results were obtained from men. However, the percentage of positive results was relatively higher in women (29.20%) compared with men (24.30%) (Table 5).

Table 6 reveals that the majority of the tests were obtained from people aged between 30 to 49 years old. However, the percentage of positive results was higher among the ones who were older than 70 years old and the ones aged between 60 and 69. This issue emphasizes the importance of reverse isolation policies for high-risk people.

According to Table 7, 59.87% of the admitted patients and 22.00% of the outpatient cases had a positive PCR test result. Moreover, 4.98% of the positive cases were admitted to the hospital and 20.01% of them were not. This shows that appropriate screening strategies and good compliance of patients and the exposed people are required to reach out for COVID-19 test.

Discussion

This study aimed to investigate the epidemiology of COVID-19 on Kish Island. PCR test result was positive among a quarter of the population who were tested for COVID-19. In a similar study conducted in Leicester, UK), 24.00 % of suspected patients were found PCR positive. The mean age of the infected people was 37.34

Table 4. Distribution of Positive and Negative COVID-19 Test Results by Nationality

Nationality	Positive	Negative	Total	Rate of Positive Test Results (%)
Iranian	1227	3542	4769	25.73
Non-Iranian	24	66	90	26.67
Total	1251	3608	4859	25.75

Table 5. The Frequency and Percentage of Positive COVID-19 Test Results by Gender

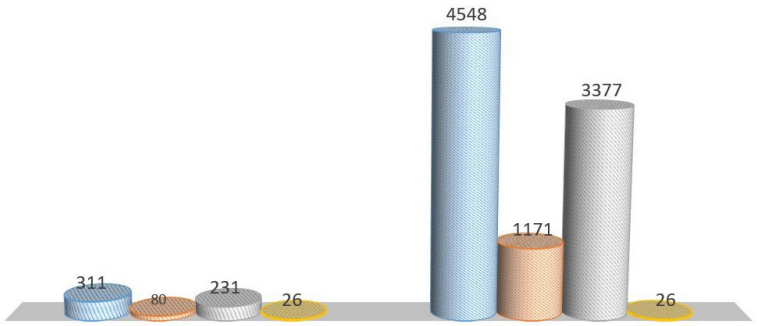
Results	Men	Women
Suspected	3424	1435
Positive	832	419
Negative	2592	1016
Rate of positive test results (%)	24.30	29.20

Table 6. Frequency and Percentage of the COVID-19 Test Results by Age

Age group (y)	Suspicious (n)	Positive (n)	Negative (n)	Mortality Among the Positive Cases (n)	Rate of Positive Test Results (%)
0-29	1120	310	810	3	27.68
30-39	1903	475	1428	2	24.96
40-49	1175	277	901	5	23.57
50-59	429	116	313	0	27.04
60-69	173	48	125	2	27.75
70 and above	56	25	31	1	44.64
Total	4859	1251	3608	13	25.75

Table 7. The relative Frequency of the Positive Test Results among Different Samples of the Population

Samples of the Population	Percent
Admitted patients with positive test results from total samples	4.98
Outpatients with positive test results from total samples	20.01
Outpatients with positive test results from all outpatient tests	22.00
Outpatients with positive test results from all inpatient tests	59.87
All positive test results from suspected cases	25.75
Admitted patients with positive test results from all positive test results	20.08
Outpatients with positive test results from all positive test results	79.92



	Traveler	Resident
Suspicious	311	4548
Positive	80	1171
Negative	231	3377
percentage of positive test result	26	26

Figure 2. The Frequency and Percentage of Positive COVID-19 Test Results by the Place of Residence

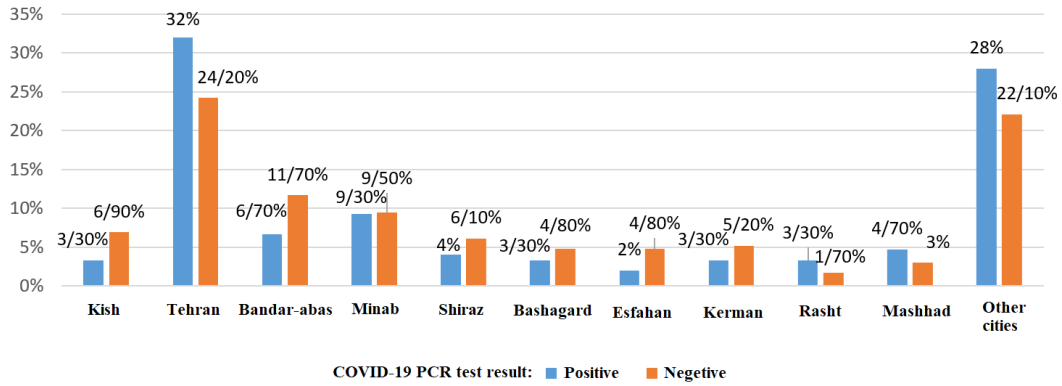


Figure 3. Distribution of Positive and Negative COVID-19 PCR Test Results by Recent Travel Destination

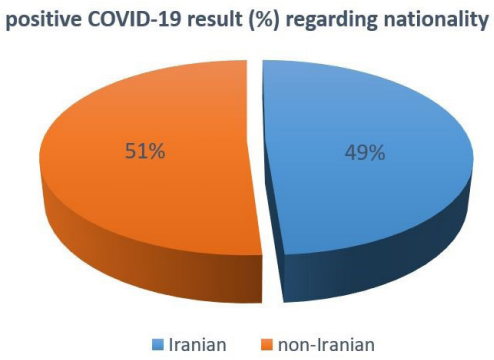


Figure 4. Distribution of Positive and Negative COVID-19 Test Results by Nationality

years old in a study conducted in the United Arabic Emirates, and it was found to be 35.6±12.7 years in confirmed cases. The wide range of CI shows their patients were in a wide range of ages. However, the average age of the infected population of Kish Island is lower compared to other regions of Iran. The mean age of infected people has been reported to be over 50 years old in previous investigations in Iran (10-12). One of the probable reasons for this age discrepancy is that most of the residents of this island are non-native people who visit the island as tourists or workforces that are usually young. The majority of the patients were men (70.5%), which is more prominent among the positive cases. Previous studies on Middle East respiratory syndrome coronavirus (MERS-CoV) and severe acute respiratory syndrome-related coronavirus (SARS-CoV) revealed that they affected men more than women (13-15). It is suggested that less susceptibility of women to such viral infections is related to the X chromosome and their sexual hormone that regulates both innate and acquired immune systems (16). The prevalence of underlying diseases was higher among the positive cases. This could be interpreted that apart from the severity of the disease, which is more pronounced among the population with underlying diseases, its transmission rate is also high (17). On the other hand, the number of asymptomatic carriers is higher among healthy people with no underlying diseases who are not usually tested for COVID-19 (18). In a study conducted in UAE, 43.5% of 791 confirmed cases were asymptomatic; however, symptomatic and asymptomatic cases were not stratified by their age group or underlying diseases. Our results show that the delay

between the presentation of COVID-19 symptoms and PCR test was longer among the patients who finally died compared to other admitted patients. Such correlation was observed in admitted patients and the ones who were treated in an outpatient setting. There is no evidence that shows whether an earlier diagnosis of COVID-19 can improve their prognosis. Since the main part of COVID-19 management is supportive care, it seems that early diagnosis of the disease in the absence of severe symptoms does not affect its management. Early diagnosis is effective when it is used to isolate the infected people to control viral spread (19). The application of PCR diagnostic kits for COVID-19 should be prioritized. Apart from the economic issues and the limitation of the kits in some countries, the false positive or false negative cases make the management of the disease more complicated. Therefore, some suggest that the application of PCR diagnostics kits should be prioritized for high-risk individuals such as people over 65 years old, population with underlying diseases and immune suppression, and health care providers (20). Since a large part of the income of Kish island is provided by tourism, the outbreak of COVID-19 damaged the economy of this region, similar to other touristic areas (21, 22).

Conclusion

The key point of the present study is its unique population considering that the majority of the population are non-native people who have traveled from other regions for work or entertainment. In such a region, controlling the commuting of the people by screening them for common signs and symptoms is crucial.

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Conflict of Interests

The authors declare that there is no conflict of interest.

Ethical Approval

The study protocol was approved by the Ethics Committee of Hormozgan University of Medical Sciences (IR.HUMS.1399.436).

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