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RESEARCH ARTICLE

CLOSE CONTACTS TRACING OF PATIENTS WITH COVID -19 IN JAZAN REGION, KSA, MAY 2020.

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ABSTRACT

Background: As of May 15, 2020, the global reported number of COVID-19 cases has crossed over 4.5 million with more than 303,000 deaths. The possibility of presymptomatic and asymptomatic transmission of SARS-CoV-2 is increasing the challenges of COVID-19 control measures. **Methods:** Based on a comprehensive contact-tracing dataset documented through the Quarantine Department in Jazan Region during the period from March 16 up to May 15, 2020, secondary data was reviewed to determine the secondary attack rate of SARS-CoV-2 among close contacts of index cases. The respiratory and non-respiratory symptoms effects on transmissibility and the infectivity of COVID-19 cases were assessed. **Results:** A total of 400 primary cases and 1167 close contacts were quarantined and traced as well. The overall secondary attack rate among close contacts of index cases with COVID-19 was 35.6% (416), while the secondary attack rate among close contacts of asymptomatic primary cases was 10%(44), which are relatively low when compared to the 51.2% (372) figure that represents the secondary attack rate among close contacts of symptomatic index cases. The study also revealed that primary cases with respiratory symptoms transmitted the infection to 67.8% of their close contacts while index cases with non-respiratory symptoms infected only 47%. The age bracket mostly affected was 25 to 49 years of age. The secondary attack rate was 82% among males compared to only 18% of females who tested positive, reflecting significant association between transmission of infection and gender (p-value0.000). This may be attributed to the fact that Saudi females always wear veils outdoors and these religious face covers might play a role against COVID-19, a perspective for which further study is highly recommended. **Conclusion:** SARS-CoV-2 was found to be less transmissible from asymptomatic patients (10. %) as compared to high rates of secondary attack among close contacts of symptomatic index cases (51.2%), with the age group (25 up to 49 years) being the most vulnerable to COVID-19 transmission. Although early detection and isolation of index cases and their close contacts, in addition to the movement restrictions play a major role to control the pandemic, the challenge for pandemic containment remains in identifying cases during the presymptomatic phase.

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INTRODUCTION

Since emerging in Wuhan, China, in December 2019, the Coronavirus disease 2019 (COVID-19) epidemic caused by novel coronavirus, SARS-CoV-2 has progressed rapidly into a pandemic.

This pandemic is a serious global health threat and it spreads from person-to-person through droplet and contact transmission. To control the spread of COVID-19, interventions need to break the chains of human-to-human transmission, ensuring that the number of new cases generated by each confirmed case is maintained below 1 (effective reproduction number < 1).

The incubation period for COVID-19 is five days, with a range of one to 14 days. The most common symptoms are fever, fatigue and a dry cough. An infected person can already start transmitting the virus up to 48 hours before the onset of symptoms (pre-symptomatic) and for up to two weeks. In the early stages of the disease, there is a particularly high concentration of the virus in secretions and therefore considerable risk of transmission. The disease is mainly spread from person to person through inhalation of respiratory droplets from an infected individual (cough, sneeze). Transmission can also occur if a person touches their eyes, nose, or mouth after touching a surface contaminated with virus-containing droplets, which can remain viable for up to several days. Some people are infected without developing symptoms at any point and, although the risk of transmissionis lower, they are still able to transmit the infection.

The first COVID-19 case in the Kingdom of Saudi Arabiawas confirmed on March 2, 2020. The KSA government implemented rigorous control measures, including shutting down entire cities or communities, banning international or domestic travel, conducting border control with symptom, screening, and implementing isolation and quarantine. A comprehensive pandemic control program was established with regular updating of the Ministry of Health national guidelines for contact tracing and quarantine, as a key intervention aiming to reduce the transmission dynamics of COVID-19, and to ensure early detection and isolation of primary cases and their close contacts.

Quarantine is undertaken to keep someone *who might have been exposed to COVID-19* away from others to avoid the spread of the disease. Quarantined individuals should stay at home, separate themselves from others, monitor their health, and follow directions from their state or local health department. In line with the advice of the Centers for disease control (CDC) in KSA, the national guideline mandates quarantine for each close contact of confirmed positive *COVID*-19 case, and advises PCR testing on day one initially and re-testing on the 13th day of contact. Contact tracing, in combination with the quarantine and potential testing of contacts, is considered a key component in outbreak control. This process is confined to close contact of *COVID-19* patients which is defined by CDC as

> "*For COVID-19, a close contact is defined as any individual who was within 6 feet of an infected person for at least 15 minutes starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to positive specimen collection) until the time the patient is isolated*".

It is critical that contact tracing and associated steps, such as quarantine of contacts and isolation of cases, not be used punitively or associated with security measures, immigration issues, or other concerns outside the realm of public health. Contact tracing activities should be available to all communities. As such, the World Health Organization (WHO) recommends voluntary participation by cases and their contacts. In Saudi Arabia contact tracing is one of the important actions adopted to reduce the spread of infection and increasing the number of new cases, as it was found effective in reducing the spread of the disease during the period of ongoing widespread transmission in both China and South Korea. Contact tracing in the context of COVID-19 depends on epidemiological scenarios:

- No cases: a well-trained contact tracing workforce should be identified, trained and on standby ready to respond to first cases.
- Sporadic cases or clusters: exhaustive contact tracing is essential for rapidly suppressing transmission.
- Clusters: contact tracing is essential for suppressing transmission and reducing transmission within clusters.
- Community transmission: contact tracing may be difficult when transmission is intense but should be carried out as much as possible, focusing on household contacts, health care workers, high-risk closed settings (dormitories, institutions, long-term care homes), and vulnerable contacts, as well as maintaining strong contact tracing capacity in areas with smaller clusters of cases. When countries have passed the peak of transmission and case numbers are decreasing, and particularly when stringent public health and social measures are being adjusted, rapid identification of cases and contact tracing are critical to maintain low levels of transmission and rapidly identify and break new transmission chains.

Polymerase chain reaction (PCR test): PCR test was used to directly detect the presence of an antigen, rather than the presence of the body's immune response, or antibodies.

Who should get tested

- People who have suspected symptoms of COVID-19.
- People who have had close contact (within 6 feet of an infected person for at least 15 minutes) with someone with confirmed COVID-19.
- People who have been asked or referred to get testing by their healthcare provider (CDC).

METHODS

This retrospective cohort study in Jazan region K.S.A, included laboratory-confirmed cases of COVID-19 (considered as index cases) and their close contacts; study participants were divided into community contacts that included all individuals who were either family members, or close relatives, such as parents, brothers and sisters, or lived in the same residential address (company's labors), and a second category who represented the health care workers in all health care facilities.

Secondary data was reviewed to determine the secondary attack rate of SARS-COV-2 among close contacts of symptomatic and asymptomatic index cases and also socio-demographic determinants were assessed. The study period was from March 16 up to May 15, 2020, covering all confirmed *COVID -19* patients (400) and their close contacts (1167). The secondary data with regards to index cases and their close contacts had been taken from the hospitals and quarantines registries respectively, given that close contacts were quarantined in hotels for 14 days dated from their last

exposure to the index cases. During the quarantine period, any relevant symptoms (fever, cough, or other respiratory symptoms) of close contacts were reported. A *COVID-19* polymerase chain reaction PCR) test (nasopharyngeal swap) was done for all close contacts on the day one and the same test was repeated for those who had negative PCR result on the 13th day from the last date of contact. Jazan Province is one of the smallest (11,670 km^2) administrative areas of the Kingdom, located in the south-western tip of the country with a coastal boundary 260 km along the Red Sea and a 120 km border with the Republic of Yemen, hosting a population of 1.5 milions. Data was entered and processed using SPSS version (23).

RESULTS AND DISCUSSION

The study achieved a 100% response rate, and the below results elaborate on the findings amongst the (400) notified and registered COVID-19 index cases and their close contacts(1167) reviewed during the study period from 16th of March to 15th of May 2020. The study results are presented in two main parts:

Part one sheds light on the results of positive index cases, including their demographic data, the source of infection and their clinical features. The second part focuses on the laboratory results of close contacts of those index cases, to estimate/quantify the secondary attack rate while correlating it with the socio-demographic data. The researchers present in this section the descriptive outputs, as well as discussions made based on descriptive statistics and chi square test, used to test the associations between secondary attack rate and selected socio-demographic characteristics and other categorical variables. All tables presented in this paper were based on the researchers' own calculations using the secondary data collected during the ongoing surveillance of index case and tracing of their close contacts.

Section 1:-Index cases: This component of the findings focuses on index cases, whereby the secondary data was taken from the national registration system of COVID-19 in quarantines department. The questionnaire was divided into a section for socio-demographic characteristics, and another one for clinical features, as shown in the following tables and figures.

Table 1. The socio-demographic characteristics of COVID-19 index cases, Jazan 2020 (n=400)

	Frequency	Percent
Male	224	56
Female	176	44
Saudi	380	95
Non Saudi	20	5
Age group		
0 to 4	3	0.8
5 to 14	13	3.3
15 to 24	145	36.3
25 to 49	206	51.5
50 to 64	27	6.8
65 to 79	5	1.3
80 and more	1	0.3
Residence		
Urban	280	70
Rural	120	30

Table 1 shows the higher number of male cases (224) accounting for 56% of cases, as compared to 176 females representing 44% of the total. Hence, the gender difference was statistically significant (p- value<0.05).A total of 8 females were found to be pregnant. A total of 380 of index cases were Saudis and 20 were non-Saudi. As per the above figure, almost 30% of index cases were unemployed accounting for the largest group, while the smallest category was for health workers at 11%.

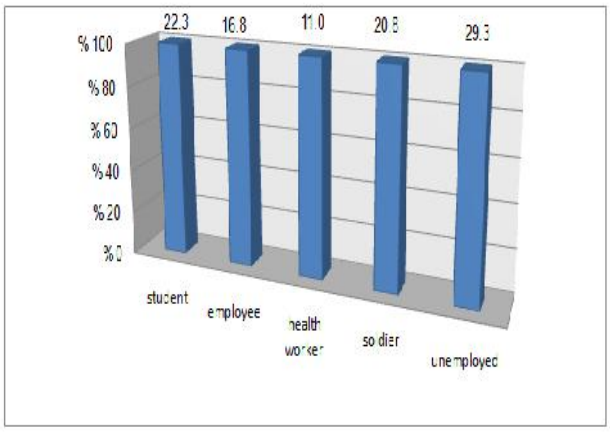

Figure 1. Distribution of index cases of COVID -19 according to employment type, Jazan 2020 (n=400)

Table 2. Transmission of infection to close contacts according to symptoms.Jazan, 2020 (n=400)

	Type of symptoms among index cases who transmitted the COVID-19 infection	
	Infection among close contacts	
Index casessymptoms	Frequency	Percent
Respiratory symptoms	158	67.8%
Non-respiratory symptoms	133	47%

The table (2) showed that the patients with respiratory symptoms transmitted the infection to (67.8%) of their close contacts while patients with non-respiratory symptoms transmitted to a less percent (47%) of their close contacts (p-value 0.02). These finding more or less similar to study conducted in China[15].

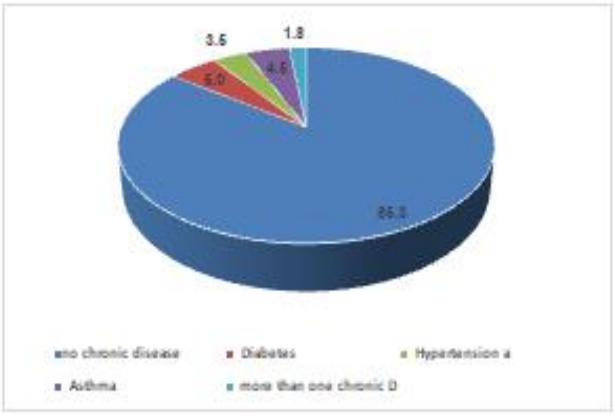

Fig.2. Distribution of chronic disease among index cases, Jazan 2020 (n=400)

Figure (2) shows that the vast majority (85%) of the index cases did not have any chronic disease, while 5% suffered from diabetes mellitus, 3.5% with hypertension, 4.5% had bronchial asthma and 1.8% of them had more than one chronic disease.

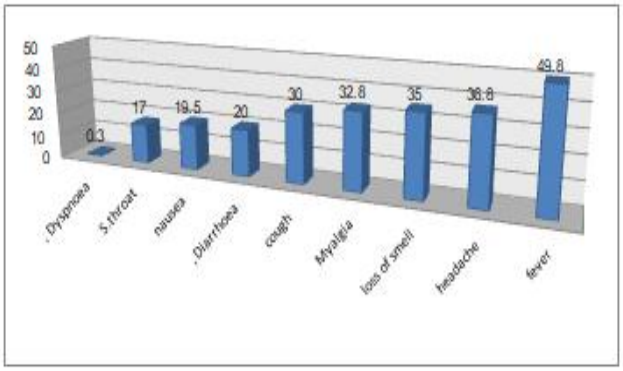

Figure 3. Distribution of symptoms among COVID-19 index cases Jazan 2020 (n=400)

The figure (3) revealed that fever was the most common symptom representing (49.8%) followed by headache (36.8%), and loss of smell (35%), amongst other cited symptoms. Sore throat accounted for the least symptom at (17%). The table (3) showed that the patients with respiratory symptoms transmitted the infection to(67.8%) of their close contacts while patients with non-respiratory symptoms transmitted to a less percent (47%) of their close contacts (p-value 0.02). These finding more or less similar to study conducted in China[15].

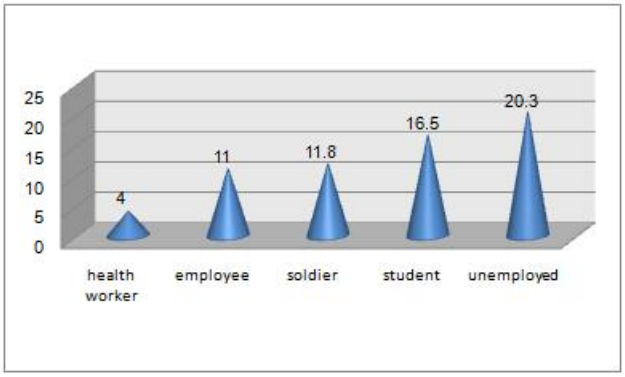

Figure 4. Transmission Patterns according to Employment distribution among COVID-19 index cases, Jazan, 2020.

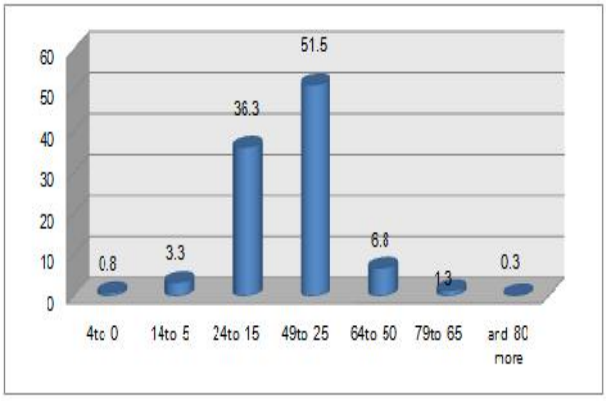

Figure 5. Distribution of infection transmission among index cases according to age group. Jazan 2020

The above chart revealed that the unemployed index cases constituted the highest category (20.3%) who were transmitting the COVID-19 infection, and this could be due to long duration of contact which justified increased probability of transmission among this group of people, while only (4%) of health care workers contacts were having the disease, this most probably due to the small number of health worker in the sample.

The age group between 25 up to 49 years represented the highest attack rate among this age group, accounted more than half of the sample, and this finding consistence with study conducted in Guangzhou, China in which the majority of the cases who got the infection were in the same age group.

Section Two: This section depicts the data for the close contacts of index cases with COVID-19**.**

Table 3. Socio-demographic characteristics of close contacts with COVID-19 patients in Jazan region 2020 (n= 1167).

Type of contact	Frequency	Percent
Community contact	783	67.1
Health worker contact	384	32.9
Total	1167	100
Sex / Gender		
Male	780	66.8
Female	387	33.2
Total	1167	100.0
Nationality		
Saudi	572	49.0
Non Saudi	595	51
Total	1167	100
Age group		
0 to 4 years	30	2.6
5 to 14 years	21	1.8
15 to 24 years	442	37.9
25 to 49 years	648	55.5
50 to 64 years	22	1.9
65 to 79	3	0.26
80 and above	1	0.08
Total	1167	100
Residence		
Urban	797	68.3
Rural	370	31.7
Total	1167	100

The above table (3) represented the demographic characteristics of the close contact of index cases with COVID 19. Those who contracted the disease through the community contacts constituted 67.1% while the health care workers were 32.9%; 66.8% were males. The respondents of age group 25-49 represented the largest percentage (56%) while the age group 80 years and above represents the lowest percentage (0.08%). The sample wasalmost equally distributed between Saudis and non-Saudis. Almost two third of contacts were from urban areas while the remaining third resided in rural areas.

Table 4. Distribution of chronic disease among close contacts. Jazan 2020

	Frequency	Percent
No chronic disease	1155	99
chronic disease	12	1.0
Total	1167	100

Table 5. Overall secondary attack rate among close contacts. Jazan, 2020

	Frequency	Percent
Negative	751	64.4
Positive	416	35.6
Total	1167	100

Most of the close contact cases were in the middle age and fortunately a mere 1% of them were suffering from chronic disease. The above table revealed that the overall secondary attack rate among close contacts of COVID 19 index cases

(symptomatic and asymptomatic) was 35.6%. As shown in the above table, there was a significant difference regarding the ability for transmission of COVID-19 infection by symptomatic index cases, whereby we found that the secondary attack rate among the close contacts of symptomatic index cases was (51.2%) , compared to only (10%) among close contacts of asymptomatic primary cases (Statistically is highly significant, p-value = 0.000). This finding is consistent with the study conducted in China[15]and Singapore[16] (12.2%)and (6.4%) respectively.

infected close contacts were non-Saudi nationality. (Fisher's Exact Test =.000) This was most likely due to poor environment and overcrowded accommodation among non-Saudi labors. Figure (7) showed that a higher proportion of those living in rural area (87.6%) tested negative as compared to the 53.6% of negative cases residing in urban areas. On the other hand, only 12.4% living in rural areas tested positive in comparison with the 46.4% of the positive cases that originated from urban areas. P-value 0.000 showed that there

Table 6. Secondary attack rate among close contacts of symptomatic and asymptomatic index cases

	Close contacts of Index cases					
	Symptomatic		Asymptomatic		Total	
	Frequency	percent	Frequency	percent	Frequency	percent
Negative	354	48.8%	397	90%	751	100
Positive	372	51.2%	44	10%	416	100

Table (8). The secondary attack rate among close contacts according to sex in Jazan region 2020

	Negative		Positive	
	Frequency	percent	Frequency	Percent
Male	439	58.5%	341	82%
Female	312	41.5%	75	18%

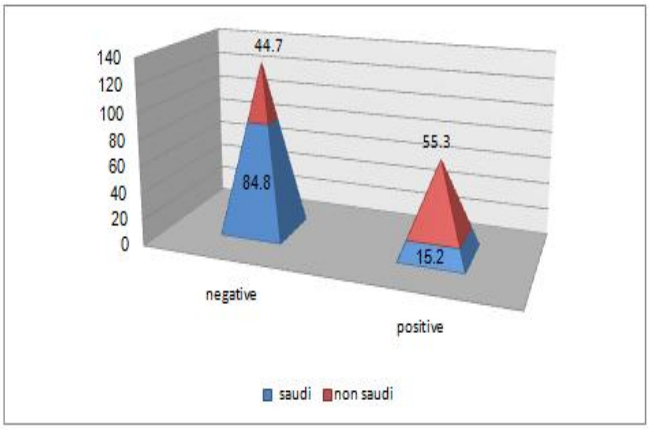

Figure 6. Distribution of secondary attack rate among close contacts according to their nationality in Jazan region 2020.

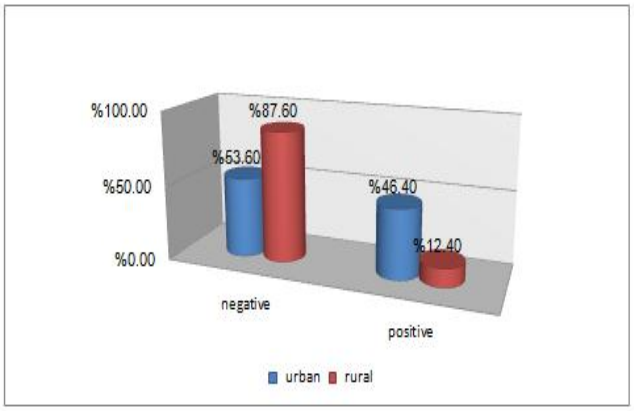

Figure 7. Distribution of secondary attack rate among close contacts according to their rural or urban Residence, Jazan, 2020

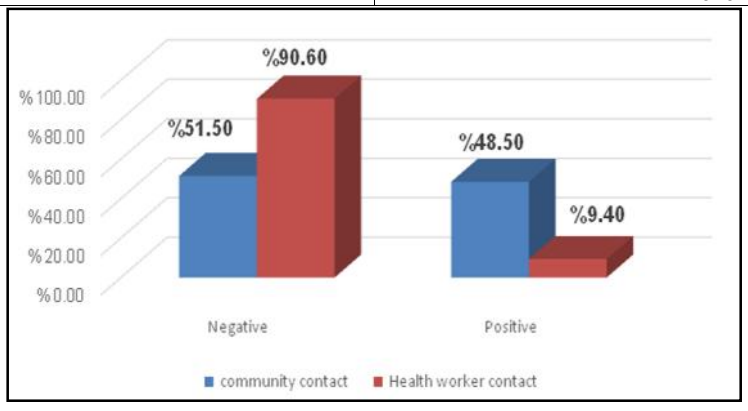

Figure 8. Types of Close contacts. Jazan region 2020

According to the above table (8), the secondary attack rate was 82% among males compared to; only 18% of females. Hence, there is significant association between transmission of infection and sex (p-value 0.000) and that might be due to the protective role offered by the veils worn outdoors by Saudi females, hence shielding them from such secondary infections. As shown from the chart above, more than 55% of

was highly significant association between the transmission of infection and residence. Figure 8 showed that 51.5% of negative cases were community contacts, compared to 90.6% were negative cases among health workers contacts. However, 48.5% were found to be positive among community contacts compared to 9.4% were positive cases among health workers contact. P-value 0.000 showed that

there was highly significant association between secondary attack rate and type of contacts and that might be due to small number of health workers in sample.

Summary

The overall secondary attack rate among close contacts of index cases of COVID-19 was 35.6% (416).

When disaggregated with regards to existence of symptoms, and secondary attack rate among close contacts of asymptomatic primary cases was as low as 10% (44) as compared to 51.2% (372) representing the secondary attack rate among close contacts of symptomatic index cases., The study also revealed that primary cases with respiratory symptoms transmitted the infection to 67.8% of their close contacts while index cases with non-respiratory symptoms infected only 47%. The age group (25 up to 49 years) were the most vulnerable to COVID-19 transmission. Although early detection and isolation of the index cases and their close contacts, coupled with movement restrictions will play a major role in controlling the pandemic, detection of cases during the presymptomatic phase remains a challenge facing the pandemic containment strategy. The secondary attack rate was 82% among males compared to only 18% of the positive cases being females. There is significant association between transmission of infection and sex (p-value0.000). This may be attributed to the fact that Saudi females always wear veils outdoors and these religious face covers might play a protective role against COVID-19, a perspective for which further study is highly recommended.

Author Declarations

All relevant ethical guidelines have been followed; ethical committee approval had been obtained. And this study was under supervision of Jazan Health Authority. And no external fund was requested.

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