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Secondary attack rate of COVID-19: analysis of contacts of COVID-19 cases admitted in a tertiary care centre, Northern district of Kerala, India-a cross-sectional study

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ABSTRACT

Background: Secondary attack rate is the proportion of primary contacts that develop infection or symptom within one incubation period after contact with an index case. The secondary attack rate will help in studying and understanding the transmission dynamics of infectious diseases. As coronavirus disease (COVID-19) is a novel disease which has resulted in a pandemic, understanding the transmission dynamics is very important for strengthening preventive measures.

Methods: The present cross-sectional study was conducted to estimate the secondary attack rate among primary contacts of COVID-19 cases admitted in a tertiary care centre in Northern Kerala. Secondary attack rate was calculated as the percentage of primary contacts that tested positive for COVID-19 with RT-PCR test within 14 days of exposure.

Results: Secondary attack rate was found to be 5.88%, secondary clinical attack rate 2.35% and secondary infection rate 3.53%. Among those contacts that developed disease, 80% were household contacts.

Conclusions: Secondary attack rate was 5.88% and household contacts were the majority to get the disease.

Keywords: COVID-19, Kerala, Secondary attack rate, Secondary clinical attack rate, Secondary infection rate

INTRODUCTION

Coronavirus disease (COVID-19) is caused by severe acute respiratory syndrome corona virus-2 (SARS-CoV-2), which is a novel virus which initially caused several cases of respiratory illness in Wuhan province of China in December 2019 and later resulted in a pandemic.¹

Globally more than 27 million individuals have been infected with COVID-19 and the death toll has crossed eight hundred ninety-four thousand. In India, more than 4 million individuals have been infected and more than 75 thousand deaths have occurred due to COVID-19. In Kerala, more than 95 thousand individuals have been infected and 384 deaths occurred due to COVID-19.

Secondary attack rate is the proportion of primary contacts who develop infection or symptom within one incubation period after contact with an index case. The secondary attack rate will help in studying and understanding the transmission dynamics of infectious diseases. Secondary attack rate will provide information regarding how social interactions influence transmission risk.⁵

As COVID-19 is a novel disease which has resulted in a pandemic, understanding the transmission dynamics will be helpful for planning and modifying preventive measures. The present study was conducted to estimate the secondary attack rate among primary contacts of

COVID-19 cases admitted in a tertiary care centre in Northern Kerala.

METHODS

The present cross-sectional study was done among primary contacts of COVID-19 positive individuals admitted in a tertiary care centre in North Kerala during 7 March to 24 April 2020. All COVID-19 positive individuals (index cases) admitted in the hospital during the study period were contacted over phone to prepare list of primary contacts. Index cases that were very critical and unable to communicate for detailed history taking were excluded from the study. After obtaining the list of primary contacts, their telephone numbers were also collected. The primary contacts were contacted over telephone and information on basic demographic details, travel details, date of last contact with the COVID-19 patient, date of symptom onset, details of symptoms and date of swab collection were obtained. The primary contacts whose phone numbers were not available were excluded. Primary contacts were assessed for disease onset within 14 days of their last contact with COVID -19 positive individual. The primary contacts that turned RT-PCR positive on throat swab within 14 days of contact with the confirmed case were counted in for estimating secondary attack rate.

Data was entered using Microsoft excel and analyzed using statistical package for social sciences (SPSS) version 16. The variables were summarized as mean with standard deviation, and frequency with percentage.

Operational definitions

Date of last exposure: the date of last exposure of the contact will be two days prior or up to 14 days after symptom onset in the positive case, whichever is late. Incubation period: the period between date of last exposure and date of symptom onset.⁶ Primary contact: individuals who were in close proximity (within 1 meter, more than 15 minutes) to a confirmed case without mask, or had close interactions (within 1 meter, more than 15 minutes) with a confirmed case without mask. Date of symptom onset: date of onset of first symptom, which may be one of the following- fever, cough, sore throat, tiredness, diarrhoea, myalgia, breathing difficulty.6 Secondary clinical attack rate: it is defined as the percentage of primary contacts who develop clinical symptoms of COVID-19 within 14 days of exposure and tested positive with RT-PCR.8 Secondary infection rate: it is defined as the percentage of primary contacts who test positive with RT-PCR but remains asymptomatic within 14 days of exposure.8

RESULTS

Primary contacts of 14 index cases admitted in the tertiary care hospital during study period were included in the study to assess onset of COVID-19 among them.

Category of primary contacts studied included: household contacts, friends and individuals who travelled in the same vehicle along with the primary case, and other primary contacts like roommates, relatives, health care workers, and individuals from community who had contact with the primary case as per operational definition. Co-passengers in flight were not included in the present study (Table 1).

Table 1: Distribution of primary contacts by type of contact.

Type of contact	Frequency	Percentage (%)
Household contact	56	22
Other relatives	47	18.4
Friends/room mates	37	14.5
Travelled in same vehicle	37	14.5
Health care worker	20	7.8
Other primary contact in community	58	22.7
Total	255	100

The mean age of primary contacts was 34.26 years (± 16.32). Among the 255 primary contacts studied, 170 (66.7%) were males and 85 (33.3%) were females.

It was observed that 22 primary contacts (8.6%) developed symptoms within 14 days of their last contact with primary case. Fever was the most common symptom reported (12 out of 22), followed by sore throat (8 out of 22). Other symptoms reported include rhinitis, cough, headache, myalgia, fatigue and breathlessness. All those who developed symptoms underwent RT-PCR for COVID-19 and among them only 6 individuals (27.27%) were found to be positive.

Secondary attack rate

Secondary attack rate varied from 3.7 to 50% for individual primary cases (Table 2). Considering all the contacts included in the study and total individuals who developed the disease among them, the secondary attack rate was found to be 5.88% (Table 2).

Secondary clinical attack rate was found to be 2.35% and secondary infection rate was found to be 3.53%. It was also observed that asymptomatic index cases were more likely to transmit infection to primary contacts compared to symptomatic index cases.

In the study it was found that 166 (65.1%) contacts underwent RT-PCR test for COVID-19 and 15 (5.9%) were found to be positive. It was also observed that 26.67% (4 out of 15) of contacts who developed disease were aged 60 years or more. Among those who got infected, seven were males and eight were females. Among those who got infected, 80% were household

contacts and rest were friends, relatives, roommates or individuals who travelled in the same vehicle along with index case. Among household contacts, 23% developed COVID-19. Among the contacts that turned positive for COVID-19, only 40% were symptomatic and 60% were asymptomatic.

Table 2: Distribution of index case, contacts and estimation of secondary attack rate.

Index case	No. of primary contacts studied	No. of primary contacts who developed COVID-19	Secondary attack rate (%)
Case 1	25	0	-
Case 2	12	0	-
Case 3	16	0	-
Case 4	4	2	50
Case 5	41	0	-
Case 6	11	0	-
Case 7	9	0	-
Case 8#	39	10	25.64
Case 9#	54	2	3.7
Case 10 [#]	17	0	-
Case 11 [#]	13	1	7.69
Case 12#	7	0	-
Case 13	1	0	-
Case 14	6	0	-
Total	255	15	5.88

[#] Index cases who did not have symptoms of COVID-19

It was observed that the mean age of persons who turned positive for COVID-19 was 42.53 years (± 19.36) and the mean age of those who did not develop disease was 30.77 years (± 16.49). This difference was statistically significant (independent sample t-test, p=0.01). It was also found that out of 14 primary contacts who were aged 60 years or more, 4 individuals (28.57%) developed COVID-19.

DISCUSSION

In the present study, overall secondary attack rate was found to be 5.88%. In a systematic review of secondary attack rate of COVID-19 among household contacts by Shah et al it was observed that secondary attack rate among household contacts was 6% in India. The same review also observed that SAR varied between 4.6% to 49.56% across different countries. The review also states that SAR was unaffected by factors such as population of the country, lockdown status of the country and geographic location.

The present study also observed that 26.67% (4 out of 15) of contacts who developed disease were aged 60 years or more. It was observed that the mean age of persons who turned positive for COVID-19 was 42.53 years (± 19.36) and those who did not develop disease was 30.77 years (± 16.49) and this difference was statistically significant

(independent sample t-test, p=0.01). It was also found that out of 14 primary contacts who were aged 60 years or more, 4 individuals (28.57%) developed disease. In a study by Jing et al to assess household secondary attack rate of COVID-19 in China, it was found that the risk of household transmission was lower among younger age groups (<20 years) and adults (20-59 years), and older age groups (≥60 years) were at higher risk for infection. ¹⁰ The same study also found that SAR varied between 12.4 to 17.1% depending on the definition of household contacts. ¹⁰

In a study by Liu et al on secondary attack rate of COVID-19, SAR was estimated to be 35% for COVID-19 after 48 contacts among 137 attendees in a gathering turned out to be positive for COVID-19. Jing et al traced a total of 195 unrelated clusters with 212 primary cases, 137 non primary (secondary or tertiary) cases and 1938 uninfected close contacts to estimate secondary attack rate (SAR). It was found that SAR was 19.3% if the household contacts were defined as those with same residential address and 13.8% if household contacts were defined as all close relatives. The odds of infection among <20 years old was 0.26 times that among elderly (>60 years).

Another study showed that SARS-CoV-2 was more transmissible in households than SARS-CoV and MERS-CoV and elderly were the most vulnerable for household transmission. The study concluded that it is not possible to contain the pandemic by case finding and isolation alone, and restriction of human movement also has to be done to contain the pandemic. ¹²

In the present study, it was found that 23% of household contacts developed COVID-19. Epidemiology and case management team, Korea centres for disease control and prevention investigated 2370 contacts of first 30 cases in republic of Korea between January 24 and March 10 2020 and found a SAR of 0.55% among all contacts and SAR of 7.56% among household contacts. The study found that transmission of COVID-19 was significant among household contacts. ¹³

Active symptom monitoring of the 445 close contacts, consisting of daily telephone, text, or in-person inquiries about fever or other symptoms for 14 days following the last known exposure to a person with confirmed COVID-19, was conducted by local health jurisdictions in United States and a SAR of 0.45% was found among all contacts and 10.5% among household contacts.¹⁴

Limitations

The study was, the study was a single centre study and sample size was limited in number.

CONCLUSION

Secondary attack rate estimated to be 5.88%. Household contacts were the majority to get the disease and

asymptomatic index cases were the most to transmit infection compared to symptomatic index cases. Elderly and high-risk individuals in the family should take extra precautions to avoid exposure.

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