Factors influencing the acquisition of COVID infection among high-risk contacts of COVID-19 patients in Madurai district-A case control study

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ABSTRACT

Introduction: COVID is a new disease; understanding the transmission dynamics and epidemiological characteristics may help in developing the effective control measures. The study is done 1. To determine the various factors influencing the acquisition of COVID-19 infection among high-risk contacts 2. To estimate the secondary attack rate among high-risk contacts 3. To determine the factors in COVID index cases influencing their secondary attack rate. **Methodology:** Unmatched case control study was conducted from March to August 2020 among 139 COVID index cases in Madurai district from March–May (Reference period) and their 50 COVID positive (cases), 551 COVID negative (controls) high-risk contacts. Case investigation form* and contact tracing Proforma*were used to collect data. Chi-square test and independent sample *t* test were used to find out the association. Univariate* and Multivariate logistic regression* were used to predict the risk of various factors in acquisition of COVID infection with the help of adjusted and unadjusted odds ratio. *P* value < 0.05 was considered statistically significant. **Results:** Male contacts (*P* = 0.005, OR = 2.520), overcrowding (*P* = 0.007, OR = 3.810), and duration of exposure to index case (for 4-7 days *P* = 0.014, OR = 2.902, for >7 days *P* = 0.001, OR = 6.748 and for > 12 hours/day *P* = 0.000, OR = 5.543) were significant factors predicted to be associated with acquisition of COVID infection among high-risk contacts. Reproductive number (R0)* estimated was 1.3. Secondary attack rate (SAR)* estimated among high-risk contacts was 8.32%. Index cases whose outcome was death (*P* = 0.026); symptomatic index cases (*P* = 0.000), cases with fever (*P* = 0.001); sorethroat (*P* = 0.019); breathlessness (*P* = 0.010); cough (*P* = 0.006) and running nose (*P* = 0.002) had significantly higher mean SAR than their counterparts. **Conclusion:** Contacts with above said risk factors who were found to be more prone to infection could be given special focus to prevent the transmission in them.

Keywords: Case investigation form, contact tracing proforma, multivariate logistic regression, reproductive number, secondary attack rate, univariate logistic regression

Key Messages: According to our study findings,
· Factors related to acquisition of COVID infection among high-risk contacts are presence of Overcrowding, increase in duration of exposure and Symptomatic status of Index cases.
· Knowledge on these risk factors may throw light in controlling future pandemic diseases following similar mode of transmission.
· Preventive measures like social distancing must be emphasized in the community as well as in the households having symptomatic family member.
· Mass screening of the community for the symptoms like fever, cough, sore throat, running nose, and breathlessness at the primary level help in early diagnosis and isolation of affected individuals.

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Introduction

COVID -19 was first reported in Wuhan city, China in late December 2019[1] and was declared as Public Health Emergency of International Concern (PHEIC) on January 30, 2020[2] and as Pandemic on March 11, 2020.[3] As on 15/1/2021, 93.1 million people worldwide,[4] 10.5 million Indians,[5] 829,000 people in Tamil Nadu, and 20,788 in Madurai were affected.[6] Basic Reproduction number (R0) was estimated to be around 1.4-6.49 with mean of 3.28.[7] In INDIA, R0 was around 1.83 in April, 1.27 in May after lockdown,[8] and around 1.405 in Tamil Nadu.[9] The risk of acquisition of COVID infection was higher among adult and old-age contacts compared to children,[10,11] higher among female contacts and contacts of symptomatic cases and spouses of index cases,[10] and higher among household contacts.[11]

COVID-19 is the emerging disease with unknown epidemiological characteristics and transmission dynamics. Understanding them may help in developing and evaluating the effective control measures; it helps the physician at primary level to take preventive measures against those factors involved in the disease spread, and also helps in contact tracing and containment at the primary level. Studies on this area is scarce, hence the need of the present study.

Objective

- To determine the various factors influencing the acquisition of COVID-19 infection among high-risk contacts
- To estimate the secondary attack rate among high-risk contacts
- To determine the factors in COVID index cases influencing their secondary attack rate.

Methodology

This unmatched case control study was conducted in Madurai district, in southern part of Tamil Nadu, with the population of 3,038,252. From March to May 2020 (our reference period), one Government tertiary care hospital and four private hospitals accommodated COVID positive cases.

The study was conducted from March to August 2020 for a duration of 6 months. Madurai district was in complete lockdown till May 31, 2020 and relaxed thereafter, leading to transmission of COVID infection through multiple sources; hence it was difficult to trace the definite source of infection for all positive cases. So, we limited our reference period from March to May 2020. The study population was divided into three categories: (1) INDEX COVID CASES (2) CASES, and (3) CONTROLS.

Covid positive

Patients who were confirmed for COVID 19 infection through RT-PCR.

Index covid cases

The first case in a family or a workplace that came to the attention of the investigator and also unlinked, that is those without contact with known lab-confirmed COVID cases.[12]

High-risk contact

Those (1) living in the same household as the confirmed case (2) touched body fluids of confirmed case without personal protective equipments (PPE) (3) had direct physical contact with body of confirmed case including physical examination without PPE (4) touched or cleaned the linen, clothes or dishes of confirmed cases (5) anyone in close proximity within 1m of confirmed case without precaution (6) passenger in close proximity within 1m of a convergence with symptomatic person who later tested positive for COVID 19 for more than 6 hours.[13,14]

Cases

High-risk contacts of index cases who were lab-confirmed swab positive through RT-PCR.

Controls

High-risk contacts of index cases who were lab-confirmed swab negative through RT-PCR.

Ethical clearance was bought from Institutional Ethical Committee and patient's confidentiality was maintained throughout the study. Out of 268 cases in MADURAI till May 2020, 208 were index cases. On contact tracing, 946 high-risk contacts were identified. Excluding the nonresponders, we arrived at the sample size of 139 index cases with 601 high-risk contacts. Out of 601 high-risk contacts, number of cases were 50 and number of controls were 551 with the ratio of 1:11. COVID-19 positive line list updated by state bulletin were obtained on a daily basis from the month of March by our department. For all those cases telephonic interview was conducted by a team of trained personals in our department, which included Assistant Professors, Post Graduates, and interns. Case Investigation Form (CIF) approved by National Centre for Disease Control (NCDC),[15] New Delhi was used to collect data for all positive cases. CIF form had questions to collect data regarding their (1) age, sex, occupation, (2) symptoms, initial symptoms, date of onset of symptoms, (3) health care facilities visited, notification by healthcare facility (4) place and date of admission and discharge date, (5) co-morbidities, (6) contact history,v(7) travel history, and (8) swab details. High-risk contacts for all the positive cases were traced along with co-ordination with Deputy Director of Health Services and were mobilized for swab test. We obtained their swab results from Microbiology department. For all those high-risk contacts we collected data using Contact tracing proforma designed by NCDC. It had questions to collect data on age, sex, duration of exposure to index cases in days and hours of exposure per day, type of contact, and their relationship to index cases. Data on co-morbidity, overcrowding were also collected through telephonic interview. Presence of overcrowding[12] was based on following criterias:

- PERSONS PER ROOM:
  1 Room >2 Persons
  2 Rooms >3 Persons
  3 Rooms >5 Persons,
  4 Rooms >7 Persons,
  5 Rooms >10 Persons

- SEX SEPARATION:

Two persons over nine years of age not husband and wife of opposite sexes were oblique to sleep in the same room.

For those whose phones were under switched off or not reachable or not attending were called again for the maximum of three times at an interval of 1 week till we could reach them on phone. Those who could not be reached even after three attempts were excluded from our study. If either an index case or their high-risk contact didn't respond, we excluded the index case along with their contacts. In case of severe cases, data were obtained from the primary care givers. All the collected data were analyzed using SPSS software version 21.

Descriptive statistics were used to find out the frequencies and percentages. Association between various risk factors (categorical) and acquisition of COVID infection was found using Chi-SQUARE test. Unadjusted Odds ratio was found out using BINARY LOGISTIC REGRESSION. *P* value < 0.05 was considered to be significant. All the significant factors were put in Multivariate logistic regression and adjusted odds ratios were calculated to predict the risk of various factors in acquisition of COVID infection. Independent sample *t* test was used to find the mean difference of secondary attack rate of index cases between two independent groups. "CORRELATION AND REGRESSION" was used to find the association between two continuous variables.

Secondary Attack Rate (SAR)[12] was defined as the number of exposed person developing the disease within the range of incubation period following exposure to primary case.

SAR = (Number of exposed persons developing disease within the range of incubation period × 100)/Total number of exposed or susceptible contacts

The basic Reproduction number (R0)[12] describes the number of people an infected person is likely to spread the disease. It says the epidemic size R0 < 1 indicates that an epidemic is arrested.

R0= (Total number of primary cases + Number of high-risk contacts tested positive)/Total number of primary cases.

Results

Among 601 high-risk contacts traced, 50 were cases and 551 were controls. Majority of the high-risk contacts that is 359 (59.7%) were in the age group 15–48 years and also 64% (32) of cases and 59.3% (327) of controls were in that age group. About 52.57%

of high-risk contacts were females and maximum of the cases were males (66%); 67.22% had overcrowding in which 11.1% were cases. Most of the cases (66%) and controls (54.44%) had exposure to the index cases for 4-7 days. Majority of cases (44%) had exposure to index case from 7–12 hours per day. Most of the controls (48.45%) had < 6 hours of exposure per day. Only 8% of high-risk contacts had any one of the co-morbidities. About 86% of Cases and 92.55% of controls were nondiabetics, whereas 98% of cases and controls were normotensive. Household contacts (86.68%) form greater cluster of total high-risk contacts.

Table 1 shows factors influencing acquisition of COVID-19 among Cases and Controls. Chance of acquisition of COVID 19 infection is higher in the age group of 15-48 years (64%) compared to other age groups. But this was not statistically significant. Among male contacts 11.6% were cases but only 5.4% of female contacts were cases (OR = 2.303). About 67.2% of Contacts had history of overcrowding in which 11.1% developed disease (OR = 4.813), it was statistically significantly higher than those without overcrowding. Proportion of contacts developing disease increased as duration of exposure with index case increased. About 9.9% contacts who had exposure between 4 and 7 days and 25.6% of contacts who had exposure >7 days developed disease but only 3.1% of contacts exposed <4 days developed disease and these differences were statistically significant. Among diabetic contacts, 14.6% developed disease whereas 7.8% of nondiabetic contacts developed disease, but that difference was not statistically significant. About 6.7% of hypertensive and 8.4% of normotensive contacts developed disease but the difference was statistically insignificant. Among different relations, proportion of children of index cases who developed disease (9.8%) was more than all other relations (spouse-4.5%, parent-8.4%, friends-9.1%, others-8.6%) but the difference between groups was not statistically significant. Secondary attack rate among work place contacts, that is the proportion of workplace contacts developed disease was 15.4% and it was higher than other type of contacts (SAR for household contacts = 8.1%, SAR for friends who came into contact with COVID index case = 9.1%, SAR for healthcare worker contacts = 0%). Workplace contacts had two times higher risk of acquiring disease than household contacts, however it was not statistically significant.

SAR among high-risk contacts was estimated to be 8.32%, which indicates that 8.32% of total high-risk contacts had a chance of developing COVID infection. R0 was calculated as 1.3, which denotes that one index case can pass virus to approximately 1.3 of high-risk contact.

Factors that were statistically significant in univariate analysis were analyzed through Multivariate regression and the unadjusted odds ratios were calculated. Table 2 shows multivariate analysis of various factors in acquisition of COVID-19. Factors significant in Chi-square and univariate analysis were also significant in multivariate analysis. Male contacts were having 2.52 times higher risk than female contacts in acquisition of COVID infection.

Table 1: Factors influencing acquisition of COVID-19 between Cases and Controls (*n*=601)					
Factors	Cases *n*=50	Controls *n*=551	Total *n*=601	Chi-Square *P*	*P* by Binary Logistic Regression	Unadjusted odds ratio (95% Confidence Interval)
Age						
<=14 YRS[a]	9 (7.4%)	112 (92.6%)	121 (100%)			-
15-48 YRS	32 (8.9%)	327 (91.1%)	359 (100%)	0.814	0.616	1.218 (0.564-2.630)
>48	9 (7.4%)	112 (9`2.6%)	121 (100%)			1.000 (0.383-2.613)
Sex						
Male	33 (11.6%)	252 (88.4%)	285 (100%)	0.006*	0.007*	2.303 (1.253-4.233)
Female[a]	17 (5.4%)	299 (94.6%)	316 (100%)			-
Overcrowding						
Absent[a]	5 (2.5%)	192 (97.5%)	197 (100%)			-
Present	45 (11.1%)	359 (88.9%)	404 (100%)	0.000*	0.001*	4.813 (1.879-12.327)
Duration of Exposure						
1-3 Days[a]	7 (3.1%)	222 (96.9%)	229 (100%)			-
4-7 Days	33 (9.9%)	300 (90.1%)	333 (100%)	0.000*	0.000*	3.489 (1.515-8.031)
>7 Days	10 (25.6%)	29 (74.4%)	39 (100%)		0.005*	10.936 (3.863-30.956)
Hours of Exposure/day						
<=6 Hrs[a]	16 (5.7%)	267 (94.3%)	283 (100%)			-
7-12 Hrs	22 (8%)	254 (92%)	276 (100%)	0.000*	0.000*	1.445 (0.742-2.815)
>12 Hrs	12 (28.6%)	30 (71.4%)	42 (100%)		0.000*	6.675 (2.887-15.435)
Diabetes						
Absent[a]	43 (7.8%)	510 (92.2%)	553 (100%)			-
Present	7 (14.6%)	41 (85.4%)	48 (100%)	0.101	0.108	2.025 (0.857-4.785)
Hypertension						
Absent[a]	49 (8.4%)	537 (91.6%)	586 (100%)	0.814	0.815	-
Present	1 (6.7%)	14 (93.3%)	15 (100%)			0.783 (0.101-6.079)
Co-morbidity status						
Absent[a]	43 (7.8%)	509 (92.2%)	552 (100%)	0.115	0.121	-
Present	7 (14.3%)	42 (85.7%)	49 (100%)			1.973 (0.836-4.655)
Relationship						
Spouse[a]	4 (4.5%)	85 (95.5%)	89 (100%)		-	-
Children	16 (9.8%)	147 (90.2%)	163 (100%)	0.711	0.945	2.313 (0.749-7.144)
Parent	8 (8.4%)	87 (91.6%)	95 (100%)		0.384	1.954 (0.567-6.731)
Friends	4 (9.1%)	40 (90.9%)	44 (100%)		0.490	2.125 (0.506-8.933)
Others	18 (8.6%)	192 (91.4%)	210 (100%)		0.225	1.992 (0.655-6.064)
Type of contact						
Household[a]	42 (8.1%)	479 (91.9%)	521 (100%)	0.442	-	-
Friends	4 (9.1%)	40 (90.9%)	44 (100%)		0.811	1.140 (0.389-3.342)
Workplace	4 (15.4%)	22 (84.6%)	26 (100%)		0.198	2.074 (0.683-6.299)
Healthcare	0 (0%)	10 (100%)	10 (100%)		0.999	0.000

*Statistically significant (*P*<0.05). [a]Reference category

Contacts with overcrowding had 3.81 times higher risk than their counterpart. Taking contacts with <4 days of exposure as reference group, the risk of acquisition of COVID infection was 2.9 times higher in contacts with 4–7 days of exposure and 6.74 times higher in those exposed for >7 days. Those contacts with exposure >12 hours per day had 5.54 times more risk of acquiring COVID infection compared to those exposed to <6 hours per day.

Table 3 shows the Association of Index Cases factors with their Secondary Attack Rate. About 103 (74.1%) of 139 index cases were males. Mean SAR of male and female Index cases were 0.19% and 0.27, respectively. This difference in mean was not statistically significant in independent sample T test. About 73.4% of index cases were asymptomatic and 26.6% were symptomatic. Mean

SAR of symptomatic cases was higher than asymptomatic index cases, which was statistically significant. Common symptoms reported in index cases were fever (15.15%), cough (14.38%), sore throat (5.03%), running nose (7.19%), nausea and vomiting (0.71%), breathlessness (6.47%), headache (2.15%), diarrhea (1.43%), and pain (4.31%). Means of SAR of people with the above mentioned symptoms were higher than those without those respective symptoms. But the mean difference was statistically significant only for fever (*P* = 0.001), sore throat (*P* = 0.014), cough (*P* = 0.006), breathlessness (*P* = 0.010), and running nose (*P* = 0.002). Mean SAR of Index cases with and without co-morbidities was nearly same. Most common co-morbidity was diabetes. Mean of SAR of diabetic patients was higher than that of nondiabetics and this association was statistically significant. Going through outcomes of 139

Table 2: Adjusted Odds Ratio For Factors Influencing Acquisition Of COVID-19 between Cases And Controls Using Multivariate Logistic Regression (*n*=601)

Factors	*P*	Adjusted odds ratio (95% Confidence Interval)
Sex		
Female[a]	-	-
Male	0.005*	2.520 (1.321-4.806)
Overcrowding		
Absent[a]	-	-
Present	0.007*	3.810 (1.434-10.125)
Duration of exposure in days		
1-3 Days[a]	-	-
4-7 Days	0.014*	2.902 (1.237-6.808)
>7 Days	0.001*	6.748 (2.282-19.960)
Duration of exposure in hours/day		
<=6 Hrs[a]	-	-
7-12 Hrs	0.709	1.144 (0.566-2.311)
>12 Hrs	0.000*	5.543 (2.227-13.797)

*Statistically significant (*P*<0.05). [a]Reference category

index cases, 98.6% were discharged successfully and 1.4% were deceased. Mean SAR of deceased cases was 41.6 and this was statistically significantly higher than mean SAR of those discharged (8.37).

Table 4 shows Correlation of age and duration of hospital stay of index case with their Secondary Attack Rate. Age and duration of hospital stay were not statistically correlated with SAR.

Discussion

In this study, out of 139 Index cases and 601 high-risk contacts, the factors such as male gender, presence of overcrowding, increased duration of exposure to index case were significantly associated with risk of acquiring COVID-19 infection among the high-risk contacts. SAR was significantly higher in index cases with symptoms like fever, sore throat, breathlessness, cough, running nose, index case with Diabetes mellitus, and in dead cases than their respective counterparts.

In our study, R0 was calculated to be 1.36. This is comparatively lower than in developed nations, a study done in China estimated Ro to be 8.21 in USA and 7.9 in Wuhan, China.[16] In another article published by Mohana Basu, Ro in India was 1.379[8] and by Marimuthu,[9] R0 in Tamil Nadu was 1.405 at the end of May month. Various other studies conducted in Tamil Nadu revealed R0 to be around three in Madurai without lockdown and one with lockdown.[17] These findings were similar to our study.

Our study shows that male contacts were affected more than female contacts which was similar to a study done by Republic of Korea.[18] But this was in contradiction to other studies like meta-analysis published by AIIMS, Delhi,[10] COVID study by ICMR,[19] and a study done by Liu *et al.* in China,[20] where female contacts were found to be highly affected. In a study done by Bi *et al.*,[21] male and female contacts were equally affected. Male

contacts in our study might have spent most of their time outdoors even during the period of lockdown, making them more prone to COVID-19 infection. The present study forms the base for future researches to find out, if there are any biological and behavioral factors making male contacts more susceptible in acquiring the infection rather than female contacts.

In our study, Overcrowding increases the risk of acquiring the COVID-19 infection among contacts, which was similar to another study conducted by Ahmad *et al.*[22] across US countries and another study by Azuma *et al.*[23] showing 3C of Crowded spaces, Close contacts, and Closed space with poor ventilation resulting in higher secondary infection. As we know, poor housing conditions like overcrowding is associated with the spread of infection through aerosol and droplets; the risk of COVID-19 infection that spreads through aerosol and droplets also increases. The risk of acquisition of COVID-19 infection among high-risk contacts increases as their duration of exposure to the index cases increases. This is similar to the study conducted by Public health England Transmission group.[24] Increase in duration of the exposure may increase the viral load in the exposed individual leading to development of infection and disease manifestation.

The SAR of household contacts in our study was 8.1%. This is similar to the study done by Centres of Disease control and prevention, Republic of South Korea[18] (7.56%) and slightly lower than a study done by Arnedo-Pena *et al.*[25] from Spain and (11.1%), by Wilkinson *et al.*[26] from Canada (14.7%) and by Li *et al.*[27] (16.3%), Jing *et al.*[28] (12.4%) from China, and slightly higher than the study done by Ng *et al.*[29] (5.9%). Among the different relationships, children of index cases were more affected (9.8%) than others. But in previous studies done by AIIMS Delhi,[10] Li *et al.*[27] and Sun *et al.*[30] from China and Madewell *et al.*,[31] spouses were more affected.

No association was found between age of the contacts and the risk of acquiring COVID infection in our study, which is similar to the study done by Ng *et al.*[29] whereas Spencer EA *et al.*[32] in their study found out that increased age of the close contacts was associated with increased risk of infection.

Age of the index case was positively correlated to their SAR in the study done by Arnedo-Pena *et al.*[25] in Spain. This is in contrast to our study where we found no significant correlation between age and SAR. Mean SAR of symptomatic index cases were higher (0.45%) than asymptomatic cases (0.14%). This is similar to studies done by Qiu *et al.*[33] and by Burke in US.[34] Index cases with fever, cough, and breathlessness were having high mean SAR, which is in line with studies done by Liu *et al.*,[20] Luo *et al.*,[35] Lin *et al.*,[36] and Hu *et al.*[11] Cough and running nose had higher chances of shedding droplets in room surroundings, which may influence the spread of COVID infection to their contacts and hence secondary attack rate might be high. Symptoms like fever, breathlessness, and sore throat may reflect the severity of the disease in index cases and this may result in higher SAR due to high viral load. Index

Table 3: Association of Index case factors with their Secondary Attack Rate (*n*=139)					
Factors	Frequency (%)	Mean (SAR)	Standard deviation	*t*	*P*
Outcome					
Death	2 (1.44%)	41.428	2.020		
Discharge	137 (98.56%)	8.375	20.638	-2.257	0.026*
Sex					
Male	103 (74.11%)	0.1942	0.397		
Female	36 (25.89%)	0.2778	0.454	-1.046	0.297
Fever					
Absent	118 (84.9%)	0.1695	0.376		
Present	21 (15.1%)	0.4762	0.511	-3.243	0.001*
Sore throat					
Absent	132 (94.97%)	0.1970	0.399		
Present	7 (5.03%)	0.5714	0.534	-2.377	0.019*
Nausea/Vomiting					
Absent	138 (99.29%)	0.2101	0.408		
Present	1 (0.71%)	1.000		-1.925	0.056
General Weakness					
Absent	136 (97.85%)	0.2132	0.411		
Present	3 (2.15%)	0.333	0.577	-0.497	0.620
Breathlessness					
Absent	130 (93.53%)	0.1923	0.395		
Present	9 (6.47%)	0.5556	0.527	-2.605	0.010*
Headache					
Absent	136 (97.85%)	0.2059	0.405		
Present	3 (2.15%)	0.6667	0.577	-1.931	0.056
Cough					
Absent	119 (85.65%)	0.1765	0.382		
Present	20 (14.38%)	0.450	0.510	-2.809	0.006*
Diarrhea					
Absent	137 (98.57%)	0.2117	0.410		
Present	2 (1.43%)	0.500	0.707	-0.980	0.329
Running nose					
Absent	129 (92.81%)	0.1860	0.390		
Present	10 (7.19%)	0.600	0.516	-3.152	0.002*
Pain					
Absent	133 (95.69%)	0.2030	0.403		
Present	6 (4.31%)	0.50	0.547	-1.736	0.085
Symptom Status					
Absent	106 (76.86%)	0.1415	0.350		
Present	33 (23.14%)	0.4545	0.505	-4.005	0.000*
Hypertension					
Absent	131 (94.25%)	0.2061	0.406		
Present	8 (5.75%)	0.375	0.517	-1.124	0.263
Diabetes mellitus					
Absent	125 (89.93%)	0.192	0.395		
Present	14 (10.07%)	0.428	0.513	-2.057	0.042*
Co-morbidity Status					
Absent	112 (80.58%)	0.2054	0.405		
Present	27 (19.42%)	0.2593	0.446	-0.608	0.545

*Statistically significant (*P*<0.05). SAR - Secondary Attack Rate

Table 4: Correlation of age and duration of hospital stay of index case with their Secondary Attack Rate (*n*=139)		
Factors	Pearson's correlation coefficient "*r*"	*P*
Age	-0.531	0.596
Duration of hospital stay	0.217	0.828

cases who were diabetic had high SAR. SAR of deceased index cases (41.2%) was higher than that of discharged; this might be because of the increase in the severity of the disease. This is similar with other studies done by Shah *et al.*[37] in western India, Luo *et al.*,[35] and Liu *et al.*[20]

It was a community-based study done in the entire Madurai district where we included all type of cases (i.e. both incidence and prevalence cases and cases with all severity) along with their contacts. Hence, common biases in case control study like incidence bias, prevalence bias, and berkesonian bias had been minimized in our study. All the retrospective data collected were about the factors that happened recently within a short time limit, thus reducing the recall bias. Inspite of these strengths, we also had few limitations. Some data were collected retrospectively through phone conversation and so it was difficult to understand some subjective perceptions of our study participants. Only RT-PCR swab positive cases were considered as COVID positive cases and CT positive clinical COVID/suspect cases were not included in our study.

Conclusions

Overcrowding increases the risk of acquisition of COVID infection, hence preventive measures like social distancing must be emphasized in the community as well as in the households. Symptomatic and severe cases spread the infection more than asymptomatics and mild cases, mass screening of the community at the primary level for the symptoms like fever, cough, sore throat, running nose, and breathlessness help in early diagnosis and isolation. Health education of the public must also be carried out to emphasize the role of self isolation if they have any of the above said symptoms, so that disease transmission and the magnitude of the pandemic can be reduced.

Key points

- Risk of acquisition is more among male contacts
- As duration of exposure increases, risk of acquiring infection also increases
- Cases with respiratory symptoms spread the disease more than those without symptoms
- As severity of disease increases, severe covid-19 cases spread the disease more than mild cases.

Conflicts of interest

There are no conflicts of interest.

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