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Household infection: The predominant risk factor for close contacts of patients with COVID-19

Dear editor

The World Health Organization (WHO) declared that the novel coronavirus disease 2019 (COVID-19) became a global epidemic on 11 March, 2020 after transmitting to over 110 countries/regions, including many developing countries with fragile and choked health systems. As of June 24, 2020, approximately 9 million confirmed cases have been reported globally, of which over 0.47 million cases (5.2%) progressed to death [1]. Seriously, surrounding the confirmed cases, countless close contacts may sustain the high infection risk. Thus, the management of this population plays a crucial role in the campaign of COVID-19. (see Table 1)

Tracking close contacts through confirmed cases is commonly used to control the transmission of contagions [2]. The Xinzhou Center for Disease Control and Prevention (CDC) screened close contacts comprehensively in its region, which is one of the thirteen districts of Wuhan, China. The close contacts were defined as those who lived in the same household, shared meals, traveled or had social interactions with a confirmed case two days before the onset of COVID-19 symptoms [2]. The telephone and personal interviews were applied to track the close contacts with the instruction of management scheme issued by the National Health Commission. We analyzed the associations between exposure factors (relation to index case-patient (ICP), contact frequency, places and methods) and the risk of infecting COVID-19 in final included 1587 close contacts who were indexed by 560 confirmed patients from January 14, 2020 to February 14, 2020. During the 14-day quarantine and medical observation, 150 close contacts were confirmed as COVID-19 cases, indicating that one ICP transmitted infection to 0.27 close contacts (150/562) averagely. Similar to Bi's study at Wuhan and Shanghai during the same period, we found that female close contacts with older age and frequent contacts had a higher rate of infection [2].

Among close contacts with different relations to ICP, being family members, colleagues/classmates/travel companions, and doctors-patients accounted for 88.1% (1398), 10.7% (170), and 0.3% (5), respectively. Following this order, the infection rate was 10.2%, 1.8% and 40.0%, respectively. It should be noted that the last exposure time with ICP of the four medical infection cases was between late December 2019 and early January 2020. Inspired by the report issued by National CDC [3], we speculated that the medical personnel infections were confined to the early stage of COVID-19 transmission might due to the inadequate acknowledgment of pathogens, the misclassification of patients with COVID-19 as ordinary fever cases, and the shortage of protective equipment. In addition, the last exposure time for 87% of colleagues/classmates/travel companions occurred before January 24, 2020, just the day before the lockdown on the city. Contrarily, family members with last exposure time after January 23 accounted for 91% of total close contacts. Thus, the types of close contacts may vary on the inherent population influx.

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The population movements during the COVID-19 outbreak in Wuhan were changed significantly due to different factors. Initially, the emerge of COVID-19 was accelerated to a national outbreak by the Spring Festival travel rush with Wuhan as the transportation hub when millions of immigrant workers hurry home and reunite with relatives [4]. After that, the contact pattern of colleagues/classmates/travel companions was completely limited by the implementation of travel bans, the closure of schools and entertainment places, and social distance rules. Besides, it has been well documented that these control measures were effective to reduce the daily contacts of 7~8 folds and mitigate the epidemic transmission [5]. However, the household is the smallest social unit and its members are difficult to be completely isolated. Still, the family members with a travel history of high-risk areas or potential symptoms should be strongly recommended to take active precautions even at home. Furthermore, the relation to ICP determined the contact frequency, contact place and methods to some extent. The overwhelming majority of family members contacted ICP frequently while eating and living at home, and colleagues/classmates/travel companions mainly contacted ICP through working in workplaces and entertaining in recreation places.

Our findings provide information on the association of exposure characteristics with COVID-19 infection in close contacts. The contact pattern may be varied by the population influx, which was affected by the public holidays and series of measures including travel bans, closure of public places, and social distance policies. Moving forward, under the premise that many countries have implemented those lockdown measures to reduce non-household infection significantly, future mitigation policies targeted on COVID-19 should be tailored to reduce household infections.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Declarations

Travel Medicine and Infectious Disease requires that all authors sign a declaration of conflicting interests. If you have nothing to declare in any of these categories then this should be stated.

Table 1

The characteristics of 1587 close contacts stratified by the relation to confirmed cases with COVID-19.

Exposure characteristics, n (%)	Family member (n = 1396)	Colleague/classmate/travel companion (n = 170)	Doctor-patient (n = 5)	Other (n = 16)
Infected cases	143 (10.2)	3 (1.8)	2 (40.0)	2 (12.5)
Male	743 (53.2)	114 (67.1)	3 (60.0)	4 (25.0)
Age, years				
0–18	249 (17.8)	–	–	6 (37.5)
18–60	894 (64)	167 (98.2)	3 (60.0)	8 (50.0)
60~	253 (18.1)	3 (1.8)	2 (40.0)	2 (12.5)
The last exposure time				
2019/12/13–2020/01/06	8 (0.6)	1 (0.6)	4 (80.0)	–
2020/01/07–2020/01/18	15 (1.1)	62 (36.5)	–	5 (31.3)
2020/1/19	6 (0.4)	10 (5.9)	–	–
2020/1/20	27 (1.9)	28 (16.5)	–	–
2020/1/21	15 (1.1)	6 (3.5)	–	–
2020/1/22	54 (3.9)	6 (3.5)	–	1 (6.3)
2020/1/23 ^a	30 (2.1)	11 (6.5)	–	3 (18.8)
2020/1/24	43 (3.1)	23 (13.5)	–	–
2020/1/25	39 (2.8)	–	–	–
2020/1/26	41 (2.9)	1 (0.6)	–	–
2020/1/27	37 (2.7)	–	–	–
2020/01/28–2020/02/02	405 (29.0)	14 (8.2)	–	6 (37.5)
2020/02/03–2020/02/09	635 (45.5)	4 (2.4)	1 (20.0)	–
Contact frequency				
Often	1323 (94.8)	5 (2.9)	2 (40.0)	5 (31.3)
Sometime/seldom	73 (5.2)	165 (97.1)	3 (60.0)	11 (68.8)
Exposure environments^b				
Household	1366 (97.9)	4 (2.4)	3 (60.0)	4 (25)
Workplace	4 (0.3)	159 (93.5)	–	5 (31.3)
Medical center	9 (0.6)	1 (0.6)	3 (60.0)	–
Other	11 (0.8)	9 (5.3)	–	9 (56.3)
Contact methods^b				
Eating together	1270 (91.0)	6 (3.5)	2 (40.0)	6 (37.5)
Living together	616 (44.1)	3 (1.8)	–	5 (31.3)
In the same house	823 (59)	4 (2.4)	–	3 (18.8)
Sleeping together	60 (4.3)	–	–	–
Working or studying together	2 (0.1)	64 (37.6)	–	–
Seeking for medical service	–	–	4 (80.0)	–
Entertaining together	–	91 (53.5)	–	4 (25.0)
Other	14 (1.0)	9 (5.3)	–	6 (37.5)

^a The time of implementing the travel bans by the government.

^b Close contacts have multiple choices in the item of exposure environments and methods.

Declaration of competing interest

There were no competing interests to declare.

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