Contact tracing and risk at different exposure periods

Journal Article, Prospective study

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Cheng H, Jian S, Liu D, et al. Contact Tracing Assessment of COVID-19 Transmission Dynamics in Taiwan and Risk at Different Exposure Periods Before and After Symptom Onset. *JAMA Intern Med.* Published online May 01, 2020. doi:10.1001/jamainternmed.2020.2020 **LINK**

Summary

Purpose: To understand the transmission dynamics of COVID-19 and evaluate the risk of transmission with respect to different durations of exposures with the index case and after how many days of symptom onset of the index case.

Methods:

- Prospective case-ascertained study in Taiwan included 100 laboratory-confirmed cases of COVID-19 from January 15 to March 18 and their contacts.
- Period of investigation: From date at symptom onset (in special cases even 4 days prior to symptom onset) till the date of COVID-19 confirmation or end of the quarantine period.
- Definition of a close contact: A person who did not wear appropriate personal protection equipment (PPE) while having face-to-face contact with a confirmed case for more than 15 minutes during the investigation period.
- Contact: A contact was listed as a household contact if he or she lived in the same household with the index case.
- Non-household family contacts: Family members not living in the same household.
- For health care settings: Medical staff, hospital workers, and other patients in the same setting were included.
- Close contacts were quarantined at home for 14 days after last exposure to index case.
- RT-PCR test was done in the contacts if symptoms appeared except in high risk cases which were anyways tested once they were listed as close contact, regardless of symptoms.
- Paired data of index case and close contacts were extracted from the contact tracing database and outbreak investigation reports.
- Secondary clinical attack rate defined as “ratio of symptomatic confirmed cases among the close contacts”.
- The exposure window period was defined as the period between the first and last day of reported exposure to the index case based on contact investigation.

Results:

- The 100 laboratory confirmed cases included 9 asymptomatic ones.
- From all 100 cases, there were a total of 2761 contacts with 5.5% household contacts, 2.8% non-household family contacts, 25.3% healthcare contacts and rest 66.5% were others (casual contacts).
- 22 secondary cases were detected with infection risk of 0.8% (95% CI 0.5-1.2%), secondary clinical attack rate was 0.7% (95% CI 0.4-1.0%) as 4 subjects were asymptomatic.
- All 22 secondary cases had their first exposure till 5th day of symptom onset in the index case.
- For all 735 cases whose exposure occurred before the onset of symptoms in the index case had a secondary clinical attack rate of 1.0%(95% CI 0.5-2.0%). Even among 299 contacts with exclusive pre-symptomatic exposure, a secondary attack rate of 0.7% (95% CI 0.2-2.4%) was reported.
- Secondary attack rate varied with type of contact, 4.6% (95% CI 2.3%-9.3%) among household contacts, 5.3% (95% CI 2.1%-12.8%) among the non-household family contact with only 0.9% (95% CI 0.4%-1.9%) among healthcare contacts and just 0.1% (95% CI 0%-0.3%) among other relatively casual contacts.
- Attack rates were also higher among those aged 40-59 years, 1.1% (95% CI 0.6%-2.1%) and among those aged 60 years or older, 0.9% (95% CI 0.3%-2.6%)
- Among the 91 close contacts of the 9 asymptomatic cases, no secondary transmission was observed.

Conclusion:

The study revealed a relatively short infectious period of COVID-19 and a higher transmission risk around the time of symptom onset of the index case, followed by a lower transmission risk at the later stage of disease.

Table 1: Secondary clinical attack rate for COVID-19 among the 2761 close contacts by different exposure settings, times, and characteristics [Table 2 in Article: LINK, Licensed as CC-BY, doi:10.1001/jamainternmed.2020.2020]

	No. of secondary cases (asymptomatic case)	No. of contacts	Secondary clinical attack rate, % (95% CI)	Risk ratio (95% CI)
Exposure setting				
Household	10 (3)	151	4.6 (2.3-9.3)	1 [Reference]
Nonhousehold family	5 (1)	76	5.3 (2.1-12.8)	1.14 (0.34-3.76)
Health care	6 (0)	698	0.9 (0.4-1.9)	0.19 (0.06-0.54)
Others[a]	1 (0)	1836	0.1 (0-0.3)	0.01 (0-0.09)
Time from onset to exposure, d[b]				
<0	10 (3)	735	1.0 (0.5-2.0)	1 [Reference]
0-3	9 (1)	867	0.9 (0.5-1.8)	0.97 (0.35-2.66)
4-5	3 (0)	216	1.4 (0.5-4.0)	1.46 (0.38-5.59)
6-7	0	119	0 (0-3.1)	0
8-9	0	449	0 (0-0.9)	0
>9	0	284	0 (0-1.3)	0
Exclusively presymptomatic exposure[c]				
No	20 (4)	2371	0.7 (0.4-1.1)	1 [Reference]
Yes	2 (0)	299	0.7 (0.2-2.4)	0.99 (0.23-4.29)
Age of close contacts, y				
0-19	1 (1)	281	0 (0-1.4)	0
20-39	8 (2)	1161	0.5 (0.2- 1.1)	1 [Reference]
40-59	10 (1)	794	1.1 (0.6-2.1)	2.19 (0.78-6.14)
≥60	3 (0)	331	0.9 (0.3-2.6)	1.75 (0.44-6.97)
Source of index case				
Local	18 (3)	967	1.6 (1.0-2.5)	1 [Reference]
Imported	4 (1)	1794	0.2 (0.1-0.5)	0.11 (0.03-0.37)
Clinical severity of index case				
Asymptomatic	0	91	0 (0-4.1)	0
Mild illness	4 (0)	1097	0.4 (0.1-0.9)	1 [Reference]
Pneumonia				
Mild	5 (2)	761	0.4 (0.1-1.2)	1.08 (0.24-4.82)
Severe	7 (0)	511	1.4 (0.7-2.8)	3.76 (1.10-12.76)
ARDS/sepsis	6 (2)	275	1.5 (0.6-3.7)	3.99 (1.00-15.84)

Abbreviations: ARDS, acute respiratory distress syndrome; COVID-19, coronavirus disease 2019.

[a] Others include friends, airline crew members and passengers, and other casual contacts.

[b] Defined as the elapsed time between the date at symptom onset of the index case and the first date at exposure. For example, people from the group "<0 days" had their first contact with the index case before the case had any symptoms.

[c] All the reported exposures occurred during the presymptomatic period of the index case.

Appraisal

- The study reiterates the fact that the maximum infectivity window for COVID-19 is 4 days before onset of symptoms to 5 days after that.
- Close contacts were tested only when symptomatic or had high risk. This would have underestimated the secondary attack rate. Ideally all contacts should have undergone RT-PCR tests.
- The current study reports nil asymptomatic transmission. However, there have been case reports on asymptomatic transmission. According to WHO there is inconclusive evidence whether such transmission occurs.
- Limited data on pre-symptomatic transmission as data was collected mostly after symptoms started to appear in the index cases.

Implications of the study:

The study has major implications for judicious resource use as epidemic nears the peak and health system capacity is stretched. While in Wuhan, every patient with mild illness was isolated in the hospital or other isolation facilities for a prolonged period, this is not feasible everywhere. Hence, countries are isolating such patients at home. This increases the risk of household contacts considerably – a choice between devil and deep sea! This has to be complemented with isolation of the subject within a room in the house and other protective measures. It is also clear that contact tracing could focus on the contacts near or even before symptom onset of the index cases when the number of index cases or contacts is too large for all contacts to be traced, given the available resources.

Appraisers

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