



Serial Interval Distribution of COVID-19 among Iranian Reported Confirmed Cases

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Abstract

Background: Serial interval refers to the average time between of the onset of the symptoms of two successive cases. Serial interval distribution can be used for the calculation of the basic reproduction number (R0), transmission rate, and study of an epidemic trend. This study aims to investigate the mean, standard deviation, and distribution of serial interval among the confirmed cases of COVID-19 using a Gamma distribution.

Methods: To determine the serial interval, 60 confirmed infected cases of COVID-19 (based on PCR test results) in February 20th-May 20th, 2020 were selected as the cases. For these cases, 37 transmissions occurred. The data of the dates of the occurrence of primary and secondary symptoms were collected by referring to the COVID-19 surveillance system and interviewing the patients

Results: The findings showed that the median and mean of the serial interval were 3.0 and 4.5±3.5 days. The findings showed that the median of the serial interval was 3.0 days (with the inter-quartile range of 2.0-6.0). The mean serial interval was 4.5±3.5 days (95% confidence interval: 3.1-5.5).

Conclusions: Our report showed a shorter period for a serial interval less than the previous reported interval in China. It seems that regarding the shorter serial interval reported in this study, the basic reproduction numbers reported by the first papers published in Iran have been overestimated regarding the serial interval of 7.5 days.

Keywords: COVID-19, Serial interval, Gamma distribution.

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Introduction

Serial interval refers to the average time between the symptom onset of two successive cases (infecter and infectee).¹ Distribution and Serial interval of disease are among the important factors involved in the calculation of the basic reproduction number (R0), transmission rate, and study of an epidemic trend. At the beginning of the COVID-19 epidemic in Iran, the relevant estimation was done based on the average Serial interval reported in Wuhan, China (7.5 days with the standard deviation of 3.4).^{2,3} The subsequent studies suggested that the average serial interval of COVID-19 is shorter than the already reported rate.⁴ This study aimed to investigate the mean, standard deviation, and distribution of serial interval among the confirmed cases of COVID-19 using a Gamma distribution.

Materials and Methods

To determine the serial interval, 60 confirmed infected patients (based on PCR test results) who had been infected by COVID-19 in February 20th-May 20th, 2020 in Shahroud county were selected as the cases. The studied cases had been infected by COVID-19 as a result of home contact or contact with their friends and relatives. The cases without any certain record of contact and reporting an indefinite time of the occurrence of symptoms were excluded from the study, and finally, 32 cases with approved contact networks were studied as the samples. Some of the primary cases were reported by more than one patient. Finally, the data of 37 transmissions were studied in this research. The data of the dates of the occurrence of primary and secondary symptoms were collected by referring to the COVID-19 surveillance system and interviewing the patients. All the patients participated in the study with informed consent. The study was approved by the ethics committee of Shahroud university of medical sciences. (IR.SHMU.REC.1398.160).

Results

The main characteristics of studied patients were summarized in table 1. The majority of them were males. Dry cough and anorexia were the main signs and symptoms of patients. The findings showed that the median of the serial interval was 3.0 days (with the inter-quartile range of 2.0-6.0). The mean serial interval was 4.5±3.5 days (Figure 1) (95% confidence interval: 3.1-5.5).

Discussion

In a study conducted in Qom, the mean±SD of the serial interval was reported as 4.5±3.3; this finding is consistent with the results of our study.⁵ In Wuhan and Hubei, the serial interval was reported as 7.5±3.4 days at the beginning of the epidemic.^{2,6} Niewshara et.al estimated the serial interval by using the information of Japanese travelers with a record of traveling to China. They reported the mean serial interval as 4.7±2.9 days.⁷ In the cases of calculating the serial interval based on the home contacts, the result is a shorter interval (4) so, it can affect the findings of the present study.

In the case of the occurrence of symptoms in secondary cases earlier than the index case, the serial interval can be obtained as a negative value.⁴ However, this condition was not observed in the present study. This condition that is difficult to

observe leads to a shorter serial interval; in such cases, the normal distribution is used instead of Gamma distribution (or Weibull distribution).⁴

One of the limitations in this calculation is remembering the time of the occurrence of symptoms; so that, people will probably attribute their infection to their recent contacts rather than the previous contacts. It will lead to getting a shorter or longer serial interval. The other limitation of this method is that there are a limited number of confirmed cases with a fully clear contact network. Despite the mentioned limitations, the obtained serial interval is consistent with the reports of other COVID-19 studies. It seems that regarding the shorter serial interval reported in this study, the basic reproduction numbers reported by the first papers published in Iran have been overestimated regarding the serial interval of 7.5 days.

Table1. Demographic and clinical characteristics

Characteristic	N(%) / mean(SD)
Age mean(SD)	43.46(19.08)
Sex	
- Male(%)	12(32.4)
- Female(%)	25(67.6)
Symptoms and signs at on admission	
- Fever(%)	12(32.4)
- Dry cough(%)	19(51.4)
- Fatigue(%)	13(35.1)
- Dyspnea(%)	9(24.3)
- Diarrhea(%)	4(10.8)
- Sore throat(%)	8(21.6)
- Chest pain(%)	1(2.7)
- Muscle pain(%)	16(43.2)
- Chills(%)	8(21.6)
- Nausea(%)	6(16.2)
- Vomiting(%)	5(13.5)
- Headache(%)	12(32.4)
- Anorexia(%)	15(40.5)
- Decreased sense of smell(%)	2(5.4)
- Decreased sense of taste(%)	1(2.7)
Comorbidities	
- Diabetes(%)	7(18.9)
- CHD(%)	4(10.8)
- Asthma(%)	1(2.7)
- Lupus(%)	1(2.7)
- Pregnancy(%)	1(2.7)
History of travel	4(10.8)
Source of infection	
- Shared room	11(29.7)
- Use of common devices	9(24.3)
- A patient medical care	15(40.5)
- Close contact (Hold hands, hug, kiss)	11(29.7)
Admission type	
- Outpatient	29(75.6)
- inpatient	9(24.3)

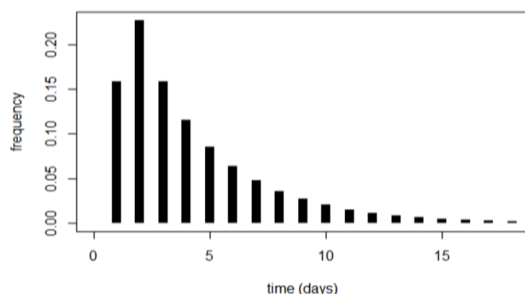


Figure1. Gama destitution of COVID-19 serial interval, Shahroud, Iran

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Conflict of Interest

The authors declare that they have no conflict of interest.

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