Preplanned Studies

Characteristics and Containment of 74 Imported COVID-19 Outbreaks: Experiences, Lessons, and Implications — China, 2020–2021

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Summary

What is already known about this topic?

After the initial coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China, the outbreaks during the dynamic-zero policy period in the mainland of China have not been systematically documented.

What is added by this report?

We summarized the characteristics of 74 imported COVID-19 outbreaks between March 19, 2020 and December 31, 2021. All outbreaks of early severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) variants were successfully contained with the aid of nucleic acid testing, modern communication technologies, and non-pharmacological interventions.

What are the implications for public health practice?

These findings provide us with confidence for the containment of future emerging infectious diseases alike at early stages to prevent pandemics or to win time to gain experience, develop vaccines and drugs, vaccinate people, and wait for the possible lessening of the virus' pathogenicity.

After the successful containment of the initial coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China adopted a dynamic-zero policy in March 2020 aimed at eradicating all imported outbreaks. In this report, we provided a comprehensive documentation and analyses of all the imported outbreaks before 2022. Data on daily COVID-19 infections were retrieved from the website of the National Health Commission of China. Results of epidemiological investigations of the outbreaks were retrieved from 1,504 publications by local governments or mainstream social media. Seventy-four outbreaks were identified consisting of 10,082 symptomatic cases and all were successfully contained. Characteristics of the outbreaks were summarized including source of the first case(s), time, place, scale, and duration. These data were then analyzed to identify potential problems and plan for future emerging infectious diseases alike. China's experience in successfully containing 74 consecutive outbreaks provides important evidence that COVID-19 or newly emerging infectious diseases alike can be contained at their early stage to prevent the occurrence of pandemics, or at least gain experiences and win time for the development of vaccines and drugs.

Data on daily number of imported cases, domestic cases, symptomatic domestic cases, and close contacts from March 19, 2020 to December 31, 2021 were retrieved from the official reports of Daily Briefing on Novel Coronavirus Cases. Our analyses of outbreaks only included symptomatic domestic cases from all the outbreaks; cases found in quarantined inbound cross-border travelers were excluded. For each symptomatic case, epidemiological investigations were traced via official reports from local governments. A total of 1,504 reports were retrieved and scrutinized. The definitions for outbreaks are presented in Supplementary Figure S1, available in https://weekly.chinacdc.cn/.

The national daily numbers of cases, which included data on location and magnitude of these outbreaks, were described chronologically and geographically. Characteristics of the outbreaks were compared among 3 study periods divided according to the announcement dates of the 7th and 8th editions of the Protocol on Prevention and Control of COVID-19 and the source of the first case (*1*–*2*). All statistical analyses were performed by using R software version 3.6.2. A full description of methods is in Supplementary Materials, available in https://weekly.chinacdc.cn/.

Overall, the study identified 74 outbreaks with a total of 10,082 symptomatic cases between March 19, 2020 and December 31, 2021 (Figure 1). The median

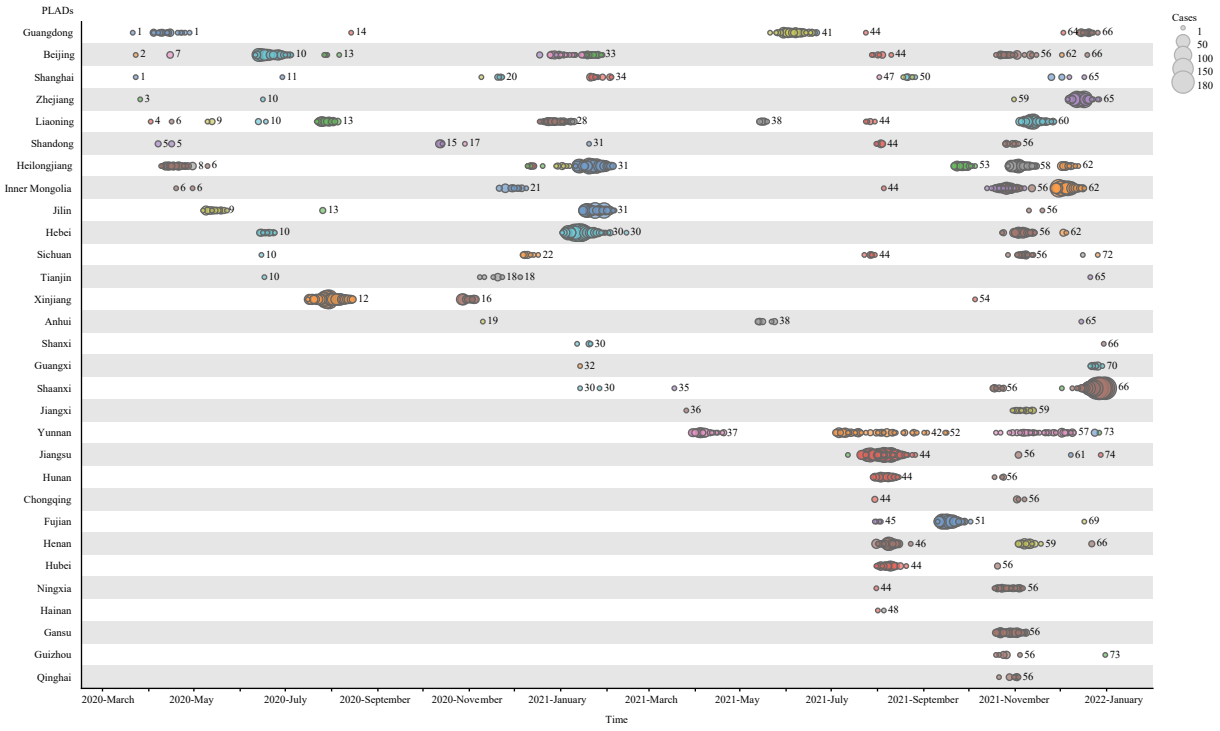

FIGURE 1. Occurrence and size of outbreaks by region and time in the mainland of China between March 19, 2020 and December 31, 2021.
Note: The number next to each outbreak refers to the unique ID number assigned for each outbreak in Supplementary Table S1 (available in http://weekly.chinacdc.cn). Cases with the same numbers belong to the same outbreak.
Abbreviation: PLADs=provincial-level administrative divisions.

number of cases in an outbreak was 10, ranging from 1 to 1,506. Out of the 74 outbreaks, 43 (58.1%) were detected via proactive surveillance, and 57 (77.0%) were contained at their origin within the provincial-level administrative divisions (PLADs) (Table 1). The outbreaks on average lasted for 10 days, ranging from 1 to 62 days. The ratio of daily number of close contacts over daily number of cases, an approximate indicator of people quarantined per case, was 60, ranging from 4 to 2,830. Detailed characteristics for each outbreak were presented in Supplementary Table S1 available in https://weekly.chinacdc.cn/.

Due to heavy international air traffic, it was anticipated that the earliest imported outbreaks occurred in Guangdong, Beijing, Shanghai, and PLADs near them. These outbreaks were generally small and quickly contained. However, as outbreaks continued to spread, an increasing trend emerged including a higher frequency of outbreaks and higher number of PLADs involved (Figure 1). By December 31, 2021, all PLADs in the mainland of China had been involved in at least one outbreak except Xizang (Tibet). No seasonal trends were observed.

Geographically, PLADs including Beijing, Shanghai, Guangdong, and their neighboring regions had the highest frequency of outbreak attacks (Supplementary Table S2, available in https://weekly.chinacdc.cn/). Five PLADs with the highest number of outbreaks included Beijing (11), Shanghai (10), Liaoning (10), Guangdong (9), and Heilongjiang (9). The 5 regions with the largest number of cases accumulated were Shaanxi (1,494 cases), Heilongjiang (1,145 cases), Hebei (1,103 cases), Xinjiang (906 cases) and Jiangsu (826 cases), totally accounting for 54.3% (5,474/10,082) of all cases.

Chronologically, the daily number of imported cases that were diagnosed during quarantine and did not cause community outbreaks considerably fluctuated during the study period. Although there was no clear increasing trend with time, there was a slight elevation after June 2021 (Supplementary Figure S2, available in https://weekly.chinacdc.cn/). The daily number of symptomatic domestic cases and close contacts showed a similar pattern.

In addition, the average size and duration of outbreaks and the average number of PLADs involved in each outbreak are shown in Table 1. Although the number of outbreaks and that of cases accumulated

TABLE 1. Characteristics of the 74 outbreaks according to the three periods of study.

Study period	Length of period (days)	Number of outbreaks (*n*, %)	Number of outbreaks involving ≥2 PLADs (*n*, %)	Number of outbreaks detected via proactive surveillance (*n*, %)	Average number of cases per outbreak (median, range)	Total number of cases (*n*, %)	Duration of outbreaks (days) (median, range)	Ratio of daily number of close contacts over that of cases (median, range)
Period 1: 2020/3/19–2020/9/30	196	14 (18.9)	5 (35.7)	2 (14.3)	7 (1, 827)	1,457 (14.5)	11.5 (1, 39)	29 (4, 2,807)
Period 2: 2020/10/1–2021/5/31	242	25 (33.8)	4 (16.0)	14 (56.0)	13 (1, 1,055)	2,632 (26.1)	12.0 (1, 44)	116 (8, 2,830)
Period 3: 2021/6/1–2021/12/31	213	35 (47.3)	8 (22.9)	27 (77.1)	6 (1, 1,506)	5,993 (59.4)	7.0 (1, 62)	68 (8, 1,737)
*P**	–	–	0.386	*P*<0.001	0.805	–	0.668	*P*<0.001
P for trend	–	–	0.610	0.030	0.392	–	0.717	0.300
Entire period	650	74 (100.0)	17 (23.0)	43 (58.1)	10 (1, 1,506)	10,082 (100.0)	10.0 (1, 62)	60 (4, 2,830)

Abbreviation: PLADs=provincial-level administrative divisions.
* *P* value for comparisons among the three study periods. Kruskal-Wallis test was used for comparisons in skewed continuous variables, Fisher's exact Chi-square test for categorical variables, and linear regression and Cochran-Armitage trend test for assessing trend for the two types of variables, respectively.

TABLE 2. Characteristics of the 74 outbreaks according to the source of the first case(s).

Source of the first case (s)	Number of outbreaks (*n*, %)	Number of outbreaks involving ≥2 PLADs (*n*, %)	Number of outbreaks detected via proactive surveillance (*n*, %)	Average number of cases per outbreak (median, range)	Total number of cases (*n*, %)	Duration of outbreaks (days) (median, range)
First frontier: cross border entrances	35 (47.3)	9 (25.7)	23 (65.7)	8 (1, 1,056)	5,654 (56.1)	8 (1, 62)
Land borders	15 (20.3)	3 (20.0)	11 (73.3)	20 (1, 636)	1,702 (16.9)	11 (1, 62)
Airports	14 (18.9)	5 (35.7)	8 (57.1)	5 (1, 1,506)	3,551 (35.2)	5 (1, 44)
Ports	6 (8.1)	1 (16.7)	4 (66.7)	19 (1, 308)	401 (4.0)	8 (1, 24)
Second frontier: Quarantine related	23 (31.1)	1 (4.3)	15 (65.2)	2 (1, 468)	805 (8.0)	1 (1, 32)
Possibly via quarantined inbound visitors	13 (17.6)	1 (7.7)	7 (53.8)	3 (1, 468)	595 (5.9)	1 (1, 32)
Designated care hospitals	5 (6.8)	0 (0.0)	4 (80.0)	2 (1, 167)	193 (1.9)	7 (1, 24)
Quarantine places	5 (6.8)	0 (0.0)	4 (80.0)	1 (1, 13)	17 (0.2)	1 (1, 11)
Local community (eg, markets & malls)	16 (21.6)	7 (43.8)	5 (31.3)	92 (1, 1,055)	3,623 (35.9)	21 (1, 39)
Possibly via cold chain	5 (6.8)	2 (40.0)	2 (40.0)	99 (10, 826)	1,333 (13.2)	25 (16, 31)
Uncertain	11 (14.9)	5 (45.5)	3 (27.3)	89 (1, 1,055)	2,290 (22.7)	20 (1, 39)
*P**	–	0.008	0.055	<0.001	–	*P*<0.001
All	74 (100.0)	17 (23.0)	43 (58.1)	10 (1, 1,056)	10,082 (100.0)	10 (1,62)

Abbreviations: PLADs=provincial-level administrative divisions.
* *P* value for comparisons among the three categories of sources of first cases. Kruskal-Wallis test was used for comparisons in skewed continuous variables, Fisher's exact Chi-square test for categorical variables.

were chronologically increasing during the 3 periods of study, the last period had the highest proportion of outbreaks detected via active surveillance (77.1%), the smallest number of patients per outbreak (6 cases), shortest duration of outbreaks (7 days), the largest proportion of outbreaks involving only one PLAD (77.1%), and an average number of 68 close contacts quarantined per patient. These findings showed that the number of outbreaks and thus prevention and control intensity increased over time, but the effect and efficiency of response actions also increased. As a result, the situation remained largely controllable.

Regarding the source of the first case(s) or the origin of an outbreak, 35 (47.3%) of the 74 outbreaks occurred at areas labeled as the first frontier, i.e., land borders, airports, and ports (Table 2). These outbreaks contributed 5,654 (56.1%) cases to the total number of cases from the 74 outbreaks (Supplementary Figure S3 available in https://weekly.chinacdc.cn/).

Surprisingly, 23 (31.1%) outbreaks occurred at the second frontier, including those at designated care hospitals, quarantine places, and among inbound travelers whose incubation time might be longer than the quarantine time or who got infected during quarantine (Table 2). However, these outbreaks were relatively small in size, quickly contained, and accounted for only 8.0% of the total number of symptomatic cases from the 74 outbreaks.

Lastly, 16 (21.6%) outbreaks were identified in communities such as shopping malls and food markets. Some were possibly caused via cold-chain logistics, while the rest had no clearly identifiable source of infection (Table 2). These outbreaks were most difficult to control when detected as well as difficult to detect once occurred, as only 31.3% (5 out of 16) were detected by proactive surveillance. As a result, they were most likely (43.8%) to involve 2 or more PLADs, resulting in more cases and longer durations per outbreak.

DISCUSSION

Under the dynamic-zero policy after the Wuhan outbreak, a total of 74 imported outbreaks were observed and successfully contained in the mainland of China before 2022. The success made in China, which was also demonstrated in economically less developed PLADs, proved that outbreaks of such highly infectious diseases could be rapidly contained by non-pharmacological interventions with the aid of nucleic acid testing and modern communication technologies.

The first and most important lesson is to put prevention first. Second, effective surveillance and early detection of domestic cases are keys to controlling outbreaks. On the technical front, prevention and control tactics are nothing more than the three conventional methods in the control of infectious diseases, namely controlling infection sources, blocking transmission routes, and protecting susceptible populations (*3*–*4*).

For controlling infection sources, quarantining inbound cross-border travelers is the first step (*5*). Due to limited quarantine facilities, international traveling also needs to be reduced. Routine nucleic acid testing in high-risk groups and general populations when deemed necessary is crucial for identifying new domestic cases. For blocking transmission routes, fast epidemiological investigations are possible with the aid of modern technologies and are important for the quick isolation of close contacts (*4*). For protecting susceptible populations, vaccination plays an important role but is far from enough due to fast waning of the protective effect of vaccines (*6*). When a community outbreak occurred, some restrictions on people's movability could be implemented on top of all the above measures. In addition, social distancing and mask-wearing are always part of the policy (*4*).

Another important lesson is to keep finding and closing the loopholes in current measures, which have been embodied in the 7th and 8th revisions of Chinese national guides for the prevention and control of COVID-19 (*1*–*2*). For instance, imported frozen goods from key areas were put under surveillance after outbreaks potentially related to cold chain logistics occurred in June 2020 (*7*). Another example is the complete separation of international and domestic passengers within the airport after a large outbreak that started in Nanjing Airport in July 2021 (*8*). The increasing number of proactively detected outbreaks over time reflected improvements in surveillance. The effects of these experiences were further confirmed in the recent large Omicron outbreak in Shanghai which caused over 626,000 cases but was eventually contained (*9*).

The limitations of this study were discussed in Supplementary Materials.

Although the strategy was overall effective, outbreaks and PLADs involved both increased over time. This may be partly because of 1) the increasing transmissibility of the new variants; 2) the efforts to

resume work and life orders, which inevitably increased people's movability, cross-border traveling, and imported goods, and caused shortening of quarantine time; and 3) the "pandemic fatigue" since people are becoming tired of the sustained pressure of the pandemic. After all, the strategy has successfully won time for China to gain experiences, develop vaccines and drugs, vaccinate people, and wait for the possible lessening of pathogenicity of the virus so that a massive number of hospitalizations and deaths from COVID-19 can be avoided, even if large outbreaks inevitably occur in the future.

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SUPPLEMENTARY MATERIAL

Full Description of Methods and Definitions

Data collection and statistical analysis: Daily reports on coronavirus disease 2019 (COVID-19) infections from March 19, 2020 to December 31, 2021 were retrieved from the official website of Daily Briefing on Novel Coronavirus Cases of the National Health Commission of China, the most authoritative source of COVID-19 data in the country. Data reported on this website were collected through the Direct Reporting System for Infectious Diseases that covers the entire country (*1*). We extracted data on the daily number of imported cases, symptomatic domestic cases, all domestic cases either symptomatic or asymptomatic, and close contacts of both imported and domestic cases. Imported cases were the inbound travelers whose nucleic acid testing was positive at entrance or during quarantine, being either symptomatic or asymptomatic. Thirty cases related to the initial Wuhan outbreak at the beginning of our study period were excluded.

Our detailed analyses of outbreaks included all the 10,082 symptomatic domestic cases from all the outbreaks; cases found in quarantined inbound cross-border travelers were excluded. Those who stayed asymptomatic throughout the entire course of disease were not included in the detailed analyses because the numbers of such cases were often inconsistent between reports from the National Health Commission and local governments. Furthermore, the reporting of epidemiological investigations on asymptomatic cases at local levels was often incomprehensive. For each of the domestic symptomatic cases, details of epidemiological investigations were traced and retrieved mostly from official reports and publications by local governments and, for a small fraction (896/10,082) supplemented by reports from other mainstream media. In total, 1,504 reports were retrieved and scanned to obtain relevant data.

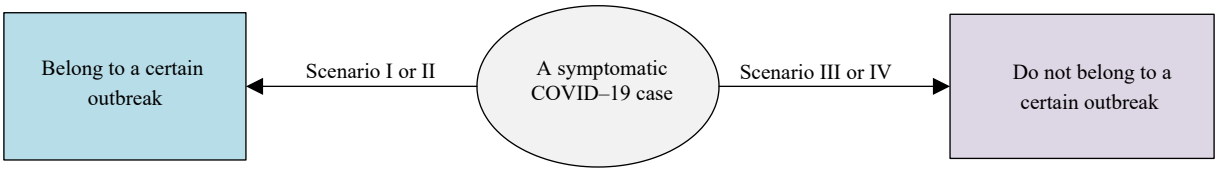
The national daily numbers of inbound cases, symptomatic domestic cases, all domestic cases, and close contacts were described chronologically in a line chart. The place and size of outbreaks were described chronologically in a bubble plot. The place and size of outbreaks were also demonstrated geographically on the map of the mainland of China. The characteristics of the outbreaks were summarized in tables according to the source of outbreak and the three periods of study which were defined based on the announcement dates of the 7th and 8th editions of Protocol on Prevention and Control of COVID-19 (*2*–*3*). All statistical analyses were performed using R software version 3.6.2. Kruskal-Wallis test was used for comparisons in skewed continuous variables, Fisher's exact Chi-square test for categorical variables, linear regression, and Cochran-Armitage trend test for assessing trend for the two types of variables, respectively. Two-tailed testing was used and P value ≤ 0.05 was considered statistically significant for all tests.

Definitions: An outbreak is defined as a cluster of domestic symptomatic COVID-19 cases that occurred within a period of time and could be linked to the same first case regardless of where they occurred in the country, although the majority of cases of an outbreak often occurred in the same city or nearby. Those who stayed asymptomatic throughout the entire course of disease were not included in the detailed analyses because the numbers of such cases were often inconsistent between reports of the National Health Commission and local governments. Furthermore, the reporting of epidemiological investigations on asymptomatic cases at local levels was often incomprehensive.

The first case of an outbreak was the one that occurred earliest in the outbreak, which was epidemiologically traced via the index case. The index case was the one that was first discovered in an outbreak and judged according to official epidemiological investigations unlinked to any other outbreaks.

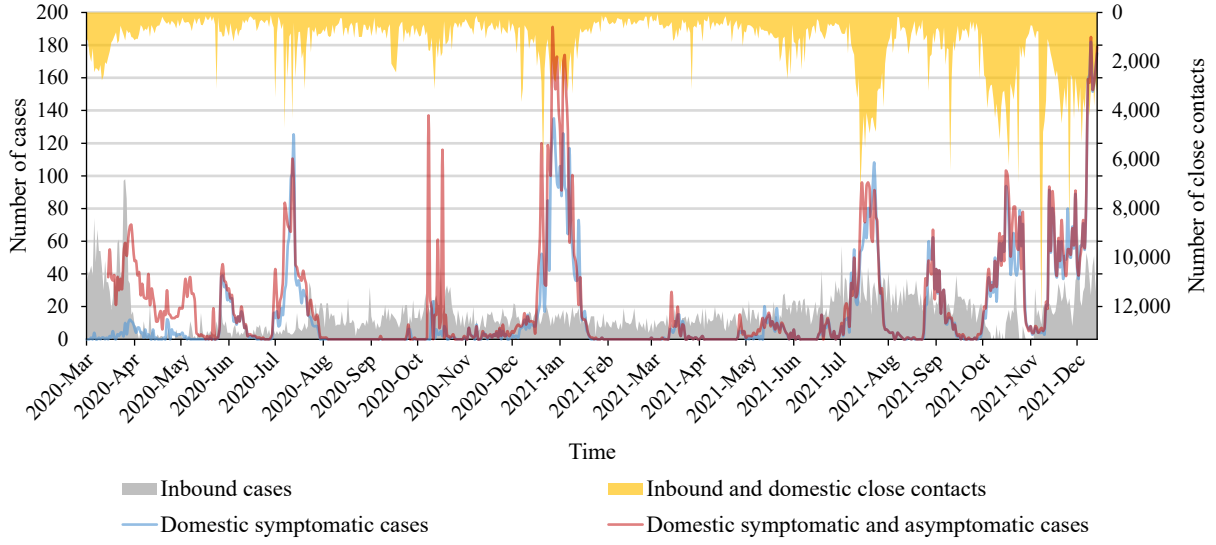
The rules for judging whether a case belonged to a certain outbreak are presented in a flowchart in the supplementary materials (Supplementary Figure S1). The conclusion was made based on the 1,504 reports first by two researchers (CW& BLL) and then double-checked by a third one (FXL). Disagreement was in less than 1% of the cases. Despite excellent epidemiological investigations, 8.96% (896/10,082) of cases from the outbreaks were still uncertain in their links and were then included in major outbreaks nearest in place and time. In addition, two or more independent outbreaks could partly overlap in time and place. Although uncommon, cases of unidentified links in such overlapping outbreaks have not been found.

For each outbreak, the following information was recorded or estimated: 1) the place where it started; 2) the date when it was discovered; 3) the number of cases involved; 4) the number of PLADs involved; 5) duration or how long it lasted; 6) detection mode of the index case or how an outbreak was initially discovered; 7) the source of the outbreak or where or how the first case was infected.

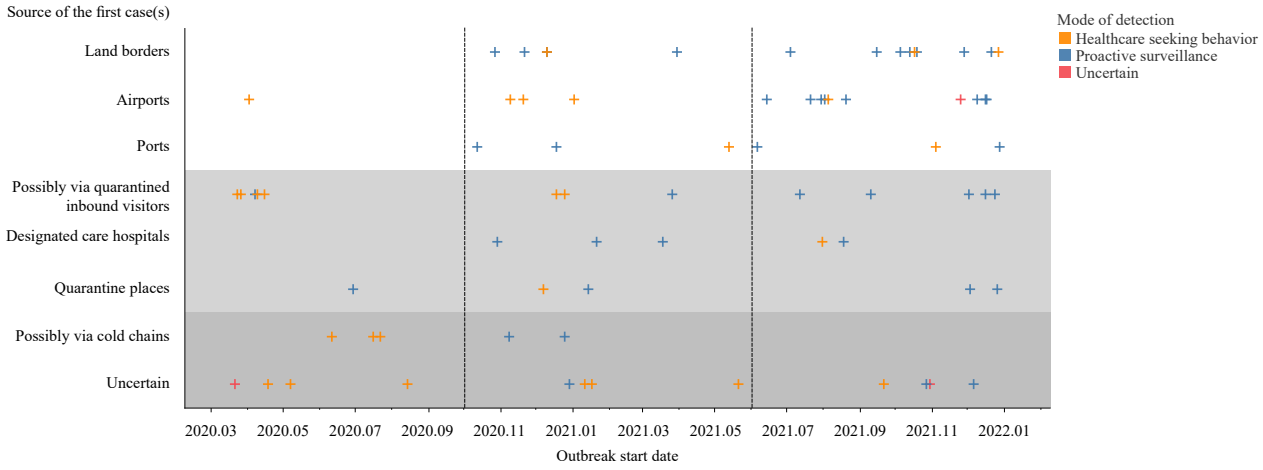


Scenario I: there is explicit evidence indicating links between the case and a certain existing outbreak.
Scenario II: there is time-space coexistence (within 14 days and in the same city/districts of a starting province/city) between the case and a certain existing outbreak in the absence of explicit evidence.
Scenario III: there is explicit evidence rejecting links between the case and a certain existing outbreak.
Scenario IV: there is no evidence showing any possible links at all.

SUPPLEMENTARY FIGURE S1. The rules for judging whether a symptomatic case belonged to a certain outbreak.



SUPPLEMENTARY FIGURE S2. Daily number of inbound cases, domestic symptomatic cases, domestic symptomatic and asymptomatic cases, and both inbound and domestic close contacts over time in the mainland of China between March 19, 2020 and December 31, 2021.



SUPPLEMENTARY FIGURE S3. The detection mode in each outbreak stratified by the source of the first case.

The duration of an outbreak was approximated by the time period from the date the index case was detected to the detection date of the last case, after which no more cases could be identified linked to the outbreak. In theory,

the first case should be used but its detection date was normally unavailable. The mode of detection was classified into three categories: 1) patients' healthcare seeking behavior (as people were required to undergo nucleic acid testing for SARS-COV-2 before visiting healthcare facilities regardless of whether or not they had COVID-19 related symptoms); 2) proactive surveillance, mostly through mandated nucleic acid testing among high-risk populations such as those working at quarantine places, designated treatment hospitals, airports and customs; and 3) uncertain. The source of outbreak was the place or route most likely via which the first case of an outbreak got infected, including the entire environments of these places and people working there. The source of outbreak was classified into 3 categories and 8 sub-categories according to the results of official epidemiological investigations: border entrances (land borders, airports and ports); quarantine and care places (possibly via quarantined inbound travelers who might have had an incubation time longer than the quarantine time or caught infection during quarantine, designated care hospitals and quarantine facilities); and uncertain (possibly via cold chain and truly uncertain).

Limitations

The study has some limitations. First, a small fraction (about 8.9%) of data for epidemiological investigations was based on non-government-official sources. But we considered information from these sources reliable because the Chinese government has been cracking down on rumors or fake data regarding the COVID-19 epidemic with legal actions. Second, those who were asymptomatic throughout the entire study period were not included as their detailed individual data were generally not publicly reported. However, exclusion of these cases would affect or underrate only the estimates of the size and duration of outbreaks. Given that the proportion of asymptomatic infections is generally low in Asian regions (6.91%) before the Omicron variant period, we think the bias is unlikely to be large if any (*4*). Third, there may be difficulties in generalizing China's experiences to populations of different cultures and social systems.

SUPPLEMENTARY TABLE S1. Characteristics for all the imported COVID-19 outbreaks in China from March 19, 2020 to December 31, 2021.

ID	Starting place	Number of PLADs involved	Starting date	Duration (days)	Number of cases	Source of the first cases	Detection mode
1	Guangdong	2	2020/3/21	39	32	Uncertain	Uncertain
2	Beijing	1	2020/3/23	1	1	Possibly via quarantined inbound visitors	Passive self-monitoring
3	Zhejiang	1	2020/3/26	1	1	Possibly via quarantined inbound visitors	Passive self-monitoring
4	Liaoning	1	2020/4/2	1	1	Airports	Passive self-monitoring
5	Shandong	1	2020/4/7	10	4	Possibly via quarantined inbound visitors	Active organized surveillance
6	Heilongjiang	3	2020/4/9	32	70	Possibly via quarantined inbound visitors	Passive self-monitoring
7	Beijing	1	2020/4/15	1	3	Possibly via quarantined inbound visitors	Passive self-monitoring
8	Heilongjiang	1	2020/4/18	13	10	Land borders	Passive self-monitoring
9	Jilin	2	2020/5/7	17	45	Uncertain	Passive self-monitoring
10	Beijing	6	2020/6/11	25	362	Possibly via cold chain	Passive self-monitoring
11	Shanghai	1	2020/6/29	1	1	Quarantine places	Active organized surveillance
12	Xinjiang	1	2020/7/16	31	827	Possibly via cold chain	Passive self-monitoring
13	Liaoning	3	2020/7/22	16	99	Possibly via cold chain	Passive self-monitoring
14	Guangdong	1	2020/8/14	1	1	Uncertain	Passive self-monitoring
15	Shandong	1	2020/10/12	3	13	Ports	Active organized surveillance
16	Xinjiang	1	2020/10/27	10	78	Land borders	Active organized surveillance
17	Shandong	1	2020/10/29	1	1	Designated care hospitals	Active organized surveillance
18	Tianjin	1	2020/11/8	28	10	Possibly via cold chain	Active organized surveillance

TABLE S1. (Continued)

ID	Starting place	Number of PLADs involved	Starting date	Duration (days)	Number of cases	Source of the first cases	Detection mode
19	Shanghai	2	2020/11/9	2	2	Airports	Passive self-monitoring
20	Shanghai	1	2020/11/20	4	6	Airports	Passive self-monitoring
21	Inner Mongolia	1	2020/11/21	19	28	Land borders	Active organized surveillance
22	Sichuan	1	2020/12/7	11	13	Quarantine places	Passive self-monitoring
23	Heilongjiang	1	2020/12/10	11	3	Land borders	Active organized surveillance
24	Heilongjiang	1	2020/12/10	5	8	Land borders	Passive self-monitoring
25	Beijing	1	2020/12/18	12	3	Possibly via quarantined inbound visitors	Passive self-monitoring
26	Liaoning	1	2020/12/18	19	51	Ports	Active organized surveillance
27	Beijing	1	2020/12/25	23	35	Possibly via cold chain	Active organized surveillance
28	Liaoning	1	2020/12/25	17	36	Possibly via quarantined inbound visitors	Passive self-monitoring
29	Heilongjiang	1	2020/12/29	10	10	Uncertain	Active organized surveillance
30	Hebei	3	2021/1/2	44	948	Airports	Passive self-monitoring
31	Heilongjiang	3	2021/1/11	27	1,055	Uncertain	Passive self-monitoring
32	Guangxi	1	2021/1/14	1	1	Quarantine places	Active organized surveillance
33	Beijing	1	2021/1/17	13	31	Uncertain	Passive self-monitoring
34	Shanghai	1	2021/1/21	15	22	Designated care hospitals	Active organized surveillance
35	Shaanxi	1	2021/3/18	1	1	Designated care hospitals	Active organized surveillance
36	Jiangxi	1	2021/3/26	1	1	Possibly via quarantined inbound visitors	Active organized surveillance
37	Yunnan	1	2021/3/30	22	93	Land borders	Active organized surveillance
38	Anhui	2	2021/5/13	12	24	Ports	Passive self-monitoring
39	Guangdong	1	2021/5/21	29	159	Uncertain	Passive self-monitoring
40	Guangdong	1	2021/6/6	2	4	Ports	Active organized surveillance
41	Guangdong	1	2021/6/14	8	7	Airports	Active organized surveillance
42	Yunnan	1	2021/7/4	62	125	Land borders	Active organized surveillance
43	Jiangsu	1	2021/7/12	1	1	Possibly via quarantined inbound visitors	Active organized surveillance
44	Jiangsu	12	2021/7/21	37	1,060	Airports	Active organized surveillance
45	Fujian	1	2021/7/30	5	4	Airports	Active organized surveillance
46	Henan	1	2021/7/31	24	167	Designated care hospitals	Passive self-monitoring
47	Shanghai	1	2021/8/2	1	1	Airports	Active organized surveillance
48	Hainan	1	2021/8/5	1	1	Airports	Passive self-monitoring
49	Shanghai	1	2021/8/18	7	2	Designated care hospitals	Active organized surveillance
50	Shanghai	1	2021/8/20	7	7	Airports	Active organized surveillance
51	Fujian	1	2021/9/10	23	468	Possibly via quarantined inbound visitors	Active organized surveillance
52	Yunnan	1	2021/9/15	2	2	Land borders	Active organized surveillance
53	Heilongjiang	1	2021/9/21	15	89	Uncertain	Passive self-monitoring
54	Xinjiang	1	2021/10/5	1	1	Land borders	Active organized surveillance

TABLE S1. (Continued)

ID	Starting place	Number of PLADs involved	Starting date	Duration (days)	Number of cases	Source of the first cases	Detection mode
55	Inner Mongolia	1	2021/10/13	26	20	Land borders	Active organized surveillance
56	Shaanxi	15	2021/10/17	34	636	Land borders	Passive self-monitoring
57	Yunnan	1	2021/10/19	8	67	Land borders	Active organized surveillance
58	Heilongjiang	1	2021/10/27	20	277	Uncertain	Active organized surveillance
59	Jiangxi	3	2021/10/30	20	95	Uncertain	Uncertain
60	Liaoning	1	2021/11/4	24	308	Ports	Passive self-monitoring
61	Shanghai	2	2021/11/25	14	6	Airports	Uncertain
62	Inner Mongolia	4	2021/11/28	20	609	Land borders	Active organized surveillance
63	Shaanxi	1	2021/12/2	1	1	Possibly via quarantined inbound visitors	Active organized surveillance
64	Guangdong	1	2021/12/3	1	1	Quarantine places	Active organized surveillance
65	Zhejiang	4	2021/12/6	22	496	Uncertain	Active organized surveillance
66	Shaanxi	5	2021/12/9	23	1,506	Airports	Active organized surveillance
67	Guangdong	1	2021/12/16	3	2	Possibly via quarantined inbound visitors	Active organized surveillance
68	Sichuan	1	2021/12/16	1	1	Airports	Active organized surveillance
69	Fujian	1	2021/12/17	1	1	Airports	Active organized surveillance
70	Guangxi	1	2021/12/21	9	20	Land borders	Active organized surveillance
71	Yunnan	1	2021/12/24	1	4	Possibly via quarantined inbound visitors	Active organized surveillance
72	Sichuan	1	2021/12/26	1	1	Quarantine places	Active organized surveillance
73	Yunnan	2	2021/12/27	5	2	Land borders	Passive self-monitoring
74	Jiangsu	1	2021/12/28	1	1	Ports	Active organized surveillance

Abbreviation: COVID-19=coronavirus disease 2019; PLAD=provincial-level administrative division.

SUPPLEMENTARY TABLE S2. Distribution of the 74 outbreaks and symptomatic COVID-19 cases in the mainland of China by provinces in the order of the date for the first outbreak between March 19, 2020 and December 31, 2021.

PLAD	Number of total outbreaks*	Number of total symptomatic cases
Guangdong	9	232
Beijing	11	470
Shanghai	10	48
Zhejiang	4	495
Liaoning	10	515
Shandong	6	44
Heilongjiang	9	1,145
Inner Mongolia	6	780
Jilin	4	462
Hebei	4	1,103
Sichuan	6	51
Tianjin	3	12
Xinjiang	3	906
Anhui	3	12
Shanxi	2	5
Guangxi	2	21
Shaanxi	5	1,494
Jiangxi	2	23
Yunnan	6	292
Jiangsu	5	826
Hunan	2	114
Chongqing	2	8
Fujian	3	473
Henan	3	241
Hubei	2	93
Ningxia	2	46
Hainan	2	2
Gansu	1	144
Guizhou	2	13
Qinghai	1	12

Abbreviation: COVID-19=coronavirus disease 2019; PLAD=provincial-level administrative division.
*The sum of total outbreaks for all PLADs is more than 74 because one outbreak might involve more than one PLAD.

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