Annex 1

Guidelines for COVID-19 Epidemiological Investigation

These Guidelines are developed to provide guidance on standardized epidemiological investigation of COVID-19 by CDCs at various localities and gather epidemiological information such as the onset, exposure history and contact history of COVID-19COVID-19 cases, analyze transmission characteristics and transmission chains of clustered cases, trace close contacts and prevent the spread and COVID-19 transmission.

I. Purpose of investigation

1. To investigate the source of infection and trace and determine close contacts;

2. To investigate the onset and treatment of patients, clinical characteristics, and risk factors;

3. To investigate and analyze transmission characteristics and transmission chains of clustered cases.

II. Targets of investigation

COVID-19 suspect cases, confirmed cases, asymptomatic infected persons and clustered cases.

III. Investigation contents and methods

1. Case investigation

County/district level CDCs, upon receiving report of COVID-19 cases, should complete the initial epidemiological investigation within 24 hours. The investigation can be carried out by reviewing documents, inquiring the patient, informants and the attending doctors. When the 14-day isolation and health condition monitoring of discharged patients have been completed, CDCs should complete, collect and report information on patient specimen collection and testing as best as they can.

Case investigation should be focused on basic information, onset and care seeking information, risk factors and exposure history, and laboratory findings of suspect cases, confirmed cases and asymptomatic infected persons, which should be filed in the Case Investigation Questionnaire (see Appendix 1) where only basic information such as name, gender, and ID number should be filed in for suspect cases. At the same time, for people determined to be closed contacts of patients after tracing and investigation, information should be filed in the Medical Observation and Health Condition Monitoring Form of COVID-19 Cases in the *Guidelines for COVID-19 Close Contact Management.*

2. Cluster investigation

Based on online direct report information and case investigation findings, the county/district CDC

shall conduct investigation immediately of clustered cases that meet the definition. Investigations should include information such as source of infection of cases and close contacts, and focus on epidemiological links among cases. Chain of transmission and transmission routes should be analyzed. For the investigation and analysis method, please refer to Appendix 2.

IV. Organization and implementation

In accordance with the principle of "localized management", the county/district health authority of the area where the case seeks medical care shall organize the CDC to carry out the epidemiological investigation of the case. The investigation unit shall promptly set up a field investigation team, specify the purpose of investigation, develop the investigation plan, and determine team members and their respective duties and tasks. During the investigation, investigators should take proper personal protection. The prefecture, provincial and national CDCs can go to the field whenever necessary to participate in the field epidemiological investigation.

V. Reporting and analysis of information

Once the investigation of confirmed cases, asymptomatic infected people and case clusters is completed, the county/district CDC should submit the case investigation form or investigation report through the online reporting system. The local authorities should review the quality of epidemiological investigation information, and complete and correct relevant information in a timely manner as investigations progress.

For cluster investigation findings, basic information and initial, progress and final reports should be submitted, and key information of clustered cases (see Appendix 2) should be included in the final report according to *National Protocol for Reporting and Management of Public Health Emergency Related Information (Trial).*

Appendix: 1. Investigation Questionnaire for COVID-19 Cases

2. Investigation and Analysis Method of COVID-19 Clusters

Appendix 1

Investigation Questionnaire for COVID-19 Cases

Questionnaire number: _____ ID number:_____

I. Basic information

1. Name:_

2. Sex: □Male □ Female

3. Importation from overseas: □Yes □ No (add to Infectious Disease Report Card)

If yes, please fill in the following:

Country(ies) and region(s) of residence or travel before entry (multiple answers possible): _____(add to Infectious Disease Report Card)

Country(ies) or region(s) where transfer(s) were made before entry: _____

Nationality: _____Passport Number: _____

Point of entry: _____of_____Province (airport, train station, and wharf, etc.)

Date of entry: (dd)/(mm)/(yyyy)

Means of transportation (number of flight, train, and ship, etc.): _____

II. Onset and care seeking

4. Identification route: □voluntary care seeking □via close contact management □ border screening □active population screening □regular surveillance of flu and SARI, etc. □others_____

5. Date of admission: (dd)/(mm)/(yyyy)

6. Symptoms and signs at admission:

□ Fever: maximum temperature_____ ℃

□ chills □ dry cough □ sputum □ nasal congestion □ sore throat

□ headache □ fatigue □ muscle soreness □ arthralgia

□ shortness of breath □ breathing difficulty □ chest tightness □ chest pain □ conjunctival hyperemia □ nausea □ vomiting □ diarrhea □ abdominal pain □ others_____

7. Are there any complications? □ Yes □ No

If yes, please select (multiple choices): □ meningitis□ encephalitis □bacteremia/sepsis

□myocarditis □ acute lung injury /ARDS □ acute kidney injury □ epilepsy

□secondary bacterial pneumonia □ others_____

8. Chest x-ray/CT test taken showing pneumonia imaging features: □Not taken □ No □ Yes

9. Date of discharge: (dd)/(mm)/(yyyy)

III. Risk factors and exposure history

10. Does the patient come from a specific professional group: □ no □ medical staff □ pathogenic microorganism detection staff □ personnel with wildlife contact □ poultry and livestock farming workers□ others_____ □ not from a specific professional group

If yes for medical staff, please select: □ doctor □ nurse □ field staff for disease control and prevention □ laboratory staff □ others_____

11. Whether the patient is pregnant: □ Yes, pregnant for ____weeks □ No

12. Past medical history (multiple choices): □none □ hypertension □ diabetes □ cardiovascular and cerebrovascular diseases □ asthma □ chronic pulmonary (□ chronic obstructive pulmonary disease, □ others_____) □ tumor (□ lung cancer □ others_____) □ chronic kidney disease □ chronic liver disease □ immunodeficiency diseases □ postpartum (within 6 weeks) □ others_____

Have you had the following exposure history or contact history within 14 days before the onset of illness or being tested positive:

13. Has the patient visited or lived in Wuhan and surrounding areas, or other domestic communities with reported cases:

□travel history □ residence history □ No

If yes, please fill in: _____county/district _____ prefecture _____ province

14. Has the patient visited or lived in overseas country(ies) or region(s) with severe outbreaks: □travel history □ residence history □ No

If yes, please specify country(ies) or region(s): _____

15. Has the patient come in contact with a person who has fever or respiratory symptoms from Wuhan and surrounding areas, or from a domestic community with a reported case/cased: □ Yes □ No □ Unclear

16. Has the patient come in contact with a person who has fever or respiratory symptoms from overseas country(ies) or region(s) with severe outbreaks: □ Yes □ No □ Unclear

17. Has the patient come in contact with a confirmed case or an asymptomatic infected person: □ Yes □ No □ Unclear

18. Does the patient have a cluster outbreak in the same family, office, school, kindergarten or nursery, or workshop? □Yes □ No □ Unclear

IV. Laboratory testing

Specimen collection and COVID-19 testing of patients on **initial sampling and every sampling until the last time during isolation after discharge** (positive/negative results included for each specimen)

Specimen type	Sampling time (dd/mm/yyyy)	Test results (+/- /to be tested)
Throat swab		
Nasal swab		
Nasopharyngeal swab		
Sputum		
Tracheal aspirate		
Alveolar lavage fluid		
Urine		
Stool/anal swab		
Blood specimen (nucleic acid testing)		
Blood specimen (IgM)		
Blood specimen (IgG)		
Blood specimen (IgM+IgG)		
*Blood specimen with IgG increase of 4 times and above (convalescence sampling)		
Others (fill in specimen name)		
Not collected (do not fill in the sampling time or results)		

*: If IgG in convalescence blood increases by 4 times or more, testing results should be positive.

Investigation organization:_____ Investigator signature:_____

Investigation date: (dd)/(mm)/(yyyy)

Appendix 2

Investigation and Analysis Method of COVID-19 Clusters

I. Definition of clusters

Clusters of cases refer to the detection of 2 or more confirmed cases or asymptomatic infected persons in a small area (such as a family, an office, a school class, and a workshop, etc.) within 14 days, and there is the possibility of interpersonal transmission, or the possibility of infection caused by common exposure.

II. Detection of cluster outbreak

1. Through case investigation, find the confirmed cases, suspect cases or asymptomatic infected persons in close contact with the case or having common exposure.

2. In China's disease prevention and control information system, search for confirmed cases, suspect cases or asymptomatic infected persons working for the same employer or having the same address whose onset is within 1 or 2 incubation periods.

3. Consolidate and review the case epidemiological investigation reports, and search for confirmed cases, suspect cases or asymptomatic infected persons from different regions with the same exposure history such as taking the same flight and train, or participating in the same travel group or meeting within 14 days before onset.

III. Investigation content

1. Investigation of patients and close contacts

The investigation of cluster-related cases should focus on: ①Whether the cases and close contacts have history of travel to or residence in Wuhan and its surrounding areas, or other domestic communities with reported cases, or overseas countries or regions with severe outbreaks; ②Whether they have been in contact with patients with fever or respiratory symptoms from Wuhan and its surrounding areas, or other domestic communities with reported cases or overseas countries or regions with severe outbreaks; ③Contact type, contact distance, frequency and personal protective measures taken; ④Case-related activity track; ⑤Verify and register the name, ID number and contact details of cases.

For the initial investigation, the time range of cluster-related cases may not be limited to 14 days, and the relevant suspect cases and asymptomatic infected persons also need to be included in the investigation. When the investigation is closed, a final judgment should be made on whether

it is a case of a cluster based on the epidemiological and laboratory findings.

The investigation of close contacts should focus on: ①The onset, specimen collection and testing of close contacts; ②The types of close contacts, such as meals together, living in the same household, sharing transportation, etc.; ③The outcome of close contacts.

2. Investigation of place of exposure

(1) Family exposure: investigate the number of family members living together, contacts and personal protection; household environment, including number of rooms, floor area, ventilation and air conditioning use, and hand washing facilities; elevator use and disinfection of the building, etc.

(2) Meal exposure: investigate the time, place, people and seating, dining environment, ventilation and air conditioning use, hand washing facilities, and behaviors that may lead to increased risk of transmission.

(3) Business exposure: investigate the number of workers, the distribution of work stations, the distribution of workshops, the type of working contact and the protection of workers in the workplace, the environmental health of the workplace, canteen, dormitory, toilet and other relevant places, use of central air conditioning, use of fresh air system and ventilation, hand washing facilities, elevator use and disinfection.

(4) Means of transportation: investigate the means of transportation, seat distribution, ventilation and use of air conditioning and the disinfection thereof, hand washing facilities, number of passengers, health conditions and personal protection.

(5) Public places: the length of stay in shopping malls, supermarkets, public baths, hotels, nursing homes, hospitals, wedding / funeral sites and other public places where the patients have been exposed, number and density of or people, personal protection, layout and floor area of public places, use of ventilation and air conditioning, use and disinfection of elevators, hand washing facilities, etc.

3. Sampling and testing

Specimen collection and testing should be done for all cases in accordance with relevant requirements. For special circumstances such as the index case of a cluster, people suspected to be asymptomatically infected or transmission within the incubation period, it is recommended to increase the frequency of sampling and testing in the case of two negative nucleic acid tests, and to collect two serum specimens within 7 days and between 3-4 weeks after onset for future reference.

IV. Information analysis

1．Analysis of transmission chains of cases

Draw epidemic curves according to the onset time of cases. Then draw the onset time sequence diagram or case relationship diagram (see Appendix 1) with information including the relationship with the index case, the exposure history of 14 days before onset and the activity track after onset, and analyze the transmission chain.

2．Generational analysis of cases

According to the epidemic curve, time sequence diagram or case relationship diagram, information of incubation period and exposure history, determine the generation of each case The following principles can be referred to in determining the generation of each cluster:

The first generation is usually the case with the earliest onset, i.e. the index case of the cluster. If it is suspected that there is asymptomatic infection or transmission during incubation, comprehensive analysis and determination should be based on epidemiological investigation and laboratory testing results.

In principle, the following three criteria should be met in determining the second generation of cases: ①There has only been a contact history with the index case within 14 days before onset; ②The case has never visited or lived in Wuhan and surrounding areas, or in other domestic communities with reported cases, or in oversees countries or regions with severe outbreaks; ③ No other suspected exposure history such as hospital visit, or no obvious community transmission in the relevant area.

The three criteria for determining the second generation of case can be used for determining the third generation of cases. If the case has been in contact with the previous two generations within 14 days before onset, the generation cannot be determined.

3．Analysis of the incubation period

The following three criteria should be met in accurately calculating the incubation period for a single case: ①The second generation case has a clear contact history with the index case; ② The second generation case has a short contact time with the index case; ③The second generation case has no other exposure history or contact history before onset than that with the index case.

In a cluster outbreak, if the incubation period of a single case is found to have exceeded the minimal and maximal value observed in the existing studies, it is necessary to verify whether the above criteria are met, and confirm the accuracy of the onset time of the case and the contact time with the index case.

4．Analysis of infectivity during incubation

In a cluster outbreak, if the index case is determined to have infectivity during incubation period, the following three criteria should be met: ①The index case and the second-generation case do not have any clinical symptoms or signs, and there is no contact history between these two cases after their onsets; ②The onset of the second-generation case happens within 14 days after the last contact with the index case; ③The second-generation case has no other exposure history or contact history than that with the index case.

It is recommended that the sampling be done as early as possible for the index case during investigation. If the sampling of the positive specimen of the index case is earlier than the onset of the second-generation case, the evidence is stronger. In addition, it is also recommended to collect two serum specimens within 7 days and between 3-4 weeks after onset of the index case for future reference.

5. Analysis of infectivity of asymptomatic infected persons

In a cluster outbreak, if an asymptomatic infected person is determined to be the source of infection, the following three conditions should be met: ①The asymptomatic infected person and the second-generation case have a clear contact history, and the second-generation case, after his/her onset, has no contact history with the asymptomatically infected; ②The second-generation case has his/her onset within 14 days after the last contact with the asymptomatic infected person; ③The second-generation case has no other relevant exposure history or contact history than with the index case.

It is recommended that the sampling be done as early as possible during investigation. If the sampling of the positive specimen of the asymptomatic infected person is earlier than the onset of the second-generation case, the evidence is stronger. In addition, it is also recommended to collect serum specimens on the day of investigation and again 3-4 weeks later for future reference.

6. Analysis of transmission routes.

During field investigation, make sure the following information is collected: type of contact, contact distance and time, personal protection during contact, hand hygiene and other relevant conditions. Investigate also the floor area of the exposure site, density of people, ventilation and air conditioning use to comprehensively analyze possible routes of transmission.

For a cluster related to a closed space such as an airplane, a carriage in the high-speed train, an Internet bar, or a karaoke bar, analyze the correlation between the onset of cases and the index case in terms of seat distance, duration of short-distance conversation, toilet exposure, hand hygiene and personal protection. If the time and space distribution of cases cannot be explained by droplet transmission and contact transmission, and the possibility of aerosol transmission is suspected, it is recommended to collect air samples and environmental smear and swabs from

the cabin, high-speed train carriage, toilet and other relevant places as much as possible to test the virus content and activity.

V. Outline for drafting the investigation report

1. Background

Describe the process of event detection and reporting, and the general situation of the local outbreak, including the number of cases, deaths and case fatality rate.

2. Epidemiological investigation

(1) Describe the total number and classification of cases (including confirmed cases, suspect cases and asymptomatic infected persons), severe cases and deaths.

(2) Describe each case by onset date including the basic information (name, age, gender, occupation, residential address at the time of onset, ID number), process of onset and diagnosis and treatment, clinical manifestations, specimen collection and testing, progress and outcome of the disease, exposure history, close contacts, activity track after onset, and personal protective measures, etc.

(3) According to case investigation results, draw the epidemic curve, time sequence diagram and case relationship diagram, sort out and summarize the key information of the cluster investigation, and fill in Appendix 2.

3. Investigation of place of exposure

Describe the environment of the exposure place, the number of people with common exposure, personnel contact and protection. If necessary, draw a plan of the exposed area.

4. Investigation of close contacts

Describe the relationship between the case and his/her close contacts, type and frequency of contact and the first and last contact time, and determine the total number of close contacts, the outcome and the number of people.

5. Measures taken

Describe the type, time and implementation of the prevention and control measures against the specific cluster.

6. Investigation findings

Determine the generations of cases in the cluster, chains of transmission, and the source and route of transmission.

7. Recommendations

On the basis of the investigation findings and the problems identified for the cluster, propose targeted prevention and control recommendations.

Appendix:

1. Sample diagrams of clustered cases

2. Registration form of key information of clustered cases

Appendix 1

Sample diagrams of a cluster outbreak

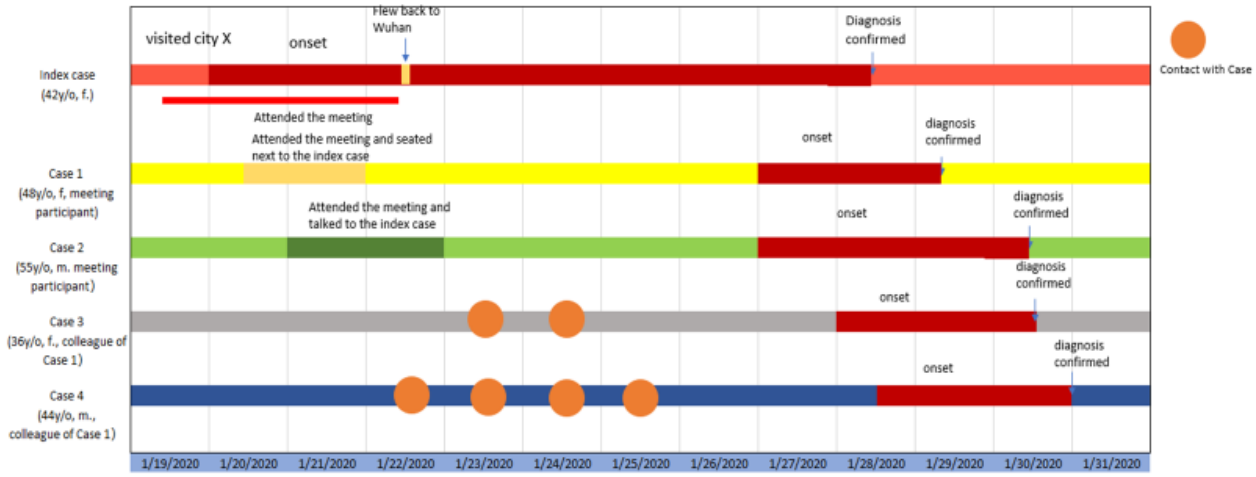

Fig. 1 Time sequence of meeting/business clusters

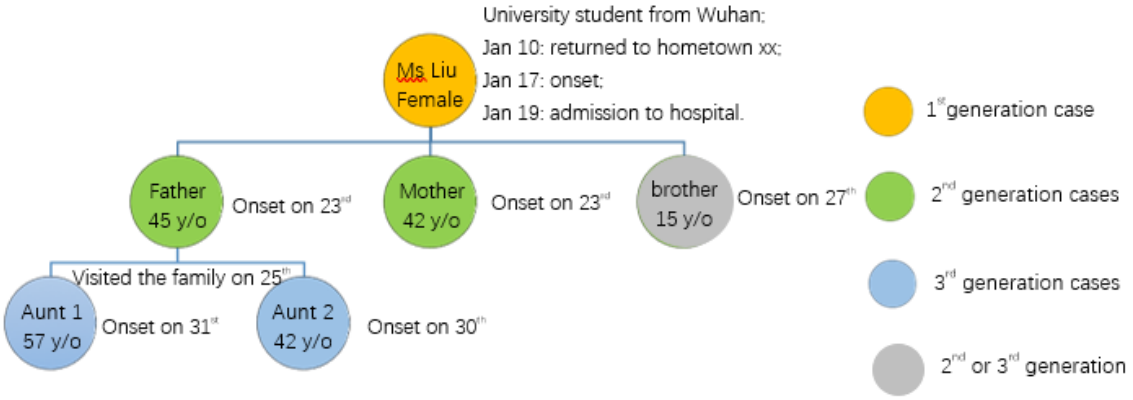

Fig. 2 Relations of a family cluster

Appendix 2 **Registration form of key information of cluster cases**

Cluster outbreak	Family cluster			Meal transmission			Other transmission type (please specify)			Transmission during incubation (1 yes 2 no)	Transmission by asymptomatic infection (1 yes 2 no)
	Number of susceptible people at exposure	Number of people having onset	Attack rate (%)	Number of susceptible people at exposure	Number of people having onset	Attack rate (%)	Number of susceptible people at exposure	Number of people having onset	Attack rate (%)		

Case number	Generation number ①	Name	Age (years)	gender	ID number	Date of onset	Date of admission	Date of centralized isolation	Date of sampling of the first positive specimen	Contact history with the previous generation②					Travel history ⑤	Other contact history ⑥
										Generation number of the case in contact	Date of first contact	Date of last contact	Place of contact③	Type of contact ④		

Notes: ①generational number: fill in 1 for the first generation, 2 for the second generation, and so on; if there are 2 or more cases in the second generation, specify according to the order of onset, such as 2-1, 2-2, etc., and so on; fill in "unknown" for cases whose generations cannot be determined; ②contact history with the previous generation: fill in the contact situation with the previous generation. The space can be left blank for the index case and cases with undetermined generations; ③contact place: please use the numbers, 1-residence, 2-restaurant, 3-means of transportation, 4-business, 5-public places (such as shopping malls, supermarkets, hotels, etc.), 6-hospital, 7-others (please specify); ④contact type: please use the numbers, 1-

family, 2-neighbors, 3-colleagues, 4-friends, 5-others (please specify). ⑤travel history: it refers to the travel history to Wuhan and its surrounding areas within 14 days before onset, or other domestic communities with reported cases, or overseas countries or regions with severe outbreaks. Please use the numbers, 1-yes, 2-no. ⑥contact history with other cases: it refers to contact except with the previous generation. Please use the numbers, 1-yes, 2-no.