

# Managing Close Contacts of COVID-19 Confirmed Cases in Metropolitan Areas in China

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## ABSTRACT

The novel coronavirus (COVID-19) outbreak has rapidly spread across the world. As medical systems continue to develop vaccines and treatments, it is crucial for the public health community to establish nonpharmaceutical interventions (NPIs) that can effectively mitigate the rate of SARS-Coronavirus-2 (SARS-CoV-2) spread across highly populated residential areas, especially among individuals who have close contact with confirmed cases. A community-driven preparedness strategy has been implemented in metropolitan areas in China. The Chinese Center for Disease Control and Prevention (CCDC) has required that all COVID-19 confirmed cases be recorded and documented in a national notifiable disease surveillance system (NDSS). After receiving reports of newly confirmed cases, an epidemiological services team at the CCDC or trained medical professionals at local clinical facilities start a case-contact investigation. A task force performs home visits to infected individuals. Persons under investigation (PUIs) can stay in designated quarantine facilities for 14 days or in special circumstances can be quarantined at home. This community-based approach involved all stakeholders including local public health departments, public safety authorities, neighborhood councils, and community health centers.

**KEY WORDS:** close-contact management, COVID-19

The novel coronavirus (COVID-19) outbreak has quickly spread across the world since late January 2020. The rapid and wide distribution of the disease has not only become a serious public health challenge but also led to a global economic downturn. Virologists identified SARS-Coronavirus-2 (SARS-CoV-2), the causative virus of COVID-19, as a zoonotic coronavirus resulting in human respiratory tract infection similar to that of severe acute respiratory syndrome (SARS) or Middle East respiratory syndrome (MERS).<sup>1</sup> Unlike SARS and MERS, the COVID-19 outbreak has resulted in lower mortality yet a much higher global prevalence, reflecting

similar epidemiological characteristics to those of influenza pandemics in the last century.<sup>2</sup> Recent analyses show that the virus has a transmission rate of 5% to 6% among people in close contact with infected individuals.<sup>3,4</sup> The virus transmission rate can reach up to 10% among family members.<sup>5</sup>

The highly contagious nature of SARS-CoV-2 has already contributed to large outbreaks and deaths in multiple cities in China, Italy, and the United States. As our medical systems develop vaccines and treatments, it is also important for public health implementation of nonpharmacologic interventions (NPIs) that can prevent the disease from spreading across highly populated residential areas, especially among individuals who have close contact with confirmed cases. To better control and manage the COVID-19 emergency, public health agencies in China have utilized a community-driven preparedness strategy involving the collaboration of local health departments, public safety authorities, neighborhood councils, and community health centers (CHCs) (Figure). The partnership advanced the coordination and use of existing resources and networks to aid populations most susceptible to COVID-19. This article outlines the framework of China's close-contact management approach to help public health professionals in other countries to cope with the global COVID-19 pandemic.

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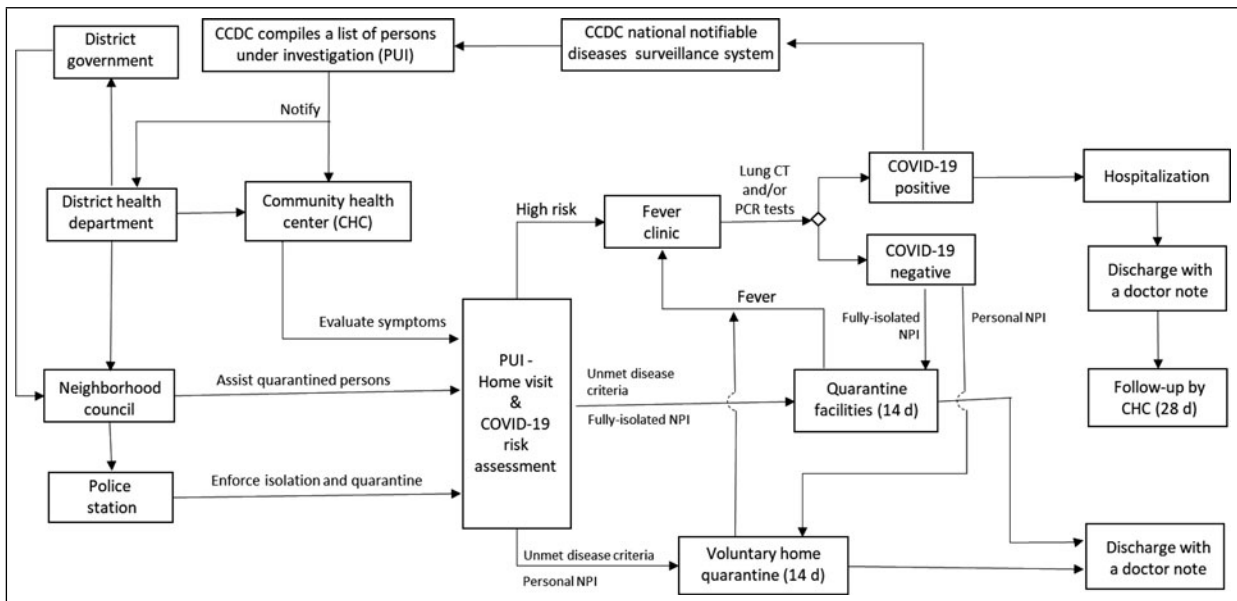
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**FIGURE** Summary of Processes and Relationships for Monitoring Individuals Who Have Had Close Contact with Confirmed COVID-19 Cases in Metropolitan Areas of China

Abbreviations: CCDC, Chinese Center for Disease Control and Prevention; CHC, community health center; CT, computed tomography; NPI, nonpharmacologic intervention; PCR, polymerase chain reaction; PUI, person under investigation.

## Rapid Reporting Infrastructure for Confirmed Cases

Because most people in China live in densely populated metropolitan areas, the person-to-person spread of COVID-19 has been a major public health concern for individuals who are in close contact with one another. To monitor the outbreak, the Chinese Center for Disease Control and Prevention (CCDC) has required that all COVID-19 confirmed cases be recorded and documented in a national notifiable disease surveillance system (NDSS). Essentially, all individuals meeting COVID-19 screening criteria (eg, travel/contact history, temperature  $\geq 37.3^{\circ}\text{C}$ , sore throat/cough) are immediately seen at fever clinics.<sup>6</sup> When suspected cases are confirmed with COVID-19 through chest computed tomography (CT) and/or polymerase chain reaction (PCR) testing, clinicians at the fever clinics must enter case information into the CCDC's NDSS database within 2 hours.<sup>7</sup> After receiving reports of newly confirmed cases, an epidemiological services team at the CCDC or trained medical professionals at local clinical facilities start a case-contact investigation to compile complete lists of persons who had close contact with confirmed cases. Those individuals with close contact then become persons under investigation (PUIs) for probable cases.

To reduce the risk of community spread, individuals who have been exposed to COVID-19 must be

notified or treated immediately. The CCDC disseminates the PUI list to both the district health department and the CHC where the PUI resides. The district health department then informs the district administrative government and neighborhood councils about the PUI in the community. The district government also notifies neighborhood councils about the PUI. The neighborhood council will further share the PUI list with local police stations. The cross-agency notification process is designed to ensure that all the key health care and civil stakeholders have access to the PUI information through multiple channels.

## Collaborative Task Forces for Preventing Community Spread

The partnership among the CHCs, neighborhood councils, and police stations enables health care professionals, social workers, and law enforcement officials to quickly create a task force team and conduct home visits to the PUI. During a home visit, a CHC's clinician performs the standard COVID-19 screening assessment for the PUI.<sup>8</sup> Any PUI showing COVID-19–like symptoms is immediately transported by ambulance to a fever clinic for chest CT and/or PCR tests. The PUI who does not meet symptomatic criteria is provided with one of 2 NPI options. Persons under investigation can stay in designated quarantine facilities for 14 days, where clinicians

continue to monitor the health status of the PUI. Or, those individuals who have special medical needs or family obligations (eg, caring for family members) can opt for the personal NPI that requires the PUI to undergo a voluntary 14-day home quarantine. The recommendation is made by the joint assessment by CHC clinicians and other task force members regarding whether the PUI's residential setting is appropriate for voluntary home quarantine. Clinicians at the CHC then monitor the clinical condition of the individual in home quarantine for the duration of the epidemic.

Moreover, the neighborhood council is responsible for providing home-quarantined individuals with basic necessities for living, such as provision of food and other necessities of daily living and garbage collection. For the PUI who refuses to comply with isolation requirements or who breaches quarantine regulations (eg, by leaving before the end of the isolation period), the public security authority may take necessary measures to enforce quarantine compliance.<sup>7</sup> Employers are required to provide quarantined individuals special leave without using vacation or sick leave days.

The PUI is released after completing a 14-day isolation period. Individuals staying in quarantine facilities receive a discharge note issued by the doctor of the quarantine facility. Persons under home quarantine are provided with a discharge note by the doctor of the CHC. The PUI with a discharge note is permitted to go back to work or school. If COVID-19 symptoms are detected during the quarantine period, the PUI is immediately transported to a fever clinic for chest CT and/or PCR testing.<sup>6</sup> If the test result is negative, the PUI resumes the previous NPI and remains in quarantine.

If the result of the COVID-19 diagnostic test is positive, the PUI is immediately hospitalized for further tests and treatments. The confirmed case is also reported to the CDC's NDSS database.<sup>7</sup> After recovering from the disease and free of the virus, the patient is released from the hospital with a discharge note issued by the doctor of the hospital. The health status of the patient continues to be monitored by CHC clinicians for another 28 days.

### Outcomes and Challenges of Close-Contact Management Practice

SARS-CoV-2 has shown a much higher rate of transmissibility than seasonal influenza. The initial estimate of the virus's basic reproduction number indicates that 1 infected person could pass the virus to 2 to 2.5 people in average.<sup>9</sup> Since the peak of the outbreak, more than 128 cities with high population density ( $\geq 1500$  persons/km<sup>2</sup>) in China have

adopted the close-contact management strategy to reduce potential community spread.<sup>8,10</sup> More than 685 000 PUIs living in metropolitan areas were identified and self-quarantined between January 25 and March 20, and more than 9300 PUIs were placed under medical observation (see the Table).<sup>11</sup> Furthermore, approximately 16% to 32% of COVID-19 patients required intensive care.<sup>12,13</sup> Implementing the close-contact management method has gradually decelerated the virus transmission across local communities.<sup>14</sup> As local health care facilities struggle with staff and resource storage in response to the outbreak, this "flattening of the curve" helps alleviate already overwhelmed patients who could be handled by existing health care systems. It also enables valuable care resources (eg, ventilators and negative-pressure rooms) to be deployed to individuals with urgent medical needs.

Several large Chinese cities have further imposed citywide lockdown to enforce quarantine restrictions. The citywide lockdown is considered the most strict and aggressive public health measure to prevent and delay the virus transmission. This population-based intervention can be useful in curbing the spread in the early stage of the pandemic and allowing more time for health care systems to develop vaccines and antiviral medications. Yet, the most effective and sustainable way to thoroughly mitigate person-to-person transmission is to identify infected cases and asymptomatic carriers in the community and to treat or isolate those who had close contact with them.<sup>3</sup> Educating and informing every local resident about the best practice to avoid cross-infection are also highly important.<sup>15</sup>

**TABLE**  
Number of Close Contacts in China and in Major Metropolitan Areas Between January 25, 2020, and March 20, 2020<sup>a</sup>

Location	Cumulative Data of Close Contacts, n	Under Quarantine, n
China	685 866	9 371
Beijing (capital)	4 033	330
Tianjin (municipality)	2 666	135
Chongqing (Southwest)	23 788	113
Harbin (Northeast)	6 250	96
Taiyuan (Northwest)	3 324	1 319
Hangzhou (South China)	8 617	188
Guangzhou (Southeast)	5 270	440

<sup>a</sup>Data extracted from the Local Municipal Health Commission Web site as of March 20, 2020.

## Implications for Policy & Practice

- A national COVID-19 information system, overseen by a central government agency such as the CCDC with its NDSS database in China, is essential for coordination of efforts. This system receives the latest information on all infected people and their close contacts and makes the information available to community health administrations, allowing for appropriate contact tracing, quarantining, testing, and treatment of PUI cases.<sup>7,8</sup>
- Key strategies for monitoring individuals who have had close contact to confirmed COVID-19 included:
  - Communication between different organizations and administrative committees/departments must be timely. Each team should be clear about its roles and responsibilities and reporting mechanisms and work together to develop the most effective ways to mobilize and use material and human resources.
  - A community-based approach must involve all stakeholders including local public health departments, public safety authorities, neighborhood councils, and CHCs.<sup>8</sup>
  - Health care providers working at different facilities need to cooperate fully to ensure the smooth and effective workflow.

Managing close-contact populations remains an essential NPI in mitigating the devastating pandemic in our community. The method strikes a balance among institutional quarantining, stress on health care systems, economic costs, and social tensions. The close-contact management plan described herein summarizes how governmental, health care, and community organizations in China collaboratively establish critical situational awareness and build a sustainable partnership in response to the COVID-19 outbreak. Countries interested in applying the close-contact management strategy should adjust implementation processes with sensitivity to their economic, culture, and social circumstances.

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