

What is Being Done, and What Can be Done, to Stop the Wuhan Corona Virus Pandemic?

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COMPLEXITY SCIENCE provides principles of pandemic response including expanding traditional individual care and isolation to multiscale community care and isolation. This means that a natural social unit—neighborhood, sub-urban, urban, district, nation—should be considered as to whether it is free of infection, exposed, or infected. As communities become infected, just like individuals in medical care, they should be provided medical and essential support services (e.g. food) as well as be put into isolation to prevent contagion to others. There is a history of public health concerns about community isolation. Our view is that this should not be seen as different from individual isolation, which can be done well or poorly. Doing it well is essential to stop outbreaks that would otherwise be devastating in their effects. Doing it poorly would result in unintended harm, just as poor care for an individual can result in harm. Informing all of the efforts should be an understanding of the transmission network that has become highly connected globally because of increasing travel for recreation and commerce. Dramatically pruning the transmission network can be necessary to stop an outbreak. This can be done for only a short period of time before supplies must be provided. Restoring services such as food and medical supply delivery to affected communities requires a supply system that itself limits transmission by no-contact transfers, and reduced connectivity by use of specific (one-dimensional) channels by which supplies are provided.

Since the first confirmed case in December in Wuhan, China, the 2019-nCov has spread to a dozen countries, with almost 2,000 confirmed cases as of Jan 26, 2020. This number, along with countries reached and death tolls, are still increasing rapidly. Indeed, the death toll grew from 3 on January 19th, to 6, 9, 17, and then 25 on each of the following days.

This pandemic bears resemblance to the SARS outbreak in 2003. Both are coronavirus infections, contagious between humans, result in respiratory system symptoms, and emerged during the travel time for the Spring Festival. However, the 2019-nCov is different from SARS, in ways that make it more challenging to stop. It has a longer incubation period of around 2 weeks, it has relatively mild nondistinct symptoms before it becomes severe, and it may be also be contagious during the incubation period. For these reasons, the traditional method of identify-and-contain strategy doesn't work because a carrier can pass it to many people before anyone even realizes they are a carrier. It has an extraordinarily high transmission rate (R_0 , estimated in the range 2.6 to 3.8 by different sources), facilitated by national and international travel in an increasingly connected world. The virus has spread across virtually all provinces of China and worldwide within days. In order to limit transmission and contain the outbreak as much as possible, the Chinese government and global community have taken actions in affected areas that are scaling up day by day. Additional actions will be needed over the upcoming days and weeks. We provide a brief summary here.

The city of Wuhan was put on lock down starting Jan 23,

2020, soon followed by Huanggang, Ezhou and other cities in Hubei Province, with a combined population of tens of millions. This is during the Spring Festival high transportation period, estimated to have 3 billion trips during its 3 weeks window. Wuhan is the largest city in Central China and one of its most import travel and commercial hubs.

Celebrations and gatherings have been cancelled or banned across the country.

When the lock down started, demand for facial masks skyrocketed and pharmacies sold out. Hospitals don't have enough stock to supply all medical personnel so that many doctors and nurses are working without proper protection. Due to air droplet contagion, safety also requires goggles. Following the initial period, the country has distributed additional medical supplies.

Similarly, there was a brief shortage of food at the beginning of the lock down with hoarding, but it has been alleviated by additional supplies.

Medical experts and personnel from top hospitals in other parts of China have been dispatched to Wuhan.

The flood of people with symptoms, or fears of symptoms, has overwhelmed hospitals. The hospitals have been a new nexus of contagion. To avoid further contagion, the government has encouraged people with mild symptom to self-isolate.

There has been a severe shortage of hospital beds, and Wuhan began to construct 2 new hospitals expected to be put in use by Feb 4, with 2000 additional beds.

Some communities, cities and counties have formed self-contained cells limiting transportation within and between them. The extent of such limitations varies, but many counties have started a no-in-no-out policy with rotating guards.

Take-out companies in Wuhan have begun to offer contact-free delivery, covering food and other daily supplies.

Chinese Government Publication #2020-5 on the outbreak (a guideline for all local governments at http://www.gov.cn/zhengce/zhengceku/2020-01/26/content_5472235.htm)

provides guidance for the response effort. Rough translation:

Focusing on community prevention and control:

A community is defined as an area governed by street office (in urban area) or town government (rural). Define three types of communities:

- A. No cases found
- B. One case in the past 14 days with no subsequent cases
- C. Two or more cases and potential spreading

Uninfected (Community A) strategy: "Prevent outside input:" mobilize the community, provide health education and specific information, improve the environment, stockpile supplies, and manage the case of people who live in the community returning from affected areas (with detailed description).

Potentially Exposed (Community B) strategy: "Prevent inside spread, prevent outside output" include all above (A) and manage close contacts and sanitation.

Infected (Community C) strategy: "Prevent inside rampage, prevent outside output" include all above (A and B) and blockade the area and limit gatherings within the community.