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Commentary

A systematic approach is needed to contain COVID-19 globally

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The novel coronavirus disease, named COVID-19, emerged in China in December 2019 [1]. In the early phases of the outbreak in Wuhan City, timely and effective control measures to prevent COVID-19 spread were delayed for several reasons, including lack of knowledge and vigilance regarding the new disease, insufficient or inefficient detection tools. However, the adoption by Chinese authorities of a systematic approach to the disease has resulted in the number of recoveries per day, since February 18th, 2020, exceeding the number of newly confirmed cases, and the cumulative number of patients cured exceeded the remaining confirmed cases on February 28th, 2020 (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd).

China's COVID-19 strategy has been remarkably effective in containing the rapid spread of COVID-19, and protected hundreds of thousands of people in China [2,3]. However, despite preliminary control of the epidemic in China, COVID-19 is rapidly spreading globally. As of March 10th, 2020, the majority of new infections are now occurring outside China, whereby 109 countries/territories/areas have recorded infections, with 32,778 confirmed cases, and the number of newly confirmed cases per day outside of China (4105 new cases on March 10th) has now far surpassed those recorded within China (20 new cases on March 10th, <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>). COVID-19 is now clearly achieving pandemic status, a situation that is especially alarming considering that there is no effective vaccine yet available. There is, therefore, an urgent need for the world to take joint action to contain COVID-19 globally. The experiences from China will be helpful for the rest of the world.

A report jointly issued by World Health Organization (WHO) and the Chinese government on February 28th, 2020 details China's responses to COVID-19, including a description of the measures deployed to control the source of infection and block transmission routes (<https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report>). Although some scientists have questioned the suitability of

applying such actions in other countries [4], as COVID-19 continues its deadly spread, researchers must ensure that their work on this outbreak is shared rapidly and openly [5]. Here, we attempt to systematically analyze China's prevention and control measures. Our purpose is to encourage countries to join forces to explore more effective measures to overcome the epidemic.

The emergence and spread of an epidemic disease occurs not only because of factors related to the virulence and infection capacity of the virus itself, but also due to socio-economic and environmental factors such as population movement [6,7]. In effect, this is an integrated human-environment system characterised by complex interactions and feedbacks [8]. To contain and control infectious diseases such as COVID-19, in addition to extensive medical treatment, systematic methods need to be carried out to isolate the source of infection, cut off transmission routes, and protect vulnerable groups. Based on the "classification-coordination-collaboration" approach of advancing sustainable development goals [9], the systematic approaches towards fighting COVID-19 adopted by China can be summarized as a combination of actions involving coordination, classification, and collaboration (Fig. 1).

- (1) Coordination. Coordination in this context refers to the organization of the medical team and resources needed to combat the epidemic, with government as the lead actor. Following formal confirmation of the gravity of COVID-19 and its deleterious health impacts on January 20th, 2020, the Chinese government implemented a coordinated top-down organization system to allocate and manage critical resources (<http://cpc.people.com.cn/n1/2020/0223/c64094-31600380.html>). For example, to improve the recovery rate and reduce mortality in Hubei Province, the central government immediately coordinated a number of different agencies, and quickly operationalized several specialized treatment hospitals within a very short period, including the construction of completely new Huoshenshan and Leishenshan hospitals. Meanwhile, until February 23rd 2020, more than 330 medical teams, comprising 41,600 medical staff from 29 provinces, including military health personnel, were temporarily assigned to Hubei Province to

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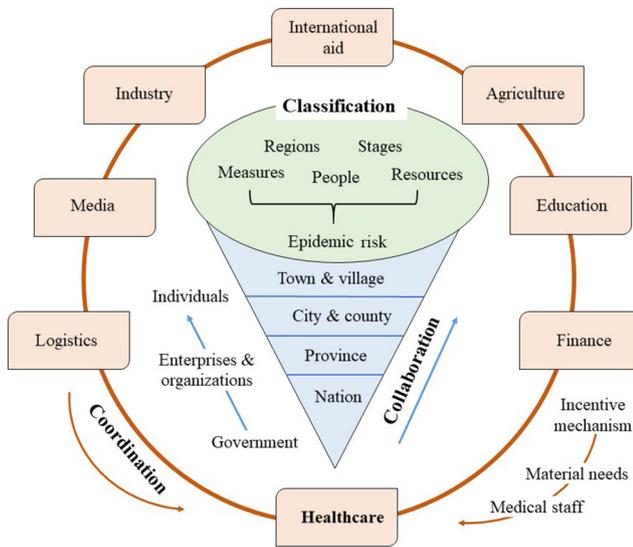


Fig. 1. The systematic approach to fight with COVID-19 in China.

contribute to the treatment of patients (<http://news.cctv.com/2020/03/01/ARTIyFaDgjnVVFUmKVuatpaz200301.shtml>). The central government also established a “green channel” transportation for medical supplies and other material resources after the shutdown of the regular transport system in Wuhan.

- (2) Classification. Classification is employed to divide the outbreak areas and their associated risk factors into different levels, which consider the number of confirmed cases and the factors closely related to disease transmission, including population characteristics and the living environment. After the confirmation of Human-to-human transmission [10], in response to the proliferation of the epidemic, differential prevention and control measures were adopted informed by a risk level detailed at the county scale. The central government, from January 23rd 2020, implemented a “closed management” policy in Wuhan [11] and six other cities in Hubei Province through closure of train stations, airports and highways that strictly controlled population mobility. Localities in cities that would typically have been crowded were closed to prevent asymptomatic patients from transmitting the virus. On February 17th 2020, to ensure an orderly return to work after the Spring Festival holiday during the containing COVID-19 process, the Chinese government issued a document stating that all provinces (except Hubei and Beijing) should declare the epidemic risk level for their counties based on the number of confirmed cases, evaluated as “low”, “medium” and “high” risk levels (http://www.gov.cn/xinwen/2020-02/18/content_5480514.htm).
- (3) Collaboration. Collaboration refers to the cooperation among the government, social organizations and individuals. The abundant and effective domestic collaboration has been recognized as a fundamental requirement to defeat the epidemic, in addition to responding to emergencies through a series of coordinated measures (<http://cpc.people.com.cn/n1/2020/0223/c64094-31600380.html>). The international community has been encouraged to contribute to joint research on the development of effective medication. In addition, spontaneous collaboration behaviors have emerged from individuals, commercial and social organizations. For example, a large number of rehabilitated patients

have proactively donated plasma to fight the disease, and those who work for delivery companies, has helped to keep people fed and maintain social stability. Moreover, the public has actively supported the government’s call to take individual disease prevention measures, such as household disinfection, frequent hand washing, wearing of masks and remaining indoors. Such collaborative behaviors, which involve the population as a whole, are critical to fighting the outbreak.

Through the coordination, classification, and collaboration (3C) systematic approach, China has been able to curb the spread of the COVID-19 nationally. It is notable that these three processes are not independent but interrelated. For example, classification requires collaboration between different government agencies at different administrative levels, which in turn helps to strengthen management coordination. In addition, effective implementation of policies is inseparable from collaboration between different departments. Moreover, spontaneous collaboration behaviors among the general public (bottom-up) requires appropriate guidance from the government (top-down). In order to deal with the huge challenges of human-environmental systems, the systematic approach needs to fully consider the interaction between different agencies and actors.

COVID-19 has become a global crisis. There is no doubt that every country has the potential to find a response that suits themselves, however, isolated actions by countries make it difficult to prevent the risk of further virus outbreaks worldwide. Therefore, only by adopting a systematic approach on a global scale and forming a global prevention and control network can the overall epidemic be overcome. Under the “3C” approach, other countries may also take effective actions suitable for themselves. We highlight here three measures that may facilitate joint action by countries.

Firstly, countries need to take immediate preventive and control measures based on potential transmission risks, rather than allowing them to remain unchecked. Considering the population density and climatic conditions of different countries, zoning management is important and this needs to be adjusted in time according to the risk level of the epidemic to avoid the negative effects of strict management. Secondly, governments of countries need to strive for a unified and equitable allocation of resources and to improve the efficiency of resource distribution through coordinated management. At global scale, beyond the WHO, collaborative international organizations such as the United Nations (UN) should unite different subordinate departments to cooperatively develop global management plans, thereby suggesting countermeasures for countries. Thirdly, the education, participation and support of all members of society is essential to defeating the epidemic. As such, governments have the responsibility and obligation to take measures that foster the willingness of the broader population to collaborate. It is also very important to publish accurate information about infection status in a timely manner and to actively seek collaboration with the international community.

Currently, more than 100 countries/territories/areas across six continents have been affected by the novel coronavirus and the challenge to control its further spread is clearly now a global one. The “3C” approach tells us that whether the fight against COVID-19 can be won depends not only on drugs and doctors, but also on the joint participation and efforts of all society members. Therefore, all countries need to nurture trust, and collaboration must be as comprehensive as possible; this requires not only the sharing of effective management and treatment methods, but also critical medicines and other materials. Overall, there is a need for all countries to take joint actions, actively contribute their own efforts and share their experiences, successful or otherwise. Such

efforts can contribute to ensuring healthy lives and the promotion of wellbeing for people of all ages.

Conflict of interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary materials

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