

The Impact of Multilateral Imported Cases of COVID-19 on the Epidemic Control in China

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Abstract. While the spread of COVID-19 in China is under control, the pandemic is developing rapidly around the world. Due to the normal migration of population, China is facing the high risk from imported cases. The potential specific medicine and vaccine are still in the process of clinical trials. Currently, controlling the impact of imported cases is the key to prevent new outbreak of COVID-19 in China. In this paper, we propose two impulsive systems to describe the impact of multilateral imported cases of COVID-19. Based on the published data, we simulate and analyze the epidemic trends under different control strategies. In particular, we compare four different scenarios and show the corresponding medical burden. The results can be useful in designing appropriate control strategy for imported cases in practice.

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Key words: COVID-19, multilateral imported cases, impulsive system, numerical simulation.

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1 Introduction

At the beginning of 2020, a horrific infectious disease caused by a novel coronavirus spread rapidly throughout China. The strong ability of transmission and high fatality ratio of the disease quickly drew attention worldwide. WHO named the infectious disease as Corona Virus Disease 2019 (COVID-19) [18]. The novel coronavirus is the seventh member of coronavirus which can infect human [21]. Compared with Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), COVID-19 has a significant but volatile incubation period, a much stronger transmission ability and a relative lower fatality ratio [7]. Another key factor of COVID-19 is its asymptomatic transmission. It is reported that the proportion of asymptomatic infected people could be up to 60% and it brings high risk for new outbreak [9]. As of April 3, over 1 million confirmed cases were reported in more than 200 countries, areas or territories around the world [18].

The Chinese government has conducted a series of strategies to prevent the spread of the disease, such as regional restrictions, home quarantine, isolating close contacts, extending vacation and postponing the resumption of work. These strategies are aiming at protecting the susceptible population [13]. All provinces of China promptly launched Level-1 response to major public health emergencies and established designated hospitals, mobile cabin hospitals and fever outpatient departments to provide adequate medical support. Clinical studies showed that the disease is susceptible to all people, even worse, there is no specific medicine and vaccine. In order to ensure that every patient is treated, the Chinese government provides free medical care for domestic confirmed COVID-19 patients. In China, COVID-19 has been under control since the end of February and the society has just returned to normalcy.

Although the number of cumulative infectious cases nearly reached its peak, the sporadic importations continue to affect the epidemic process. COVID-19 is now raging in many countries of the world. On March 17 [18], the total confirmed COVID-19 cases nearly reached to 100 thousands, Italy, Iran and Spain are all reporting more than 10 thousands cases. Some of these countries took similar measures as China to urgently control the disease. Due to the international migration, especially those overseas Chinese nationals fleeing from COVID-19 hot spots, the worldwide outbreak of COVID-19 still threaten China. Retaining the costly achieved control of COVID-19 while the pandemic is still raging around the world has to be the most important task of the whole society of China. In this paper, we will focus on the management and control of cases imported from foreign countries.