Integrative Molecular Biology and Biotechnology

RESEARCH ARTICLE

The Importance of Surveillance and Containment Measures to Contain Virus Spread: A Focus on Covid-19

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Abstract

In December 2019, COVID-19 was responsible for a pandemic scenario having Wuhan, China, as the epicenter of the transmission. The virus has a notorious capacity for human-to-human transmission, which facilitated rapid global dissemination, being declared a public health emergency of international concern. In this article we collected information about the COVID-19 outbreak, using recent publications from around the world. This revision identifies the need to self-isolation, the autonomy to order a test based on clinical suspicion and also tracking the cases, the importance to invest on organizing hospital triage, separating the diagnosed cases and on educating the population about the COVID-19. We hope that through this data we can all learn more from this virus behavior, taking the example from other countries who are also dealing with the ongoing outbreak to battle against virus spread.

Keywords: Quarantine; Virus; SARS; Covid-19

Introduction

Severe acute respiratory syndrome (SARS) is a clinical condition that involves a febrile upper respiratory illness that, in some patients, can evolve to a life-threatening pneumonia1. The SARS's agent has been researched and several groups identified the corona virus as the causative agent of SAR, entitled as SARS-CoV virus [1-3]. There are over 36 coronavirus in the Coronaviridae Family, within the order Nidovirales, and they are known to cause respiratory or intestinal infections in humans and also other animals [4].

In December 2019, a novel coronavirus (SARS-CoV-2) was responsible for a pandemic scenario having Wuhan, China, as the epicenter of the transmission. The new coronavirus disease, also known as COVID-19, has a notorious capacity for human-to-human transmission, which facilitated rapid global dissemination [5].

The acute and dramatic impact on health care systems, economies, and societies of affected countries within just a few months had the World Health Organization (WHO), on January 30th, 2020, declared COVID-19 as a public health emergency of international concern [6]. On March 11th, WHO declared it a pandemic, with over 110,000 affected patients [7].

Clinical Manifestations

The COVID-19 infection appears after an incubation period of approximately 5.2 days [8]. The period from the start of COVID-19 symptoms to death ranged from 6 to 41 days, with a median of 14 days [9]. According to the WHO-China report from 55924 laboratory confirmed cases, the most common manifestations of COVID-19 are: fever, fatigue and dry cough. Some other symptoms are less frequent but can include myalgia, chest tightness, dyspnea and gastrointestinal tract symptoms, such as nausea, vomiting and diarrhea (Table 1) [10].

Table 1: Frequency of signs and symptoms presentation of patents with Covid-19.

Signs and Symptoms	Frequency of Presentation (%)
Fever	87.9
Dry cough	67.7
Fatigue	38.1
Sputum production	33.4
Shortness of breath	18.6
Myalgia or arthralgia	14.8
Sore throat	13.9
Headache	13.6
Chills	11.4
Nausea or vomiting	5.0
Nasal congestion	4.8
Diarrhea	3.7
Hemoptysis	0.9
Conjunctival congestion	0.8

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Surveillance and Containment Measures

Singapore

In order to fight against a rapid and potentially devastating spread of the COVID-19, Singapore had enhanced surveillance strategies such as tracing contacts of patients that had laboratory confirmed cases of COVID-19, closely observation of clinical suspected cases with infectious disease, influenza-like illness, pneumonia and several other respiratory diseases from patients in intensive care units. They also gave the clinician the autonomy to order a test based on clinical suspicion, even without classical signs of the infection [11].

Containment measures have also been taken, including isolation and quarantine, border controls, community education, and temperature screening, initially for travelers on flights from Wuhan. Singapore residents returning from China, South Korea, northern Italy and Iran were placed under a mandatory 14-day self-quarantine.

These aggressive measures caused the decrease of transmission after one month of implementation. The authors associate the decrease of transmitted cases with early actions of surveillance and containment.

Approximately one quarter of cases, in Singapore, was detected through enhanced surveillance among hospitalized patients with pneumonia and Intensive Care Unit patients. A recent study considered Singapore to have the highest surveillance capacity for COVID-19, and estimated that if other countries follow the Singapore's example, the total number of imported cases detected would increase in 2.8 times, helping the health system provide isolation and the right treatment, decreasing the transmission of cases that are underdiagnosed.

Switzerland

Recent studies cited basic epidemiological models of the spread of the SARS-Cov-2 virus to suggest that its high contamination potential, along with the population lack of immunity, could infect around 40-70% of the population [12, 13]. That conclusion brings the need for aggressive and effective measures to contain virus spread.

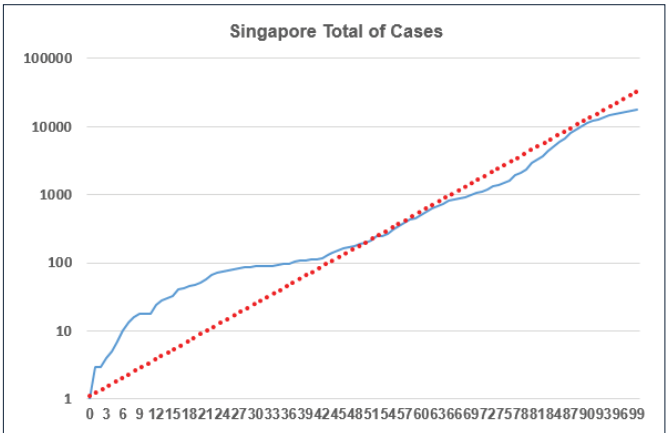

Figure 1: Graph in logarithmic scale showing the progression of virus spread according to days of infection in Singapore. The red line represents the growth in a linear scale, without mitigating measures.

On March 16th, 2020, the Swiss government announced drastic measures to fight virus propagation such as social distancing. The article also highlights the short term impact to the economy due to the high cost of increased testing and quarantine; in the longer term, however, a more rapid control of the transmission could reduce the impact on the health system, lowering the number of deaths and bringing the community back to work as soon as the virus spread is controlled.

The study suggests that a liberal approach to testing for SARS-Cov-2 virus needs to be a part of the package of control measures, along with contact tracing and quarantine, in order to help managing the crisis until vaccination or the treatment for COVID-19 is available.

China

Yen *et al.,* in March 2020, drew attention to the importance of fomites due to population's focus to easily protect themselves from observable transmissions, such as droplets (cough and sneezing) then inanimate objects that can absorb and retain contaminants. Due to its invisibility, fomites transmission tends to be overlooked, especially at the community and hospitals and may play an important role in emergent infectious diseases [14-17].

The study from Yen *et al.* argued that one way to stop the transmission cycle of community-hospital-community is by

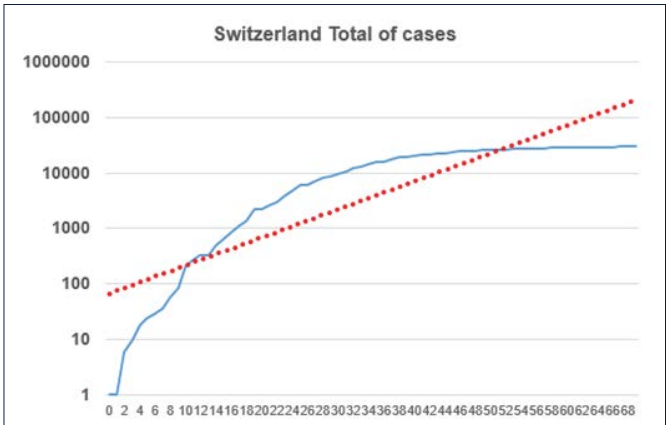

Figure 2: Graph in logarithmic scale showing the progression of virus spread according to days of infection in Switzerland. The red line represents the growth in a linear scale, without mitigating measures.

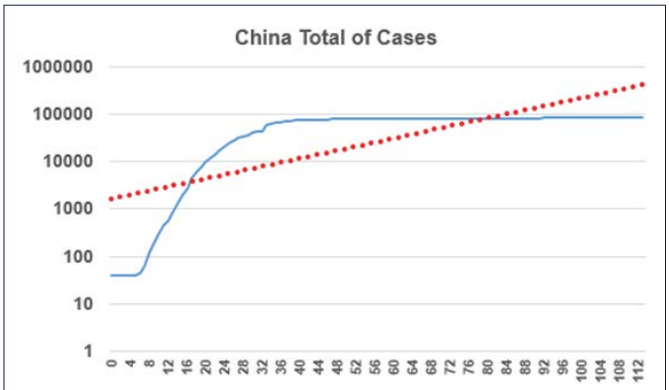

Figure 3: Graph in logarithmic scale showing the progression of virus spread according to days of infection in China. The red line represents the growth in a linear scale, without mitigating measures.

enhancing traffic control bundling. The Traffic Control Bundling (TCT) strategy has already been used during the SARS outbreak in 2003. The TCT is a multi-modal care and consists of Hospital triage, strict separation among zones of risk, requirements and protocols for personal protective equipment, used along with hand disinfection. The enhanced TCT protocol stipulates the triage for patients infected with SARS-CoV-2 and sent them through a control route to a designated contamination zone, called "zones of risk". Health workers of the contaminated zone, before moving to a clear zone, must undertake decontamination in a transition zone, and hand disinfection at every checkpoint in the transition zones. As a result, community infection declines as the hospital fomites, contact and droplet transmission were efficiently controlled.

A recent work from Xiaopeng Liu and Sisen Zhang stressed the importance of infected patients on using masks to prevent virus spread. They reported a cluster outbreak caused by a public transportation exposure, during the COVID-19 outbreak. One patient with symptoms, but unaware that he might have been infected with COVID-19, failed to wear a mask on the first public transportation, which caused the contamination of 5 out of 39 passengers. The same patient took another public transportation, but that time used a face mask and prevented the contamination of all the 14 passengers that used the same transportation. This work demonstrates the importance of using a face mask on symptomatic cases to avoid COVID-19 transmission [18].

The same recommendation was made by Centers for Disease and Control Prevention (CDC), advising the use of simple cloth face coverings in order to slow virus' spread and reinforcing the information that only healthcare workers and other medical first responders should use surgical masks or N-95 respirators [19].

Worldwide Scenario

The New England Journal of Medicine published a perspective from Parmet et al. upon the "Law and Limits of Quarantine". One of the considerations is that travel bans and mandatory quarantines alone are not sufficient to end the outbreak. In order to flatten the curve and make it viable for the Health System to treat the cases, we must reduce hurdles to testing cases, patients with mild symptoms should stay at home and, finally, regulations and emergency guidance should be provided to reduce the impact of the disease. They suggest that it's time to create and implement public health laws that emphasize support rather than restriction [20].

Another recent study, published on The Lancet, advertised that the governments are not able to minimize both deaths from COVID-19 and the economic impact of viral spread. The government must focus on reducing the mortality to the lowest number possible and putting in place some measures to assuage the inevitable economic downturn. These measures

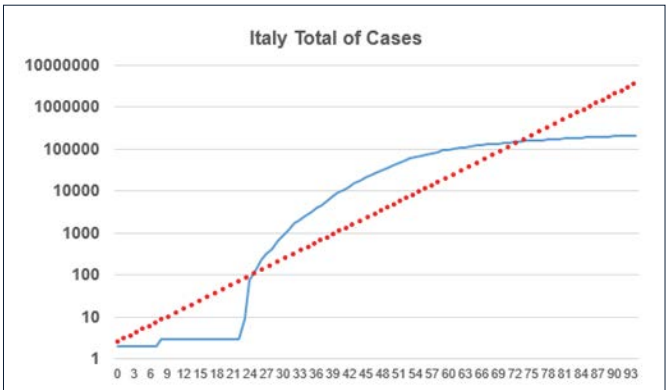

Figure 4: Graph in logarithmic scale showing the progression of virus spread according to days of infection in Italy. The red line represents the growth in a linear scale, without mitigating measures.

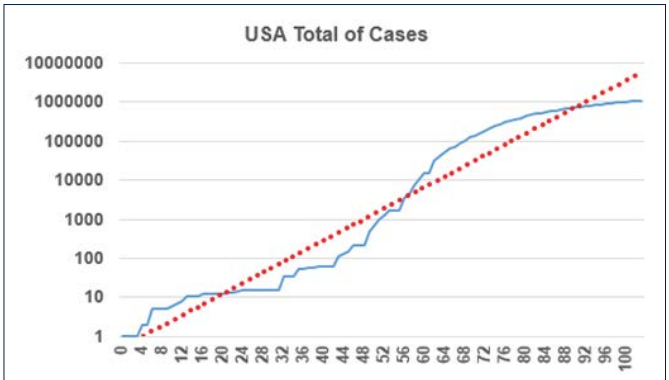

Figure 5: Graph in logarithmic scale showing the progression of virus spread according to days of infection in USA. The red line represents the growth in a linear scale, without mitigating measures.

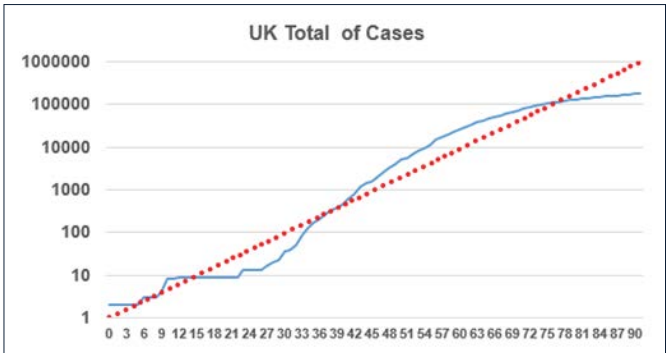

Figure 6: Graph in logarithmic scale showing the progression of virus spread according to days of infection in UK. The red line represents the growth in a linear scale, without mitigating measures.

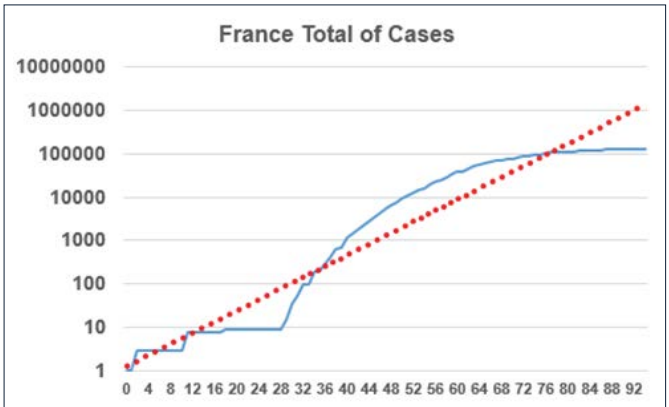

Figure 7: Graph in logarithmic scale showing the progression of virus spread according to days of infection in France. The red line represents the growth in a linear scale, without mitigating measures.

Figure 8: Graph in logarithmic scale showing the progression of virus spread according to days of infection in Brazil. The red line represents the growth in a linear scale, without mitigating measures.

outline four phases: contain, delay, research and mitigate. The study highlights that if we lighten the measures, a further peak could occur.

Strategies to reduce transmission are based on the epidemiological characteristics of COVID-19, such as isolation, supporting home treatment and contact tracing, the last example being one of the most important in the early stages to contain spread.

In the current crisis scenario, the World Health Organization recommends a combination of measures that includes diagnosis and immediate isolation of cases, and rigorous tracking and self-quarantine of close contacts. They also claim that the understanding and acceptance of these measures for the majority of the population is critical for countries with ongoing outbreaks.

Hereby, we collected information about the COVID-19 outbreak and we hope that through this data we can all learn more from this virus behavior, by taking the example from other countries that are also dealing with the ongoing outbreak to battle against virus spread.

"You cannot fight a fire blindfolded. And we cannot stop this pandemic if we don't know who is infected." (World Health Organization Director-General, 16 March 2020).

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