

REVIEW

Controlling the Cascade of Corona

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Abstract:

The pandemic of the 2019 novel Coronavirus has seen unprecedented exponential growth. Within three months, 192 countries have been affected, crossing more than 1 million confirmed cases and over 60 thousand deaths until the first week of April. Decision making in such a pandemic becomes difficult due to limited data on the nature of the disease and its propagation, course, prevention, and treatment. The pandemic response has varied from country to country and has resulted in a heterogeneous timeline for novel Coronavirus propagation. We compared the public health measures taken by various countries and the potential impact on the spread. We studied 6 countries including China, Italy, South Korea, Singapore, United Kingdom (UK), United States (US), and the special administrative region of Hong Kong. All articles, press releases, and websites of government entities published over a five-month period were included. A comparison of the date of the first diagnosed case, the spread of disease, and time since the first case and major public health policy implemented for prevention and containment and current cases was done. An emphasis on early and aggressive border restriction and surveillance of travelers from infected areas, use of information technology, and social distancing is necessary for control of the novel pandemic. Moving forwards, improvement in infrastructure, and adequate preparedness for pandemics is required

Keywords: Public Health, COVID-19, Infectious disease, Coronavirus

Introduction

The novel Coronavirus was first reported in Wuhan China, from a wild animal wet market. There are many answers that yet remain obscure, i.e. the transmission dynamics, seasonal variations, incubation period, infectivity of asymptomatic or mildly symptomatic cases, and post-infectious immunity. These parameters will become well defined once enough data is published on the disease. However, countries in a novel pandemic are faced with the difficult task of implementing rules and regulations, with limited data about the disease. Previous epidemic outbreaks have shown that prompt public health initiatives are imperative to contain the viral spread and its potential impact. A closer look at countries, their public health measures implemented and their cases might shed some light on the current situation and for the future of pandemic preparedness.

China

In late November cases of bizarre pneumonia emerged in Wuhan city of Guangdong province. The first patient was reported on 31st December 2019 in a cluster of similar cases from Huanan Seafood Market which was subsequently closed for cleaning and disinfection [1]. On Jan. 23, areas like Wuhan and Ezhou shut down public transportation, airport, and railway stations. Construction began for a specialist emergency hospital [2]. A day later, the lockdown extended to the entire Hubei province along with a complete closure of fast-food chains, cinemas, and tourist attractions across China. On Jan. 25 a level 1 health emergency was declared in all divisions in mainland China [3]. Construction of a second emergency specialty hospital with a planned capacity of 1,300 beds began. 1,230 civil and 450 military medical personnel landed in the city to offer support [4]. Schools in Beijing were closed for holidays and remained closed. The very next day, China started isolation of infected individuals by implementing nationwide monitoring and screening of travelers at airports, railway stations, bus stations, and ports [5]. Authorities in Hubei suspended passport application and travel permits in efforts to contain the spread of the virus. By Jan. 30, urban and inter-provincial transportation ceased in most of China [6]. On Feb. 3 specialist emergency hospital dedicated to treating COVID-19 patients in Wuhan started operations. Initially reluctant, Beijing finally entered lockdown on day 41 (Feb. 9) of the start of the infection after the death toll in China surpassed that of the Severe Acute Respiratory Syndrome (SARS) epidemic [7]. By March 28, around 2,820.4 tests/ million were done for COVID-19 in the Guangdong province [8]. Aggressive testing, treatment, and strict measures continued. On March 19 for the first time, China reported no new local cases. On Day 81 of infection, March 28, China closed its borders to foreigners in an effort to stop new imported cases of the Coronavirus [9]. The Chinese government announced it will lift the lockdown on Wuhan on April 8, 2020. The National Health Commission stated that the number of cases came down to 32 confirmed cases with no single death on 7th April 2020. The Alipay Health Code system was established for a safe transition out of lockdown. The system comprises color codes - green, yellow, or

red - that designated each individual's health level. Thus determining whether they could access the subway or should be quarantined at home.

Hong Kong

Hong Kong City is a managerial district of China. Hong Kong acted promptly and on the very first day of the outbreak in Wuhan, (Dec. 31) initiated isolation of any suspected patients or individuals with recent travel history to Wuhan [10]. By Jan. 6, Hong Kong began screening passengers arriving on trains coming from Wuhan. The first confirmed case of COVID-19 was announced on day 24 of the outbreak in China, Jan. 23. Just two days later, all flights to and from Wuhan were suspended and Hong Kong declared a state of emergency, and schools were closed[11]. Immediately a series of increasing restrictions were set in place. From Jan. 27- Feb 4, Hong Kong barred entry to any new visitors from Hubei Province, and recent visitors from the province were quarantined [12,13]. The Hong Kong government employees were shifted to working from home [14]. By Feb 5, the mandatory two-week quarantine was extended to all visitors from mainland China [15]. Hong Kong broadened the travelers' ban to South Korea on 25 February [16]. Due to its swift and aggressive restrictions Hong Kong had successfully managed to keep a count of just 100 confirmed cases by day 63 of the pandemic, March 2. On the same day, Most of Hong Kong's 180,000 government employees returned to their offices after a month of working from home [17]. On day 81; March 20, Hong Kong recorded 48 new infections, the largest number of cases since testing began and 256 confirmed cases. Hong Kong closed its border to nonresidents on March 25. All returning residents, regardless of point of departure, were mandated to stay at a quarantine premise for 14 days. Tracking devices were utilized for imposing the order[18]. So far Hong Kong has done 2,134 tests/million.8 48 new cases were confirmed on the 4th of April 2020. The reemergence of cases has been attributed to travelers returning to their home towns from abroad.

South Korea

South Korea's Coronavirus response has been successful so far in controlling the spread of disease. Its strategy relied on extensive testing, tracing, and treating all the while maintaining transparency and public cooperation instead of lockdowns. Screening and surveillance for potential causes along with quarantine measures for travelers from Wuhan were started on Jan. 3, day 4 of the outbreak in China[19]. On Jan. 20 South Korea declared the first case of COVID-19. On day 36 of the outbreak, Feb 4, the Korean government banned the entry of all foreign nationals who had been to Hubei Province recently [20]. Korean Center for Disease Control and Prevention (KCDC) ramped up efforts to develop commercial test kits. The first test was approved on 7 February and was dispensed to the regional health centers [21]. Soon after, on Feb 11, South Korea advised travelers to avoid traveling to 6 countries and territories affected by the Coronavirus [22]. On February 18, South Korea diagnosed its patient 31 who reportedly infected thousands in Daegu city before getting tested [23]. Within two days, Daegu and Cheongdo County were cordoned off as special care zones and Residents were advised to stay indoors. The government raised its disease alert to

the highest level, as extensive testing of the Shincheonji religious group began [24]. Starting March 1, (day 62) South Koreans were advised to stay indoors and avoid going to any events [25]. After the harrowing experience with 2015 Middle East respiratory syndrome MERS, legislation was enacted to ensure the traceability of corona positive cases by means of data collection from mobile phones and credit cards, etc. A government-backed smartphone app was rolled out on March 7, which tracked the quarantined, notified people near an infected individual and collected data on symptoms [26]. Another website showed the nearest pharmacy with masks to help people buy their weekly ration of two masks [27]. Up until Mar 20, 6148 tests per million people have been performed in South Korea [8]. Due to these robust efforts, South Korea has been maintaining a small number of new cases i.e. 47 new cases on 6th April 2020.

Singapore

Within 4 days of the outbreak in China, on Jan. 3, Singapore began screening passengers at Changi Airport [28]. Following the first laboratory-confirmed case on 23 January, Singapore canceled flights to Wuhan. On Jan 24 Border control measures in Singapore were enhanced and extended to include temperature checks to land and sea checkpoints [29]. By Jan. 29, Singapore had suspended any entry or transit for all new visitors from Hubei province except for Singaporean residents. Two days later, the suspension was extended to all travelers from mainland China. Since Jan. 31, Singapore implemented a 14-day Leave Of Absence (LOA) for everyone working in schools, healthcare, and eldercare personnel who traveled to China recently. Students who returned from these places were switched to home-based learning. In addition, people who went to China were required to fill health and travel declarations and monitor symptoms [30]. Starting February 1, Singapore rationed masks and every household received four masks [31]. By Feb. 6 The Singapore government expanded the leave of absence for every worker who returned from China and raised its contagion threat level to Orange, panic buying of groceries and consumer goods ensued [32]. The Ministry of Health reactivated Public Health Preparedness Clinics (PHPC) consisting of 900 general practitioners (GP) to help with the growing pandemic. Cases kept increasing and soon after, on 18 Feb, leave of absence (LOA) was changed to more stringent Stay at Home Notice (SHN) extended to all travelers arriving into Singapore [33]. Travelers were also advised to delay travel plans and exercise social distancing measures. All group activities for senior citizens organized by the government have ceased since March 11. Singapore has not imposed a lockdown on its citizens, public venues, events, and workplaces are all open while adhering to Ministry Of Health Regulations and social responsibility [34]. Singapore has been performing around 6,800 tests per million people during the pandemic and has started mounting restrictions amidst the fear of succeeding wave of imported Coronavirus infections in early April 2020 [35].

United Kingdom

The UK had a slow start as compared to early and aggressive screening and border control in Hong Kong, South Korea, and Singapore. On January 22, 23 days after the outbreak in China, the UK changed the risk level of travel from

very low to low. The airport received tightened surveillance of the three direct flights received from Wuhan weekly [36]. Efforts were made to trace 2,000 people who had flown into the UK from Wuhan over the last 14 days [37]. Within a week, the risk level was again raised from low to moderate on January 30. With the diagnosis of the first few cases in the UK on January 31, a public awareness campaign was launched to decrease the risk of spreading the virus [38]. Travelers from Hubei province in China were advised to self-isolate, and inform authorities. The number of cases continued to increase sharply.²⁴ On Feb. 27, massive testing of over 210,000 members of The National Health Service (NHS) if they had arrived in the UK in the previous 14 days, regardless of whether they were symptomatic or not. Starting February 10, British Airways canceled all flights from mainland China. A few weeks later, on February 25, travelers from Hubei, Iran, Italy, and South Korea since 19 February were advised to self-isolate and inform the NHS [39]. Starting March 15, vulnerable population, especially those over the age of 70 were told to self-isolate. 77 days after the start of pandemic in China, on March 16, The UK Prime Minister made an announcement advising against all non-essential travel and social contact, avoiding venues such as pubs, restaurants, and theatres. Working from home was also encouraged [40]. On March 20, the government announced that all leisure establishments were to close. On 23 March, the Prime Minister notified for more aggressive social distancing, impeding gatherings of more than 2 individuals. These rules were enforceable by police through the issuing of fines. Most businesses were closed, apart from essentials including supermarkets, pharmacies, banks, hardware shops, petrol stations, and garages. The UK has performed 959.7 tests per million up until the last week of march [8].

Italy

Italy confirmed its first two cases on Jan 31 and closed all air traffic to and from China. Within 1 day, Italy declared a state of emergency, the first European Union country to do so, and allocated an initial 5 million Euros to tackle the virus. Feb. 3, Italy set up enhanced screening measures, including thermal cameras and medical staff at airports [41]. By Feb. 23 Italy introduced strict measures for lockdown in an attempt to control the virus. Fines were imposed on those caught entering or leaving the outbreak areas. Two days later, the Lombardy region press office issued a list of towns and villages that were in complete lockdown. Around 100,000 people were affected by the travel restrictions [42]. By March 3, Italy announced setting up of quarantine red zones to contain the spread of the virus. The next day March 4, Italy closed schools and universities until 15 March to contain the virus, with crowd control measures instituted. March 9, Italy placed more than 16 million people under quarantine in Lombardy and 14 other provinces. Schools, gyms, museums, and other public venues across the country were closed. All travel was restricted except for necessity, work, and health circumstances. People flocked to the supermarkets and prison riots erupted [43]. On March 19 the Army was deployed to the city of Bergamo, as the local authorities could no longer process the number of dead residents. Army trucks transported bodies to crematoriums. All open-air sports were barred, except those individually and near one's own residence. Parks, playgrounds, and public green spaces were closed down. By March 21, Italy halted all non-essential production, industries, and businesses, following the rise in the number of new cases and deaths in the previous days [44]. 3,498.7 tests per

million were performed till March 19.8 On 24 March imposed higher fines for the violation of the restrictive measures. Despite the heavy measures and the country being in strict lockdown Italy still recorded 880 new cases on 7th April 2020.

United States of America

January 5, The US Centers for Disease Control and Prevention (US CDC) issued a travel watch at Level 1. It advised on washing hands, avoiding animal markets, and contact with potential patients if visiting Wuhan [45]. Starting January 17, airports in San Francisco, New York, and Los-Angeles implemented screenings for symptoms. The first known case of COVID-19 in the U.S. was confirmed on January 21. Within two days, The USCDC escalated the travel warning to Level 3, i.e. Avoid All Nonessential Travel to China. A week later on Jan 30, The US State Department updated the travel advisory to Level 4: Do Not Travel to China. Moreover, travelers in China were advised to leave China [46]. February 2, The United States declared a Public Health Emergency due to the coronavirus, closed its borders to all foreign nationals, and quarantined U.S. citizens returning from Hubei province for up to 14 days [47]. On February 28, a school in Washington and another in Oregon was temporarily closed. After staff members in each of the two schools were found positive for the coronavirus. Soon after, several schools were closed in the state of Washington due to the rise of coronavirus cases. On March 11, all travel from Europe (except the UK) to the United States was suspended for 30 days [48]. From March 11-13, Drive-through testing stations were started all over the country [49]. The CDC warned that widespread transmission may force large numbers of people to seek hospitalization and other healthcare, and advised social distancing to avoid healthcare systems overload. Since March 31, the Department of State has advised U.S. citizens to restrain from all international travel and advised against any gathering of more than 10 people [50]. From March 13-25, statewide closure of bars, schools and mass gatherings began and people started work from home. As of March 19, 313.6/ million have been done and private companies have started to expedite test production after approval from the USCDC.8 The USA implemented enhanced screening procedures for US residents returning from various areas around the globe. According to Worldometer US has a total of 884,075 confirmed Coronavirus cases on first April 2020. The prevalence of COVID-19 cases for the above-mentioned countries is shown in Figure I. An interactive model can be found in the link below.

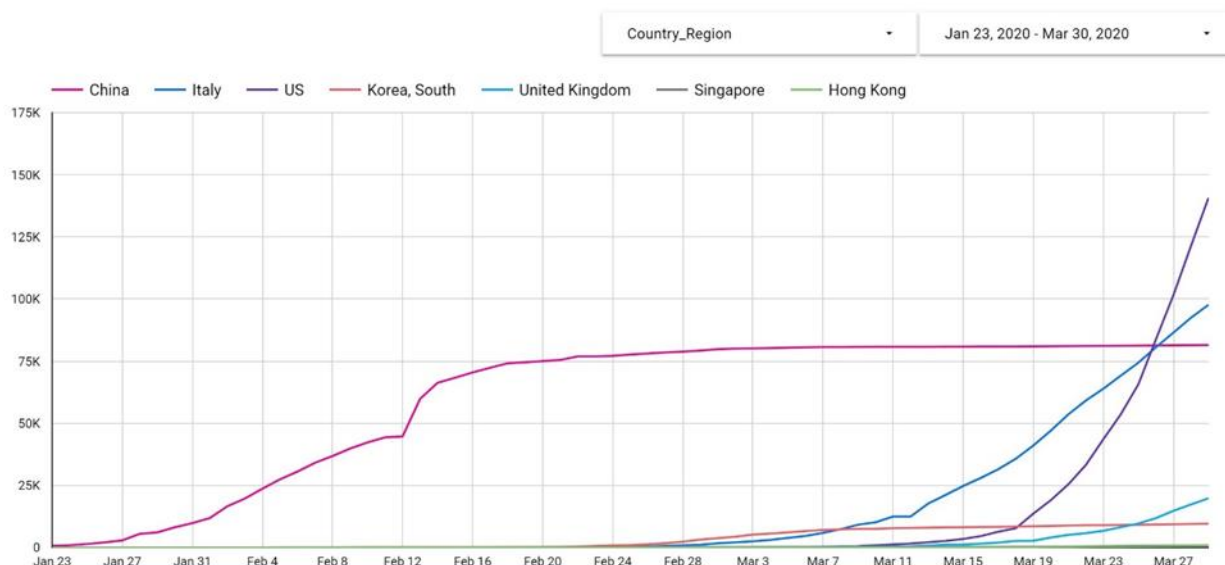


Figure 1: Prevalence of COVID-19 cases.
Interactive Model [<https://datastudio.google.com/s/kbZ7H4R0czc>]

Conclusion

The current pandemic is ongoing and far from over. The modus operandi is to contain, delay, and mitigate the viral disease. Swift restriction and surveillance of travelers by weighing on the side of caution is an effective strategy to contain the pandemic. Countries with previous experiences with SARS and MERS implemented restrictive public policies and travel bans swiftly. Hong Kong shares a border with China but it implemented screening and surveillance of travelers the day after the first case in China was diagnosed. South Korea and Singapore followed suit. As a result, Singapore and South Korea greatly decreased their cases. Hong Kong had the cases under control but a combination of the lifting of lockdown in early March and imported cases resulted in the second surge in Hong Kong. Social distancing when exercised, has been effective in decreasing the rate of spread and delaying the course of the disease. Thus, nearly all countries have adopted one form or another of social distancing. Improving testing infrastructures and implementing wide-scale testing to identify patients and asymptomatic carriers are important for better surveillance and efficient resource allocation. While the Asian countries have utilized this opportunity to make contact tracing, inventory more accessible and process transparent by the use of technology, the potential of information technology seems to be underutilized in other countries. Shortage of masks and Personal Protective Equipment (PPE) seems to be a common narrative in the UK, USA, and Italy. Rationing of PPE regulated by the government might be able to ensure accessibility to protective equipment for all in times of shortage. In the future, preparedness and capacity building for a pandemic is necessary to avoid the current situation. Keeping in view the consequence of economic halt, a fine balance has to be struck achieving functional society amidst the restrictions imposed by the pandemic.

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