

Q1. Quarantine and Isolation

Word Count: 2877 words

Background

Quarantine and isolation are two concepts that are very similar yet being fundamentally different. Both quarantine and isolation emphasize on restricting the activity of people and goods to prevent possible disease transmission. (1) To facilitate our discussion, focus is placed on only people in the following. The word ‘quarantine’ applies to segregation of individuals who are suspected to have exposure to contagious pathogens but have not been diagnosed with relevant diseases. ‘Isolation’, also referring to separation of people, applies to isolating those with a transmissible disease from those healthy and uninfected. (1)The key difference lies upon whether the individual involved has been diagnosed with the disease. Quarantine and isolation are often used hand in hand to limit the spread of communicable diseases. Such public health practice has been adopted since ancient times and widely adopted across history, notably during the epidemics of Black Death (14th century), smallpox (17th – 18th century), SARS (year 2002 – 2004), Ebola (since year 1976), COVID-19 (since year 2019), and many more. (2-11)There is not a single standard guideline on quarantine and isolation, as in when, where, and how to carry out these measures. However, execution of such public health actions is based upon infection control theories such as precautions applicable to contact, droplet, and air-borne disease transmissions. (12)A balance between public health and human rights is also oftentimes taken into consideration.

A brief overview of how quarantine and isolation are normally implemented globally and locally is as follows. Isolation is mostly done in hospitals, where adequate medical care and treatments are provided to the patients. Quarantine tactics are usually where the differences show amongst jurisdictions.

In the United States of America, quarantine decisions are made by the Department of Health and Human Services, and they are strictly monitored by the Centre for Disease Control and

Prevention (CDC). It is stated that individuals involved should be well-protected with respect to due process, and prior informed consent is necessary for the authorization of medical examinations, testing, and treatments. (13)Quarantine in the US is mostly done at the 24-hour operating Quarantine Stations located at all ports of entry where travelers arrive from abroad. At the Quarantine Station, Individuals receive medical attention from and follow further arrangements made by qualified officers of CDC. (14)

In Japan, the quarantine station chief is responsible for quarantine arrangements with reference to the Quarantine Act. (15)Quarantine can be done on board if the individuals involved arrive from abroad via a marine vessel, or at a designated medical institution for that particular infectious disease. If deemed appropriate, the quarantine station chief might quarantine the individual at a hospital instead. During the quarantine, relevant medical examinations are performed, and individuals might also be examined for other infectious diseases apart from the quarantinable infectious diseases. (15)For new infectious diseases, the Health, Labor and Welfare Minister might give instructions to the quarantine station chief to keep the suspected patients under medical supervision, and await further details and instructions. Isolation is also performed by placing patients at different medical institutions for different infectious diseases diagnosed. (15)

In Hong Kong, under the Prevention and Control of Disease Ordinance, a health officer is given the rights to quarantine a suspected patient who is believed to be infectious or containing infectious agents. (16)Health officers can also arrest the suspected patient if he or she escapes from detention. Such practice is usually executed at borders of land, sea, and air. (16)Quarantine centres are usually set up at institutions managed by the government, examples include the Lady MacLehose Holiday Village and new unused public housing. (17)

Literature Review

Quarantine, the strategy of mandatory removal of asymptomatic individuals with potential exposure to a contagious disease from the general population during the disease transmissible period, had been adopted as one of the cornerstones of epidemic control since the 14th century during the plague. (18) Whilst isolation is defined as the mandatory removal of symptomatic individuals, the two terms are used interchangeably. The aim of quarantine is to lower the basic reproduction number (R_0), defined by the number of new infections generated by single infected personnel in a susceptible population. In the absence of quarantine, the infected individual can transmit the disease throughout the infectious period, until they become symptomatic and isolated for treatment. With the implementation of quarantine, the infected individual is isolated during its infectious period prior to treatment, therefore reducing disease transmission. (19) By lowering R_0 to less than 1, the population of infected individuals decreases in size, thus containing the outbreak. (20)

Several factors determine the success of quarantine. First, the overall transmissibility, and the time of peak infectivity, determines if the patient can be isolated before infecting others. In SARS, the peak in infectivity after symptom onset, along with its relatively lower transmissibility, were found to be the underlying reasons that made the quarantining of symptomatic patients and all potential contacts an effective disease control strategy. (21, 22) Fraser et al. compared the models of smallpox, SARS, HIV and pandemic Influenza A, and reported isolation measures to be highly effective against diseases with low asymptomatic transmission. However, patient-only quarantine was ineffective in infections such as pandemic Influenza A due to its high pre-symptomatic transmissibility. (21) The case of COVID-19 is more similar to the modelled pandemic Influenza A, with a higher overall transmissibility and infectivity arising early within

the incubation period. However, in countries with mostly imported cases in the early stage, such as Singapore and South Korea, the synergy of quarantine with prompt national efforts in patient identification and the establishment of diagnostic capacity were able to largely contain the outbreak. (23, 24) Furthermore, mathematical models suggest that although the effects of quarantine become limited if infected individuals remain disease-susceptible, quarantine remains highly effective under synergistic effects with basic preventive measures, such as handwashing and wearing masks. (25, 26) Moreover, early implementation and mass adherence to quarantine measures is key to the effectiveness of the strategy. Outbreak models for Ebola and Influenza, illustrates that quarantine can prevent the introduction of epidemics and contain ongoing outbreaks only under prompt, strict policy execution. (27-29) A recent study based on the COVID-19 outbreak in Italy reported that regardless of population size, a high degree of adherence is required for effective quarantine. (30)

Quarantine measures may be evaluated through its benefits in reducing the number of cases as well as increasing the efficiency in identifying cases. In Singapore, asymptomatic individuals with contact within 2 meters and over 30 minutes with COVID-19 patients were placed under 14 days of quarantine. As of February 29 2020, 75.5% of patients identified through such contact tracing and quarantine developed symptoms after the beginning of quarantine. (31) Based on modelling studies, the benefit of simulated contact tracing and subsequent quarantine features may avert 44% of cases as calculated by a modified SEIR model for the current COVID-19 outbreak. (32) Similarly, a retrospective study on the SARS outbreak in Taiwan found that quarantine of potentially infected contacts of suspected or confirmed SARS patients prevented 81% of cases. (33) The same study found that quarantine of travelers from SARS affected areas also reduced the incidence of cases by 54.4%. During the SARS outbreak in Hong Kong, the extension of

quarantine to close contacts of suspected cases was found to correlate to the absence of further infection waves. (34)The advantage of quarantine is not limited to lowering the rate of community transmission by potentially exposed individuals, but also rapidly identifying potential patients for more rapid diagnosis and treatment. During the SARS outbreak, the quarantine in Taiwan was found to be effective in reducing the time to diagnose and isolate SARS patients. (35)

However, there are also negative impacts associated with quarantine. First, quarantine may constitute a risk in further spread of infection. During the SARS outbreak, over 150,000 individuals were quarantined in Taiwan, and the staggering number of suspected cases in combination with limited isolation facilities meant that individuals pending review or laboratory investigation had to wait for days with inadequate isolation facilities. (35) This incurred a high risk of hospital-acquired infections. Secondly, quarantined individuals face mental health problems, ranging from depression to post-traumatic stress disorder. (36)Prominent reasons for negative psychological impacts include inadequate information, inadequate supplies, fear of infection, and stigmatization. (37)In Canada, healthcare workers quarantined during the SARS outbreak were found to have more severe psychological distress. (38)This same study also found that the mandatory 10-day quarantine mandated at the time over one-quarter of respondents suffered a loss of household income, which suggests a socioeconomic cost of quarantine, though not significantly associated with any mental health burden. Finally, the rights of the person under quarantine may also be unreasonably infringed upon by motivations other than the maintenance of public health. Early in the history of quarantine, during the 18th century, quarantine regulations were beset by bureaucracy and the supposed disinfection of letters and writing allowed for the invasive search of correspondence to or from political figures. (39)

Discussion

Quarantine Strategies Implemented in Hong Kong

Hong Kong has a population of 7.5 million and is one of the highest populated cities in the world. (40)With its high mobility as an international hub and close proximity with mainland China where the first outbreak of COVID-19 appeared, Hong Kong had been placed at a vulnerable position to be affected by the viral disease. In face of this growing threat in early 2020, the HKSAR government has launched a series of measures to combat COVID-19. These include border control, quarantine and contact tracing, vigorous screening and surveillance program, as well as communication with the public.

Effectiveness of quarantine depends largely on whether it is implemented early enough before community transmission becomes uncontrollable. From March 11th to 31st, there was an exponential growth in the number of imported cases of COVID-19 in Hong Kong. (41)In response, on March 19, 2020, the HKSAR adopted a 14-day mandatory quarantine policy on all inbound travelers from the Mainland, including Hong Kong and non-Hong Kong residents. Vigorous screening and contact tracing of confirmed cases were carried out. They, together with travelers coming from high risk areas in the past 14 days preceding arrival in Hong Kong before March 25, 2020, were required to complete a 14-day quarantine in designated centers.(42) Since March 25, all returning Hong Kong residents need to finish 14-day home-quarantine under the surveillance by an electronic wristband and the StayHomeSafe mobile application. Failure of abiding the quarantine orders will be considered as a criminal offence.

By May 11, Hong Kong had 1,048 cases of SARS-CoV-2 positive, including 4 deaths of COVID-19. For 22 consecutive days, there had been no reported local transmitted cases of the disease. These numbers have demonstrated the effectiveness of the combined disease control

measures (border control, social distancing, quarantine and isolation, communication with the public) employed in the early response towards COVID-19.

Effectiveness

With a population density of 6,659 people per sq. km as well as physical proximity to Mainland China, Hong Kong was originally predicted to be heavily hit by the pandemic. However, Hong Kong's 1,048 cases since January 23 seem meagre, compared to New York's 185,206 cases, which only had its first confirmed case on March 1. (43) Arguably, the two cities have similar population sizes and density, as well as robust medical systems. As COVID-19 has no proven cure, the success of disease control relies on public health strategies.

The exponential nature of this disease means the development to outbreak status is insidious. Especially at the early stages, it is difficult for public health and government bodies to decide which groups of people should be subjected to quarantine. In February, returning cases became on the rise from Egypt, the UK and others; however, mandatory quarantine to all inbound persons was not implemented until March. Though many individuals self-implemented quarantine, whole families were sometimes affected from a single returning traveler or student. The later implementation may also have inadvertently spawned local cases.

Self-quarantine relies heavily on social compliance. Aside support with Government backing, strict enforcement and punishment in cases of compulsory quarantine, its successful implementation in Hong Kong is due to social compliance. This is reflective of beliefs of social responsibility amongst many East Asian countries, as well as the shared trauma of the 2003 SARS outbreak that strongly hit Hong Kong. Compared to Western counterparts, compliance of

quarantine was thought to be unfeasible and at extremes draconian due to the heavy emphasis on personal freedoms.

Interestingly, it is New York City that has implemented mass quarantine (and social distancing) by a shelter in place executive order on March 20. (43)After 10 days, the effect of lockdown can be seen as new cases began to decrease.

Though there was seemingly a surge of new cases in March in Hong Kong, nearly all have been imported cases. With no new community cases for 22 consecutive days, the power of quarantine and isolation alone can be clearly inferred in disease control and “flattening the curve”.

Concerns

Concerns over the lawfulness of compulsory quarantine measures have been raised. Critics branded mandatory quarantine as unethical and inhumane, a violation of universal human right. Individuals under quarantine may also be prone to the development of depression and post-traumatic stress disorder. (44) Hence, there is a need of an evaluation on the proper use of quarantine as disease control intervention.

There are three aspects to justify compulsory public health powers. (45)First and foremost, individuals subject the measures have posed a significant risk of spreading an infectious disease. If scientific data is not sufficient, the intervention can still be justified as being precautionary based on the best available evidence. Next, the policy ought to reduce the public health risks. By minimizing the community exposure of (potentially) infected patients during the asymptomatic incubation period, quarantine measure can suppress community transmission of the disease. Thirdly, the adopted coercion must be proportional to the risk. The HKSAR government has imposed compulsory quarantine on returning travelers (and their close contacts) from high risk

areas where a local epidemic has been proven, or those showing positive results in SARS-CoV-2 testing, thereby justifying the use of compulsory quarantine for disease control.

Conclusion

At once thought to be amongst the most devastatingly affected areas by the 2019 novel coronavirus, Hong Kong has surprisingly emerged and outperformed as one of the best systems in managing the coronavirus disease so far, with only just over 1,000 cases over 100 days in a city of over 7.5 million people as of May 11 2020.

Both fortunately and unfortunately, Hong Kong's experience with the 2003 SARS epidemic has heightened the city's response to disease outbreak and epidemic, as well as prepared its residents for a new way of life. Changing habits at the individual level (donning masks, constant hand hygiene, etc.) and implementing disease control strategies (quarantine and isolation, social distancing, reorganizing of hospital services, etc.) are some key elements to such temporary success.

Our group's recommendation towards the public health measures of quarantine and isolation can be concluded in three adjectives: timely, quality, and practical.

When should be the best time to implement such measures? At present, there is not a concrete and answer. Compulsory quarantine is always required once we are able to trace contacts that have exposure to infectious pathogens under guidance of the infection control theories. However, if signs of silent spreaders have come into attention, it becomes harder to trace contacts. This is when compulsory quarantine should be implemented on individuals coming from high risks regions, like what Hong Kong is doing at the moment. Social distancing by staying at home more

often can also be regarded as a loose form of quarantine. The government should implement these measures once a silent spreader trend or community outbreak phenomenon is observed.

How would you define a quality quarantine? Technically speaking, quarantine is a violation of human rights for the betterment of the public health and other members of the society. It is very important that the quarantined individuals are well-catered for and being respected with due process. As mentioned in the above, quarantine can cause detrimental effects on one's mental health. Therefore, it is important to consider a person's basic needs under such isolation, providing them with holistic care towards their health (physical, mental, social wellbeing). The government should make sure help is reachable, for example having officers providing onsite support at the quarantine institutions, providing hotlines for home quarantine individuals in providing knowledge on how to protect their family members or preparation of food. Quarantined individuals are not prisoners, they ought to be provided with a decent environment and service to help them get through difficult times.

Last but not least, practicality matters. Usually going to the extremes gives quick results, but a lot of sacrifice might be resulted on the way. The government should always balance costs and benefits in making decisions. Of course it would be best to quarantine all individuals involved in mandatory quarantine centres under the government's management, however, space and manpower are limited. Home quarantine was at last decided for Hong Kong, and many parts of the world are doing this too. What we need to be aware of is that the difference between quarantining at home and at mandatory quarantine centres is that home lacks professional officers ensuring proper quarantine to be executed. Such limitations could lead to totally ineffective and useless quarantine in the worst case, and increase the risk of disease transmission ultimately. All-rounded support measures must be done, including but not limited to a well-developed electronic

or physical monitoring system. The government should keep reviewing implemented measures from time to time, in order to improve the quality and effectiveness of quarantine.

Good analysis of effectiveness of quarantine measures and also including suggestions and recommendations

88%

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