



Severe acute respiratory syndrome (SARS) and coronavirus disease-2019 (COVID-19): From causes to preventions in Hong Kong



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ABSTRACT

Hong Kong has been recently attacked by the coronavirus disease-2019 (COVID-19). In late January 2020, it's shown a steadily increasing trend of confirmed cases. There is a 257 in total infected cases confirmed including 4 deaths until 20th of March 2020. To prevent further outbreak of COVID-19, this article discusses the current understanding of COVID-19 and compares with the outbreak of SARS-CoV-2 in 2003 of Hong Kong from the causes, transmission, symptoms, diagnosis, treatments and preventions to study for an applicable measurement to control COVID-19.

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Introduction

An outbreak of pneumonia with unknown etiology emerged in Wuhan of Hubei Province, China on December in 2019. Chinese scientists confirmed that a new coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the cause of pneumonia outbreak. Now, this severe acute respiratory syndrome has been termed as coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO) (Peng et al., 2020).

Coronavirus is a group of viruses categorized into alphacoronavirus and betacoronavirus often causing cold and other mild upper respiratory tract infections in the human body. Alphacoronavirus consists of HCoV-229E and HCoV-NL63; Betacoronavirus consists of HCoV-OC43 and HCoV-HKU1. Nevertheless, the rare form would be lethal such as SARS, MERS and COVID-19 (Geller et al., 2012). SARS-CoV, MERS-CoV and SARS-CoV-2 are

betacoronavirus (Gorbalenya et al., 2020). However, SARSr-CoVs belong to the subgenus Sarbecovirus (previously lineage B) of genus Betacoronavirus and occupy a unique phylogenetic position. It's the most lethal (Guan et al., 2020).

On the 20th of March 2020, 178 countries or territories reported that there are 234073 in the total confirmed case with 9840 deaths globally; 81300 confirmed cases and 3253 deaths reported in China (Coronavirus disease, 2020); 257 confirmed case with 4 deaths in Hong Kong (CHP, 2020a). In response to the outbreak, we summarize the current knowledge of COVID-19 and compare it with the previous experiences of the SARS outbreak in Hong Kong to study for an effective measurement to control the COVID-19 epidemic.

Causes

SARS was caused by a coronavirus (CoV) and identified in 2003 according to the World Health Organization (WHO). Coronavirus (CoV) is an animal virus from bats which infected human in Guangdong province, China (Peiris et al., 2003; Poon et al., 2003).

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Hong Kong's SARS index-patient was Dr. LIU Jianlun in February 2003, who came to attend a family wedding gathering. He was a Provinciale doctor contacting and treating SARS patients from Sun Yat-Sen Memorial Hospital in Guangdong (Hughes, 2006). On 21st of February 2003, Dr. LIU and his wife checked into room 911 on the 9th floor of Metropole Hotel in Kowloon Hong Kong. He was a SARS super-spreader infected 23 other hotel guests from 7th to the 9th floor. The hotel guests traveled to Canada, Singapore, Taiwan and Vietnam transmitting SARS to these locations. Dr. LIU was hospitalized in Kwong Wah Hospital of Hong Kong, he never recovered and died in the Intensive Care Unit on 4th of March, while he caused around 80% of the Hong Kong cases (Hanage, 2010; BWHO, 2011).

COVID-19 is similar to SARS, also caused by a coronavirus (CoV) that occurred in the seafood and wet animal wholesale market in Wuhan, Hubei Province, China (Bogoch et al., 2020; Lu et al., 2020).

On 22th of January 2020, the first COVID-19 case was confirmed in Hong Kong and announced by the Centre of Health Protection (CHP). However, no index patient has been identified at present. Initially, most of the confirmed cases had a travel history to Mainland China by High-Speed Rail, especially from Wuhan. Only a confirmed case had no recent travel history on 5th of February 2020 (CHP, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h). There was an increase in the largest number of 10 confirmed cases per day from 9th of February 2020. In the Chinese lunar new year family gathering with two relatives from Guangdong Province, China (Chan et al., 2004). 11 of 19 participants were diagnosed with COVID-19 infection. 2 other confirmed cases were the colleagues of the infected participants (CHP, 2020i, 2020j, 2020k). Besides, the largest community spreading was reported at Fook Wai Ching She from Maylun Apartments in North Point Hong Kong on 4th of March. 18 patients in total were tested with a positive result of COVID-19 who's visited the temple or association with the confirmed cases in January or February (CHP, 2020h). The accumulated number of cases was raised to 257 with a steadily increasing number of infected cases in Hong Kong on 20th of March 2020 (CHP, 2020a).

The trend of SARS outbreak

A total of 1718 infected cases appeared in Hong Kong from 11th of March to 6th of June 2003 (Lee, 2003a). The SARS epidemic had three phases from March to June. First, the outbreak in Prince Wales Hospital was in March because of the local infected person admission while the spreading of SARS infection affected a large number of medical staffs and students; Second outbreak related to the spread from hospital to the community on 15th of April 2003 which influenced block E of Amoy Garden with a total 329 estate residents infected cases; Third phase was from the early of May to the mid of June 2003, continuous new cases were reported but in a declining trend. According to the previous studied, SARS induced 253 dead in Hong Kong (Lee, 2003b), it was approximately 15% dead rate ranging from 1% in those aged less than 24 years to over 50% in those aged over 65 years within this period (Abdullah et al., 2004).

The trend of COVID-19 outbreak

In Hong Kong, there were 257 infected cases from 23th of January to 20th of March 2020. It consisted of 140 males and 117 females within ten age groups from 0 to 100 years old. The age and gender distribution of infected patients were shown in Figure 1 (CHP, 2020a).

The identity of confirmed cases were divided into three categories, 9 (3%) person of unknown (waiting for confirmation),

10 (4%) of Non-Hong Kong residents and 238 (93%) of Hong Kong residents (Figure 2) (CHP, 2020a).

There were only a few infection cases from 23th of January to 8th of February. However, the infection cases rose quickly on the 9th of February as the Hong Kong boundary control points such as Lo Wu, Lok Ma Chau, Lok Ma Chau Spur Line and Macau Ferry Terminal were not closed at the beginning for reducing the flow of people and traffic (MBPC, 2020). The reported cases were increased sharply from 23rd of January to 20th of March especially after 17th of March which was double per day (Figure 3) possibly because some Hong Kong residents returned to Hong Kong from overseas countries with infected COVID-19 (CHP, 2020a).

On 12th of February, the first infected person was discharged and the accumulated discharged persons were 97 at present (Figure 4).

Transmission

SARS-CoV is most readily transmitted by respiratory droplets when an infected person coughs or sneezes within a short distance. The virus could also spread when a person touches a surface or object contaminated with infectious droplets then touched his/her mouth, nose or eyes (SARS, 2017). The average incubation period for SARS within human is 4 to 6 days, although rarely it can be as short as 1 day or as long as 14 days (SARS, 2003). SARS patients secrete the virus excretion in respiratory and stool during the second week of illness and start to deteriorate. It resulted in more than 8000 persons suffered from Severe Acute Respiratory Syndrome (SARS) and caused 774 person's death in 2002–2003 (SARS, 2015).

SARS-CoV-2 was indicated as animal-to-human transmission because of the linkage between fish and wild animal market based on the early studied (Li et al., 2020a). However, there is a rapidly increasing incidence of infections by asymptomatic carriers (Chang et al., 2020; Carlos et al., 2020), therefore, SARS-CoV-2 may have human-to-human transmission through droplets or direct contact (Zhao et al., 2020; Biscayart et al., 2020).

Compared to SARS-CoV, SARS-CoV-2 might be transmitted by respiratory droplets within a long distance of 2m or by contaminated surfaces leading to infection through contact transmission (Peng et al., 2020). The average incubation period for COVID-19 expands to 5 days and the period of quarantine is 14 days from the last date of exposure. It was the longest incubation period for similar types of coronaviruses. However, it's remained argumentative since the longest incubation period for COVID-19 can be 27 days or above according to the present-day finding (CIP, 2020). Perhaps, respiratory droplets were not the major factor for transmission (nCoV, 2020). Recently, there is a patient dog infected from its nasal and oral cavity with a low level of COVID-19 virus. It's not shown any signs of disease before. This is the first case of human-to-animal transmission that has been confirmed by the experts from School of Public Health in the Hong Kong University, College of Veterinary Medicine & Life Sciences in the City University of Hong Kong and the World Organization for Animal Health (COVID, 2020).

Symptoms

The symptoms of SARS and COVID-19 are divided into systematic and respiratory disorders (Table 1). Systematic disorders of SARS and COVID-19 are fever, cough and fatigue. The major respiratory disorders of COVID-19 and SARS are rhinorrhea, sneezing, sore throat and pneumonia but COVID-19 patients have more respiratory symptoms than the patients with SARS (SARS, 2017; Carlos et al., 2020; Chen et al., 2020; Wang et al., 2020a; Huang et al., 2020). Leukopenia, lymphopenia and lower

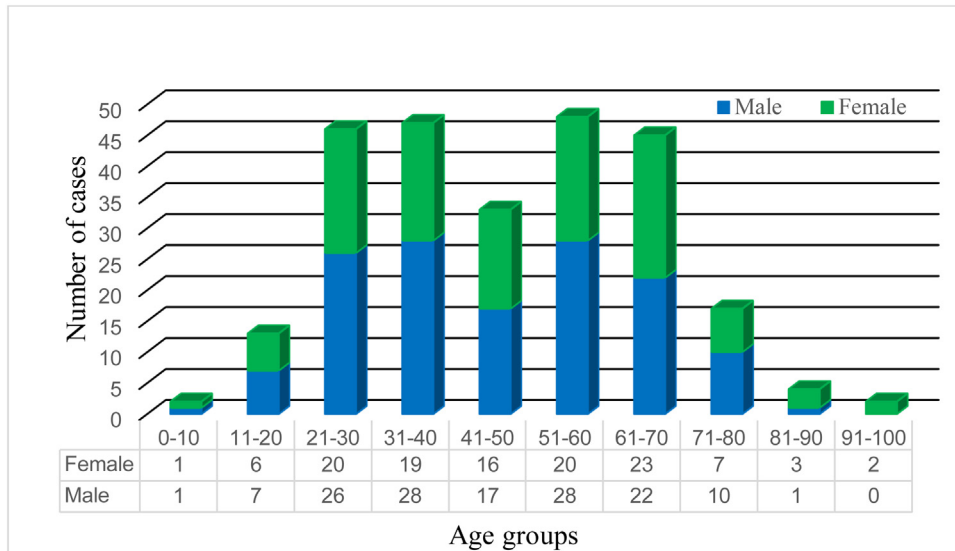


Figure 1. Infected cases in different age groups.

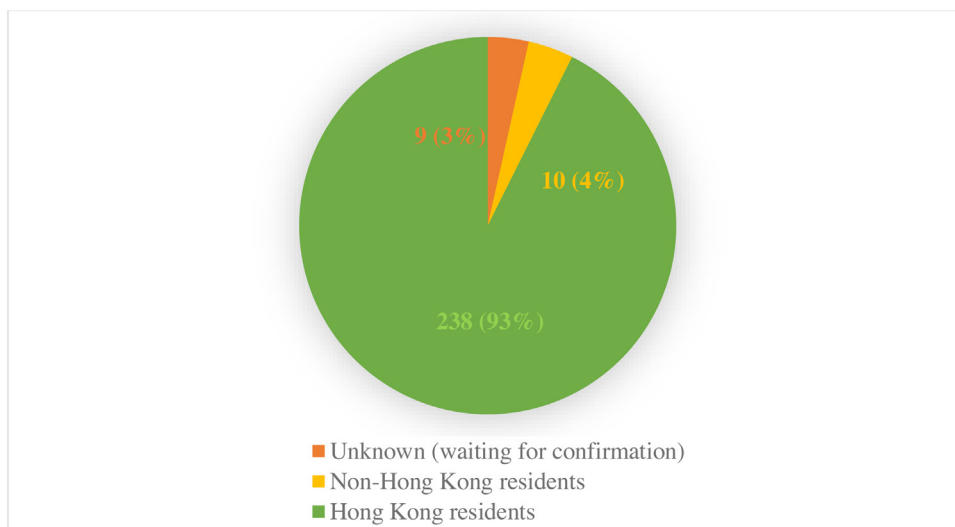


Figure 2. Identity for the confirmed cases.

platelet count are possibly observed in the hematology (Yang et al., 2020; Chen et al., 2006).

Diagnosis

Reverse transcription polymerase chain reaction(RT-PCR) is the golden test for the diagnosis of SARS and COVID-19. Computed Tomography (CT) scan is the auxiliary diagnostic method. The images of CT sometimes appear bilateral pulmonary parenchymal ground-glass and consolidative pulmonary opacities with a rounded morphology and a peripheral lung distribution when patients infected with SARS and COVID-19 (Li et al., 2020b).

SARS

RT-PCR is a technique that combines RNA reverse transcription with polymerase chain amplification (PCR) of cDNA. It's the rapid and specific diagnostic test for SARS following the protocols of the World Health Organization (WHO) and commonly used in the SARS outbreak 2003. Respiratory specimen, stool specimen and urine specimen could be used for RT-PCR testing while respiratory specimens were collected in the SARS epidemic (Yam et al., 2005).

The peak detection period in SARS-CoV after illness: respiratory specimen is week 2; stool and rectal swab specimens are weeks 2 to 3 and urine specimen is week 4 (Chan et al., 2004).

COVID-19

Real-time quantitative polymerase chain reaction (RT-qPCR) is the most common and effective nucleic acid detection technologies for SARS-CoV-2. Meanwhile, high-throughput sequencing technology has been applied for diagnosis. It's limited usage because of the high cost. Immune identification technologies such as Point-of-care Testing (POCT) of IgM/IgG and enzyme-linked immunosorbent assay (ELISA) are other possible diagnostic methods for COVID-19 but remain to be studied (Li et al., 2020b).

Treatments

SARS

The combination regimen of steroids and ribavirin was the treatment protocols for SARS in Hong Kong (So et al., 2003).

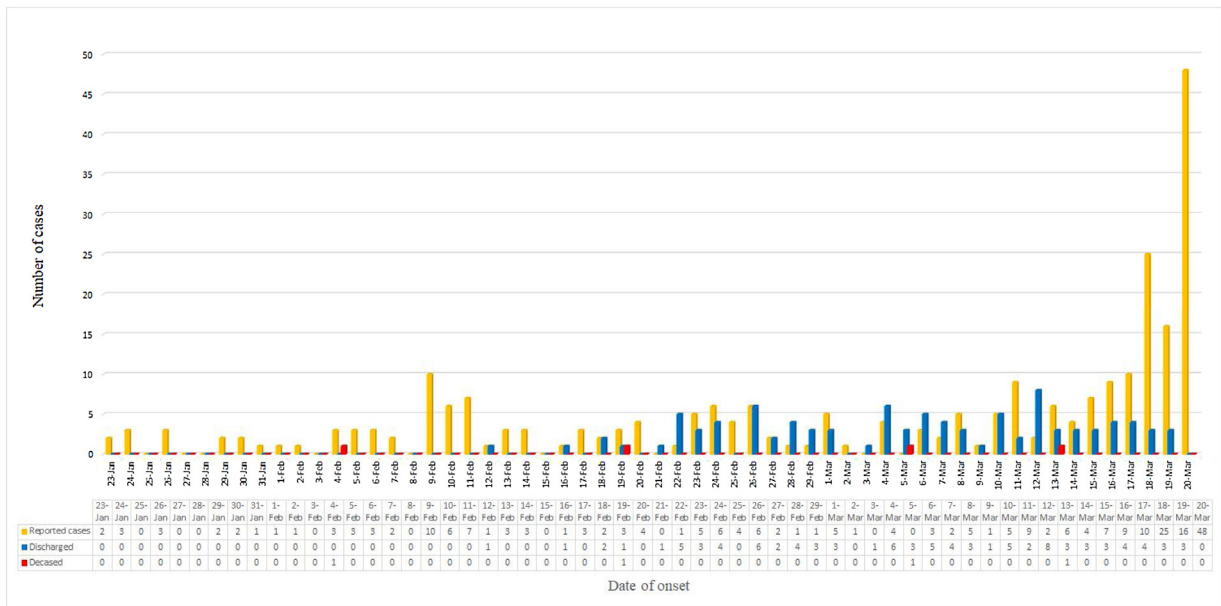


Figure 3. Infection number of reported, discharged and deceased persons.

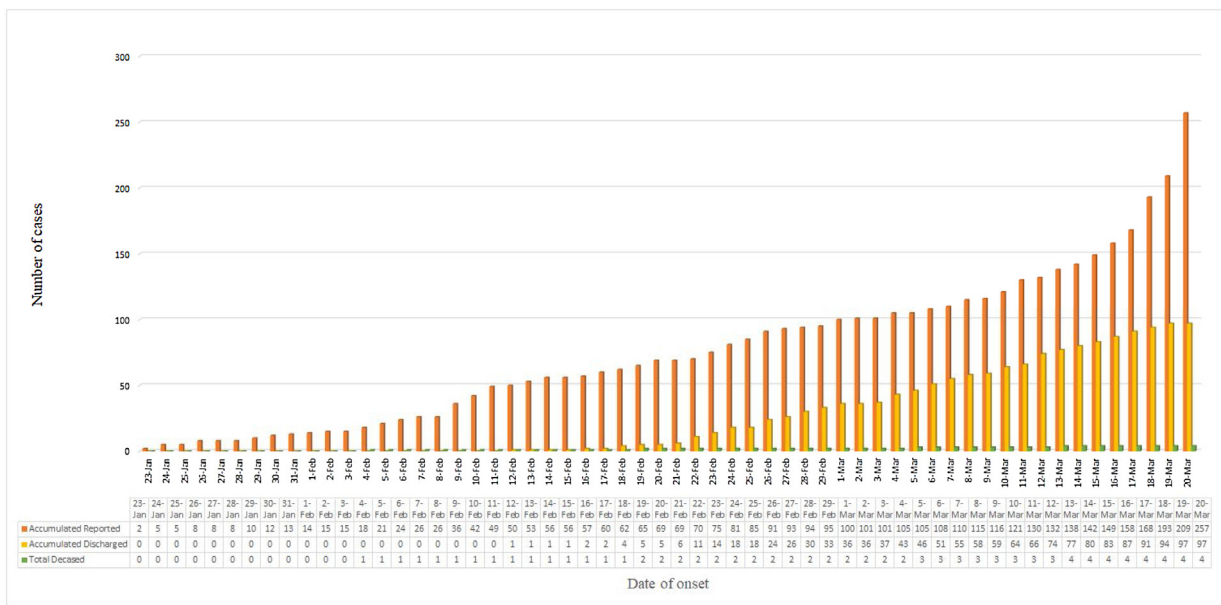


Figure 4. Infection of accumulated reported, accumulated discharged and total deceased persons.

Corticosteroid is commonly used as an immunomodulatory agent to modulate inflammatory cytokines to achieve immune homeostasis (Yam et al., 2007). Steroid with high dosage was used to treat patients with SARS (Ho et al., 2003).

Ribavirin can suppress the replication of RNA virus. It has been used in treating hepatitis C virus, lassa fever virus and severe respiratory syncytial virus infection (Lauer and Walker, 2001). However, the usage of ribavirin did not reduce the intra-tracheal intubation or mortality rates (Booth et al., 2003). It has significant toxicity which may cause hemolytic anemia and electrolyte disturbances (Lauer and Walker, 2001).

Protease inhibitor for treating human immunodeficiency virus (HIV) infection has also been considered as a treatment for SARS. Lopinavir-ritonavir coformulation (Kaletra) blocks the virus replicase polyprotein and prevents the replication of RNA. This is able to reduce the intubation and mortality rates especially administered in the early

stage with ribavirin and corticosteroid (Sung, 2003). Glycyrrhizin that can inhibit viral absorption and penetration has been found to be effective against SARS-CoV during and after the viral adsorption period (Cinatl et al., 2003). The Interferons are partly effective against coronaviruses but the efficacy is not accurately tested (Pitkäranta et al., 1999). Gamma immunoglobulins are used in SARS but the effectiveness remains to be evaluated (Fujii et al., 2004).

Broad spectrum antibiotics such as fluoroquinolone or beta-lactams and macrolide are also utilized to treat nonspecific features and assisted ventilation is commonly used for respiratory failure in SARS patients (Fujii et al., 2004).

COVID-19

Broad spectrum antiviral drugs have been used in treating COVID-19 infection e.g oseltamivir, lopinavir, ritonavir and

Table 1
Systematic and respiratory disorders for SARS-CoV-2 and COVID-19.

	SARS	COVID-19
Systematic disorders	High fever, >38.0 °C Headache Cough (Dry) Fatigue Diarrhea (10–20% of patients)	Fever Headache Cough Fatigue Diarrhea (2% of patients) Sputum production Haemoptysis Dyspnoea Lymphopenia
Respiratory disorders	Rhinorrhoea Sneezing Sore throat Pneumonia Mild respiratory problems	Rhinorrhoea Sneezing Sore throat Bilateral pneumonia Ground-glass opacity Acute respiratory distress symptoms

ganciclovir regimen; remdesivir and chloroquine regimen (Chen et al., 2020). The invention of a specific antiviral drug for COVID-19 is still progressing. Potential compounds are available for further investigation such as EIDD-2801 (isopropyl ester of N4-hydroxycytidine), Sofosbuvir, IDX-184, Ribavirin and Remdesivir may be considered as its high therapeutic potential in treating emerged viral infection (Wang et al., 2020b; Elfiky, 2020). Meanwhile, there are not only the antiviral drugs needed for an infected patient but also the prophylaxis e.g. vaccine is required for the uninfected person especially for the healthcare workers. Antibiotics and ventilation support are also utilized in COVID19 patients (Yang et al., 2020).

Sequela

SARS

The exercise capacity and health status of SARS recoverees were significantly lower than the general population. In the early rehabilitation phase, the short and weak breath caused limitations in physical function because of reduced lung function with patchy changes. A minority of survivors had a mild decrease in carbon monoxide diffusing capacity (Hui et al., 2009a). Steroid resulted in some psycho-behavioral problems such as anxiety and depression, it might be improved gradually in most of the patients (Chan et al., 2003). However, high dose corticosteroid treatment induced avascular necrosis of the joint and hip which further decreases the health status and mobility (Hui et al., 2009b).

COVID-19

Some patients recovered have 20–30% decrease of the lung capacity because of the reveal irreversible fibrosis (Barbara Walsh, 2020). This causes lung tissue scarring and stiffening as well as the immune system damage. Lung permanent damage may be leading to severe respiratory issues such as acute respiratory distress syndrome (ARDS) (Bell, 2020). Younger patients have a better chance of recovery but patients within 40 to 50 years old only have little chance and difficulty back to their pre-illness status.

Preventions

To prevent the spread of SARS and COVID-19, measures are based on effective infection control and isolation. The relative measures are mainly focused on 4 aspects, confirmed cases, close contact handling, community prevention as well as protection on healthcare workers.

SARS

Confirmed cases

On 12th of March 2003, the Department of Health in Hong Kong alerted World Health Organization (WHO) for the first notable suspected infection condition in Prince of Wales Hospital (PWH) ward 8A for handling the confirmed cases. The department of Food and Health Secretary started daily press briefings on the latest SARS condition and government measures for informing the public and increasing the effectiveness of tracing close contact person since 16th of March 2003. In the mid of April 2003, a temperature check was required for a person who arriving in Hong Kong to detect any suspected case of SARS (Tomlinson and Cockram, 2003).

Close contacted handling

On 31st of March 2003, all close contactors of SARS were mandated to report daily and designated medical centers by Department of Health for close contacted handling. Home quarantine measure extend to close contactors of a suspected case to minimize the opportunities of transmission for the virus since 25th of April 2003. Due to the increasing report of a confirmed case in block E Amoy Garden, isolation camp was opened for the evacuation of block E Amoy Gardens residents in April 2003 (Pang et al., 2003).

Community prevention

On 27th of March 2003, Hong Kong government announced the suspension of classes in all schools from 29th of March to 6th of April 2003 to prevent clustering. While there was no visiting policy extending to all acute ward in HA hospital for preventing further close contact cases. On 2nd of April 2003, the World Health Organization (WHO) issued a travel advisory recommended to postpone for all non-essential travel to Hong Kong and Guangdong. Education for the use of face mask, hand hygiene, disinfection of surfaces for fomites, avoiding contact with SARS patients and their body fluids, covering your mouth by tissue when coughing or sneezing and other simple hygiene measures were provided by the government to prevent further community outbreak (Bell, 2004).

Protection on healthcare workers

Healthcare workers were advised to use personal protective equipment (PPE) including N95 masks for an aerosol generated procedure, face shield or goggles, gloves and isolation gowns with strict infection control to prevent the droplet and contact transmission. During the SARS period, health workers worked in

a pair for mutually monitoring the infection control implement, especially wearing and removing the PPE. When transferring the confirmed patient, advise the patient putting on the mask to prevent the spread of droplets with viruses. Daily self-monitoring of fever and any other symptoms of SARS were implemented in Hospital Authority for early detection of SARS infection. The high-risk areas such as A&E, ICU and Isolation ward were adequately ventilated with negative pressure to prevent infection of the health workers (Lau et al., 2004).

COVID 19

Confirmed cases

On 8th of January 2020, Centre for Health Protection added “Severe respiratory disease associated with a new infectious agent” as the notifiable diseases in Hong Kong which gained the authority on quarantine for handling the confirmed case. All confirmed cases should stay in the hospital for isolation and treatment until fully recovered. Suspected cases were also required to isolate in the hospital until a negative result of SARS-CoV-2 observed. To increase the effectiveness of detecting high risk cases on admission to the hospital in early February 2020, the patient's travel history was connected from the immigration department and shown in the hospital authority computer system (Clinical Management System). Temperature check maintained the routine check for person arriving in Hong Kong. The Health declaration form should be submitted compulsorily by paper or electronic for all travellers who arrived at Hong Kong International Airport from 8th of March 2020. Private doctors were allowed to collect a respiratory specimen for the symptomatic patient to send for viral testing at accredited private laboratories on 9th of March 2020 (HKSAR, 2020). Started from 20th March, 2020, the Hospital Authority (HA) established 2 temporary COVID-19 virus test centers at the AsiaWorld-Expo and the North Lantau Hospital for people arriving in Hong Kong with upper respiratory symptoms to undergo viral test and to wait for the laboratory results (Temporary test, 2020).

Close contacted handling

All visitors arrived at Hong Kong who has been to Hubei Province in the past 14 days must be transferred to 3 quarantine centers (Chai Wan Lei Yue Mun Park and Holiday Village, Jao Tsung-I Academy Heritage Lodge, Chun Yeung Estate) (HKSAR, 2019). On 19th of March 2020, all people arriving in Hong Kong who have been to Iran, Daegu and Gyeongsangbuk-do in Korea, Emilia-Romagna, Lombardy and Veneto regions in Italy within the past 14 days have to stay in a quarantine center for quarantine (Guidelines on Prevention, 2019). Compulsory home or accommodation quarantine for 14 days implemented to people who arrived in Hong Kong from Mainland China (but not include Hubei Province) on 8th February 2020 has been extended to people who arrived to Hong Kong from all any other overseas countries and area except Macau, Hong Kong and Taiwan since 19th of March 2020 (HKSAR, 2019). Home or accommodation quarantine for 14 days, daily body temperature, sign and symptoms monitoring are required and electronic wristbands are also worn to monitor the location of who have been isolated (Thematic Website, 2020).

Community prevention

In the late of January government gradually declared to close all kindergarten, primary schools, secondary schools and special schools for community prevention; all amusement parks in Hong Kong including Hong Kong Disneyland Resort, Ocean Park Hong Kong and Madame Tussauds Hong Kong; all facilities of the Leisure and Cultural Services Department (LCSD) including public museums, public libraries, sports centers and venue were also closed to prevent clustering. Home office for working was advised.

Special arrangements for the Hong Kong Diploma of Secondary Education examination, such as widen seating plan, compulsory use of mask and temperature measuring will be implemented to prevent cross infection. On 17th of January 2020, Hong Kong Government prohibited the entry of non-Hong Kong residents who have visited the Hubei Province in the past 14 days since 27th of January 2020 (Thematic Website, 2020). The High-Speed Rail train services have been suspended from 29th of January 2020 and the cross border train station has been suspended from 4th of February 2020 to prevent close contacted high-risk cases to Hong Kong. On 17th of March 2020, the Hong Kong Security Bureau extended the red outbound travel alert to all overseas countries/territories based on public health concerns (Government issues Red, 2020). Hospital Authority (HA) raised the emergency response level to emergency with no visiting, exceptions will be made for clinical consideration and suspended volunteer services or clinical attachment in all public hospitals to prevent further close contact cases on 25th of January (Transport Department, 2020; Hospital Authority, 2020).

Protection on healthcare workers

Every person in a public hospital was required to wear a surgical mask for preventing cross contamination with the emergency response level. Same to SARS conditions, the hospital authority advised using personal protective equipment (PPE) as discussed above. A special allowance as housing allowance (HK\$500/day) was provided for the healthcare staff working in high-risk areas for the purpose of renting accommodation for self-isolation to prevent close contact with their family so as to prevent from spreading to the community (Healthcare staff, 2020).

Conclusion

The causes, transmissions, symptoms and preventive measures of SARS and COVID-19 are reviewed above. However, diagnosis and treatments remain for further study. Polymerase chain reaction for confirming the interaction of SARS or COVID-19 sometimes may show a false negative. There is no specific treatment regimen, only has a broad spectrum of antiviral drugs for COVID-19 patients and no vaccine for prevention at present. Nowadays, personal hygiene and protection are the most important for preventing the spread of COVID-19 such as wearing a mask and washing hands as well as reducing social contact including avoiding crowds, working in home, so on.

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Conflict of interest

All authors declare no competing interests exist.

Ethical approval

Ethical approval is not required.

Appendix A. Supplementary data

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References

- Abdullah ASM, Thomas GN, McGhee SM, Morisky DE. Impact of Severe Acute Respiratory Syndrome (SARS) on travel and population mobility: implications for travel medicine practitioners. *J Travel Med* 2004;11:107–11.

- Barbara Walsh. Sequelae of COVID-19. Retrieved from <https://theunionjournal.com/sequelaeof-covid-19/> (16.03.20).
- Bell DM. Public health interventions and SARS spread, 2003. *J Emerg Infect Dis* 2004;10(11):1900–6, doi:<http://dx.doi.org/10.3201/eid1011.040729>.
- Bell, D. COVID-19: radiology reference article. Retrieved from <https://radiopaedia.org/articles/covid-19-3?lang=us> (11.03.20).
- Biscayart C, Angeleri P, Lloveras S, Chaves T, Schlagenhauf P, RodriguezMorales AJ. The next big threat to global health? 2019 novel coronavirus (2019-nCoV): What advice can we give to travellers? – Interim recommendations January 2020, from the Latin-American Society for Travel Medicine (SLAMVI). *Travel Med Infect Dis* 2020;, doi:<http://dx.doi.org/10.1016/j.tmaid.2020.101567>.
- Bogoch A, Watts A, Thomas-Bachli C, Huber MUG, Kraemer K, Khan K. Pneumonia of unknown etiology in wuhan, China: potential for international spread via commercial air travel. *J Travel Med* 2020;, doi:<http://dx.doi.org/10.1093/jtm/taaa008>.
- Booth CM, Matukas LM, Tomlinson GA, Rachlis AR, Rose DB, Dwosh HA, et al. Clinical features and short-term outcomes of 144 patients with SARS in the greater Toronto area. *JAMA* 2003;289(21):2801–9, doi:<http://dx.doi.org/10.1001/jama.289.21.JOC30885>.
- Bulletin of the World Health Organization. Retrieved from <https://www.who.int/bulletin/volumes/81/8> (04.03.11).
- Carlos WG, Dela Cruz CS, Cao B, Pansnick S, Jamil S. Novel Wuhan (2019-nCoV) coronavirus. *Am J Respir Crit Care Med* 2020;, doi:<http://dx.doi.org/10.1164/rccm.2014P7>.
- Chan KS, Zheng JP, Mok YW, Li YM, Liu YN, Chu CM, et al. SARS: prognosis, outcome and sequelae. *J Respirol* 2003;8:S36–40.
- Chan PKS, To WK, Ng KC, Lam RKY, Ng TK, Chan RCW, et al. Laboratory diagnosis of SARS. *J Emerg Infect Dis* 2004;10(5):825–31, doi:<http://dx.doi.org/10.3201/eid1005.030682>.
- Chang D, Lin M, Wei L, Xie L, Zhu G, Dela Cruz CS, et al. Epidemiologic and clinical characteristics of novel coronavirus infections involving 13 patients outside Wuhan, China. *JAMA* 2020;, doi:<http://dx.doi.org/10.1001/jama.2020.1623>.
- Chen RF, Chang JC, Yeh WT, Lee CH, Liu JW, Eng HL, et al. Role of vascular cell adhesion molecules and leukocyte apoptosis in the lymphopenia and thrombocytopenia of patients with severe acute respiratory syndrome (SARS). *J Microbes Infect* 2006;8(1):122–7, doi:<http://dx.doi.org/10.1016/j.micinf.2005.06.007>.
- Chen NS, Zhou M, Dong X, Qu JM, Gong FY, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 2020;395;, doi:[http://dx.doi.org/10.1016/S0140-6736\(20\)30211-7](http://dx.doi.org/10.1016/S0140-6736(20)30211-7).
- CHP Latest situation of cases of COVID-19. Retrieved from https://www.chp.gov.hk/files/pdf/local_situation_covid19_en.pdf (20.03.20).
- CHP announces latest situations and measures on imported cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202001/23/P2020012300914.htm> (23.01.20).
- CHP investigates three additional imported cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202001/25/P2020012500012.htm> (25.01.20).
- CHP investigates three additional imported cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202001/27/P2020012700049.htm> (27.01.20).
- CHP investigates two additional imported cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202001/29/P2020012900804.htm> (29.01.20).
- CHP investigates three additional cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202002/05/P2020020400729.htm> (05.02.20).
- CHP investigates 10 additional cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202002/09/P2020020900704.htm> (09.02.20).
- CHP investigates 10 additional cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202003/04/P2020030400780.htm> (04.03.20).
- CHP investigates six additional cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202002/11/P2020021100018.htm> (10.02.20).
- CHP investigates seven additional cases of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202002/11/P2020021100773.htm> (11.02.20).
- CHP investigates additional case of novel coronavirus infection. Retrieved from <https://www.info.gov.hk/gia/general/202002/12/P2020021200705.htm> (12.02.20).
- Cinatl J, Morgenstern B, Bauer G, Chandra P, Rabenau H, Doerr HW. Glycyrrhizin, an active component of liquorice roots, and replication of SARS-associated coronavirus. *Lancet* 2003;361(9374):2045–6, doi:[http://dx.doi.org/10.1016/S0140-6736\(03\)13615-X](http://dx.doi.org/10.1016/S0140-6736(03)13615-X).
- Coronavirus Incubation Period. Retrieved from <https://www.worldometers.info/coronavirus/coronavirus-incubation-period> (23.02.20).
- Coronavirus disease 2019 (COVID-19) Situation Report – 60. Retrieved from https://www.who.int/docs/default-source/coronavirus/situation-reports/20200320-sitrep-60-covid-19.pdf?sfvrsn=d2bb4f1f_2 (20.03.20).
- COVID-19 dog case explained. Retrieved from https://www.news.gov.hk/eng/2020/03/20200304/20200304_212513_790.html (04.03.20).
- Elfiky AA. Anti-HCV, nucleotide inhibitors, repurposing against COVID-19. *J Life Sci* 2020;248:117477, doi:<http://dx.doi.org/10.1016/j.lfs.2020.117477>.
- Fujii T, Nakamura T, Iwamoto A. Current concepts in SARS treatment. *J Infect Chemother* 2004;10(1):1–7, doi:<http://dx.doi.org/10.1007/s10156-003-0296-9>.
- Geller C, Varbanov M, Duval RE. Human coronaviruses: insights into environmental resistance and its influence on the development of new antiseptic strategies. *Viruses* 2012;4(11):3044–68, doi:<http://dx.doi.org/10.3390/v4113044>.
- Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et al. Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020;, doi:<http://dx.doi.org/10.1038/s41564-020-0695-z>.
- Government issues Red Outbound Travel Alert on all overseas countries/territories. Retrieved from <https://www.info.gov.hk/gia/general/202003/17/P2020031700577.htm?fontSize=1> (20.03.20).
- Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical characteristics of coronavirus disease 2019 in China. *New Engl J Med* 2020;, doi:<http://dx.doi.org/10.1056/NEJMoa2002032>.
- Guidelines on Prevention of Coronavirus Disease 2019 (COVID-19) for Travellers. Retrieved from https://www.chp.gov.hk/files/pdf/novel_infectious_agent_participants_for_travellers_en.pdf (19.03.20).
- Hanage WP. The next pandemic: on the front lines against humankind's gravest dangers. *J Emerg Infect Dis* 2010;23(12):2123.
- Healthcare staff get special allowance. Retrieved from https://www.news.gov.hk/eng/2020/02/20200224/20200224_164455_542.html?type=ticker (24.02.20).
- HKSAR Department of Health Health Quarantine Facilities Form. Retrieved from https://www.chp.gov.hk/files/pdf/quarantine_centre_en.pdf (08.02.20).
- HKSAR Department of Health Health Declaration Form. Retrieved from <https://hdf.chp.gov.hk/dhehd/?lang=en-us> (08.03.20).
- Ho JC, Ooi GC, Mok TY, Chan JW, Hung I, Lam B, et al. High-dose pulse versus nonpulse corticosteroid regimens in severe acute respiratory syndrome. *Am J Respir Crit Care Med* 2003;168(12):1449–56, doi:<http://dx.doi.org/10.1016/10.1164/rccm.200306-7660C>.
- Hospital authority activates Emergency Response Level. Retrieved from <https://www.info.gov.hk/gia/general/202001/25/P2020012500689.htm?fontSize=1> (25.01.20).
- Huang CL, Wang YM, Li XW, Ren LL, Zhao JP, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;, doi:[http://dx.doi.org/10.1016/S0140-6736\(20\)30183-5](http://dx.doi.org/10.1016/S0140-6736(20)30183-5).
- Hughes JM. Twenty-first century plague “The story of SARS”. *J Clin Invest* 2006;116(4):846, doi:<http://dx.doi.org/10.1172/JCI28377>.
- Hui DSC, Wong K, Antonio GE, Tong M, Chan DP, Sung JY. Long-term sequelae of SARS: physical, neuropsychiatric, and quality-of-life assessment. *Hong Kong Med J* 2009a;15(Suppl. 8):S21–3.
- Hui LV, Vlas SJD, Liu W, Wang TB, Cao ZY, Li CP, et al. Avascular osteonecrosis after treatment of SARS: a 3-year longitudinal study. *J Trop Med Int Health* 2009b;14:79–84.
- Lau JTF, Fung KS, Wong TW, Kim JH, Wong E, Chung S, et al. SARS transmission among hospital workers in Hong Kong. *J Emerg Infect Dis* 2004;10(2):280–6, doi:<http://dx.doi.org/10.3201/eid1002.030534>.
- Lauer GM, Walker BD. Hepatitis C virus infection. *New Engl J Med* 2001;345(1):41–52, doi:<http://dx.doi.org/10.1056/NEJM200107053450107>.
- Lee HS. The SARS epidemic in Hong Kong: what lessons have we learned?. *J R Soc Med* 2003a;96(8):374–8.
- Lee HS. The SARS epidemic in Hong Kong. *J Epidemiol Commun Health* 2003b;57:652–4.
- Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *New Engl J Med* 2020a;, doi:<http://dx.doi.org/10.1056/NEJMoa2001316>.
- Li XW, Geng MM, Peng YH, Meng LS, LU SM. Molecular immune pathogenesis and diagnosis of COVID-19. *J Pharm Anal* 2020b;, doi:<http://dx.doi.org/10.1016/j.jpha.2020.03.001>.
- Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in wuhan China: the mystery and the miracle. *J Med Virol* 2020;92(4):401–2, doi:<http://dx.doi.org/10.1002/jmv.25678>.
- More boundary points to close. Retrieved from https://www.news.gov.hk/eng/2020/02/20200203/20200203_182410_508.html?type=category (03.02.20).
- 2019-nCoV Frequently Asked Questions and Answers. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/faq.html> (03.03.20).
- Pang XH, Zhu ZH, Xu FJ, Guo JY, Gong XH, Liu DL, et al. Evaluation of control measures implemented in the severe acute respiratory syndrome outbreak in Beijing, 2003. *JAMA* 2003;290(24):3215–21, doi:<http://dx.doi.org/10.1001/jama.290.24.3215>.
- Peiris JS, Yuen KY, Osterhaus AD, Stohr K. The severe acute respiratory syndrome. *New Engl J Med* 2003;349:2431–41.
- Peng PWH, Ho PL, Hosta SS. Outbreak of a new coronavirus: what anaesthetists should know. *Br J Anaesth* 2020;, doi:<http://dx.doi.org/10.1016/j.bja.2020.02.008>.
- Pitkäranta A, Nokso-Koivisto J, Jääntti V, Takala A, Kilpi T, Hovi T. Lowered yields of virus-induced interferon production in leukocyte cultures and risk of recurrent respiratory infections in children. *J Clin Virol* 1999;14(3):199–205, doi:[http://dx.doi.org/10.1016/S1386-6532\(99\)00056-6](http://dx.doi.org/10.1016/S1386-6532(99)00056-6).
- Poon LL, Chan KH, Wong OK, Yam WC, Yuen KY, Guan Y, et al. Early diagnosis of SARS coronavirus infection by real time RT-PCR. *J Clin Virol* 2003;28:233–8.
- Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). Retrieved from <https://apps.who.int/iris/handle/10665/70863> (November, 2003).

- Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003. Retrieved from https://www.who.int/csr/sars/country/table2004_04_21 (24.07.15).
- SARS. Retrieved from <https://www.cdc.gov/sars/about/fs-sars.html> (06.12.17).
- So LK, Lau AC, Yam LY, Cheung TM, Poon E, Yung RW, et al. Development of a standard treatment protocol for severe acute respiratory syndrome. *Lancet* 2003;10;361(9369):1615–7, doi:[http://dx.doi.org/10.1016/S0140-6736\(03\)13265-5](http://dx.doi.org/10.1016/S0140-6736(03)13265-5).
- Sung J. Clinical diagnosis and management of SARS. Proceedings of the WHO global conference on severe acute respiratory syndrome (SARS).
- Temporary test centres speed up tests for people upon arrival. Retrieved from <https://www.info.gov.hk/gia/general/202003/19/P2020031900664.htm?font-size=1> (20.03.20).
- COVID-19 Thematic Website, Together, We Fight the Virus, Inbound Travel. Retrieved from <https://www.coronavirus.gov.hk/eng/inbound-travel.html> (08.03.20).
- Tomlinson B, Cockram C. SARS: experience at Prince of Wales Hospital, Hong Kong. *Lancet* 2003;361:, doi:[http://dx.doi.org/10.1016/S0140-6736\(03\)13218-7](http://dx.doi.org/10.1016/S0140-6736(03)13218-7).
- Transport Department announces special arrangements of cross-boundary transport services. Retrieved from <https://www.info.gov.hk/gia/general/202002/03/P2020020300781.htm> (03.02.20).
- Wang W, Tang JM, Wei FQ. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. *J Med Virol* 2020a;, doi:<http://dx.doi.org/10.1002/jmv.25689>.
- Wang ML, Cao RY, Zhang LK, Yang XL, Liu J, Xu MY, et al. Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. *Cell Res* 2020b;30:269–71, doi:<http://dx.doi.org/10.1038/s41422-020-0282-0>.
- Yam WC, Chan KH, Chow KH, Poon LL, Lam HY, Yuen KY, et al. Clinical evaluation of real-time PCR assays for rapid diagnosis of SARS coronavirus during outbreak and post-epidemic periods. *J Clin Virol* 2005;33(1):19–24, doi:<http://dx.doi.org/10.1016/j.jcv.2004.09.029>.
- Yam LY, Lau AC, Lai FY, Shung E, Chan J, Wong V. Hong Kong Hospital Authority SARS Collaborative Group (HASCOG). Corticosteroid treatment of severe acute respiratory syndrome in Hong Kong. *J Infect* 2007;54(1):28–39, doi:<http://dx.doi.org/10.1016/j.jinf.2006.01.005>.
- Yang W, Cao Q, Qin L, Wang X, Cheng Z, Pan A, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): a multi-center study in Wenzhou city, Zhejiang, China. *J Infect* 2020;, doi:<http://dx.doi.org/10.1016/j.jinf.2020.02.016>.
- Zhao S, Lin Q, Ran J, Musa SS, Yang G, Lou YJ, et al. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: a data-driven analysis in the early phase of the outbreak. *Int J Infect Dis* 2020;92:214–7, doi:<http://dx.doi.org/10.1016/j.ijid.2020.01.050>.