Covid-19: HKUMed at the Vanguard

To the many health care and public health workers
who have selflessly given their all to protect and save lives

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HKU
Med

CHANCE FAVOURS THE PREPARED MIND

As 2019 drew to a close over the Christmas break, I had been reflecting on the many demands of the Faculty's huge and unprecedented expansion. Physically, we were in the midst of building new blocks, planning to move whole schools and departments into new premises, and preparing to have more clinical affiliates. We were also grappling with how to accommodate our largest-ever classes and adapt our programmes for that – prophetically, we decided that a key solution was to put more content online – and how to recruit enough world-class researchers and teachers in a competitive market. Our research profile was also reaching new heights with the multi-billion-dollar award we received through the @InnoHK programme.

And then came the COVID-19 pandemic.

Professor Gabriel Leung, Dean of Medicine, The University of Hong Kong

This disease has not dented our ambitions and plans, but it has required us to turn on a dime to respond to demands from our city, our country, our profession and the world – in fact, to put what we have learned into practice. We have had much to offer.

HKUMed is one of the leading research centres in the world when it comes to infectious diseases and pandemics. Our experience with avian/swine/human influenza and SARS, our subsequent investment in growing teams of top-flight infectious disease experts, and our international collaborations with globally-important medical institutions including the World Health Organization, positioned us as the go-to source when news of a new infectious virus started to emerge from Mainland China in early January. Governments sought our input, every major international media outlet (from more than 45 countries and territories) sought our expert comment and latest findings, and the general population sought our guidance on how they could protect themselves against the SARS-CoV-2 virus that causes COVID-19.

We have provided all this and much more. Research firsts include producing the first evidence of human-to-human transmission and, later, of reinfection with a different strain of the virus; the first alert to the world of the likely national and global spread of the disease; and the first epidemiological analyses showing how quickly the disease could spread (the latter, produced with China's Center for Disease Control and Prevention, also recommended quarantine and isolation rules). More than 160 scholarly articles have been published on every aspect of the disease including transmission and diagnosis, treatment and vaccine (in fact, we have a vaccine candidate going to clinical trial), and the animal origins of the virus. Knowledge sharing has extended beyond scientific journals to the World Health Organization, Hong Kong government, and the world's media. We have also endeavoured to help members of the community separate fact from fiction through our social media activities and initiatives such as the #askHKUMed short video series.

Our founding mission was to educate medical professionals for Hong Kong and China, and we have worked very hard to sustain the quality of our teaching and the student experience. We were already moving some lessons online, so we stepped up the pace. We also provided ongoing support and advice to students – some of whom were out of Hong Kong as the pandemic broke – and

pushed forward new ways of teaching, such as developing online bedside teaching. We are likely to see a flourishing of these kinds of innovations moving forward.

None of these things would be possible without the dedication and energy that every member of the Faculty has provided during this period. Many of the adaptations required in teaching and research have required intense team-based work and a reshuffling of research priorities. Many of our staff have also been working in hospitals alongside our graduates and other medical professionals at the frontline, who have been heroic in the face of a moving target.

We will continue to devote resources and effort into tackling COVID-19, but at the same time, our longer-term aims are undiminished. We will continue with our research programmes into other conditions and diseases, continue our programme to build new facilities, and continue to provide our students with a fantastic education that was recently commended in a review by the Medical Council of Hong Kong. The whirlwind of COVID-19 may have upended the whole world, but at HKUMed it has added oil to our engine.

Hopefully, the world can tilt back upright again – vaccines will certainly help and HKUMed is working to make a contribution here – but it should also be acknowledged that we face a new normal. Wearing face masks, practicing hand hygiene and adhering to social-distancing measures in response to intermittent outbreaks are likely to be part of everyday life. The world, and even HKUMed, may not go back to the way we were, but the rapid way in which we have been able to adjust and continue to thrive gives hope that the future can be bright again.

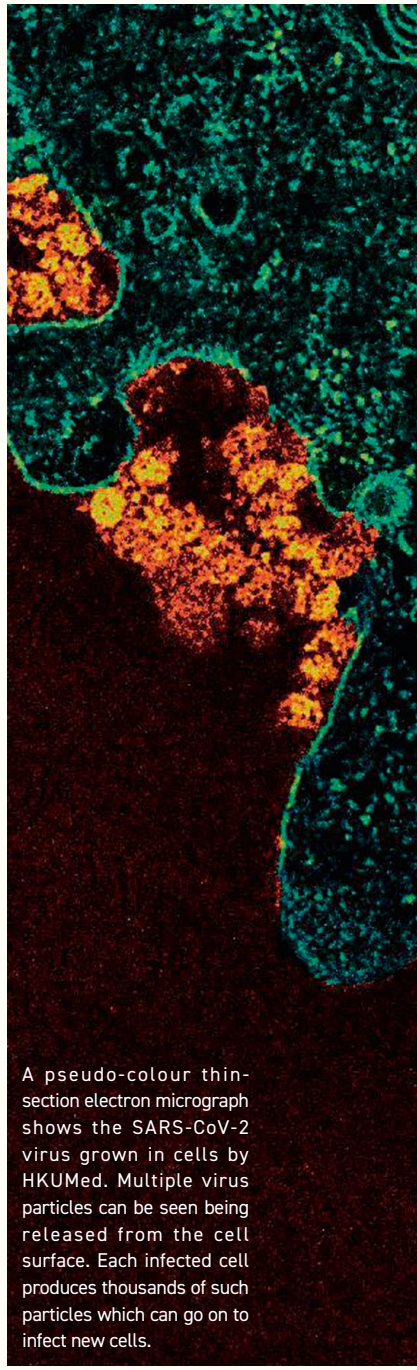
Professor Gabriel Leung,
Dean of Medicine

“禍兮，福之所倚；福兮，禍之所伏。”

——老子《道德經》

世間萬物，福禍相隨，我們最終必定能戰勝疾病，度過難關，苦盡甘來。

LEADING THE QUEST FOR KNOWLEDGE



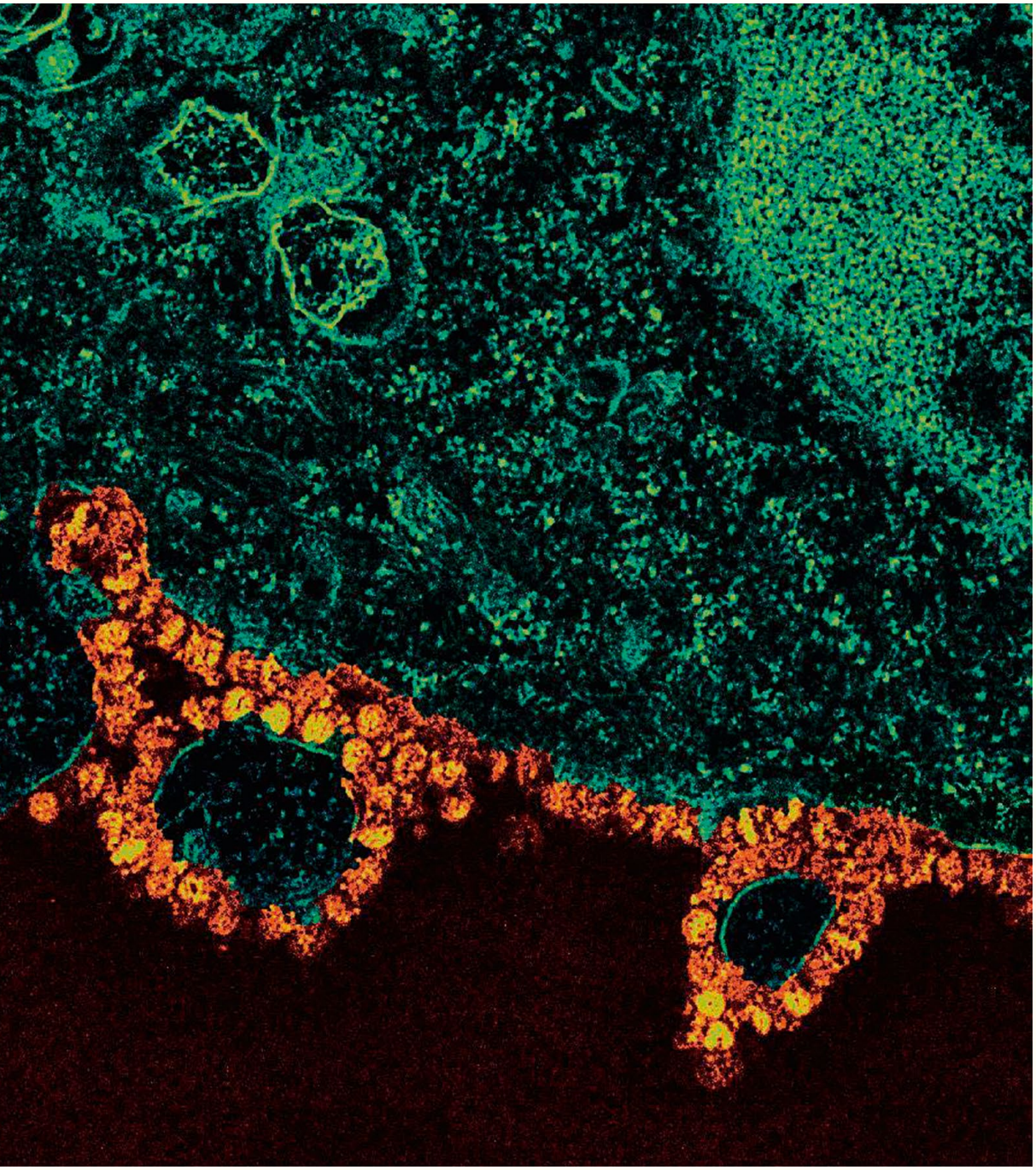
A pseudo-colour thin-section electron micrograph shows the SARS-CoV-2 virus grown in cells by HKUMed. Multiple virus particles can be seen being released from the cell surface. Each infected cell produces thousands of such particles which can go on to infect new cells.

HKUMed researchers have made ground-breaking discoveries about the science of COVID-19 that have informed coping strategies by governments and organisations around the world. We had several world firsts early on that provided critical insights on the transmission and infectious nature of SARS-CoV-2, the virus that causes COVID-19. We have since continued to produce a steady stream of research as our understanding of the virus and pandemic becomes more advanced.

A crucial factor behind our contributions has been our lightning-quick response to the outbreak, honed by years of working on infectious diseases. Our first major test was the 2003 SARS outbreak, after which we recruited new expertise, created new teams, strengthened existing ones, and put a sharp focus on producing scientific evidence about infectious diseases. Our growing research strength in this area has attracted funding success and collaborators from around the nation and the world, including the World Health Organization which established a WHO Collaborating Centre in Infectious Disease Epidemiology and Control (WHO Collaborating Centre) and a WHO Reference Laboratory for H5N1 Influenza in our Faculty, and the State Key Laboratory of Emerging Infectious Diseases. Recently, five @InnoHK hubs led by HKUMed scholars each received hundreds of millions of dollars to pursue cutting-edge research that will, among other things, advance our ability to fight infectious diseases.

Our collective experience and expertise meant that when COVID-19 started to hit the radar in early January, HKUMed scholars were the right people in the right place at the right time – close to the epicentre, but not in harm's way, and able to draw on all the lessons of the past to quickly ascertain the nature of this disease and the virus causing it. Our preparedness helped us to secure a total of HK$97.288 million for commissioned research projects on COVID-19 under the Health and Medical Research Fund by Food and Health Bureau, HKSAR Government, in 2020. The work is ongoing and the key findings to date are described on these pages.

An important feature of our work has



been collaboration. Researchers across disciplines and countries are working against the clock on COVID-19. Within the Faculty, multiple disciplines have been helping to shed light – not only microbiology, pathology and epidemiology, but such disciplines as paediatrics, cardiology, surgery, medicine and biomedical sciences.

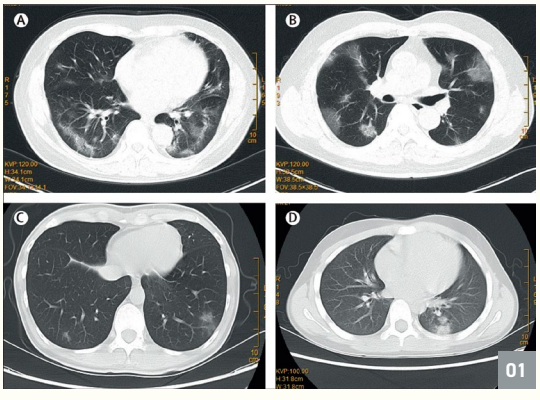
COVID-19 remains a moving target. Outbreaks will continue to happen even in places that previously had the virus under control. Our scholars are continuing to attack this problem from all angles. Stay tuned to HKUMed's website and social media accounts for the latest findings from our COVID-19 research.

As of 30/10/2020

Our researchers unveiled a virus-specific probe and primer to detect the SARS-CoV-2 virus on January 16, only six days after Mainland China had released the virus's genetic sequence. Public health laboratories have since been able to use this test to efficiently pinpoint the presence of the virus in samples.

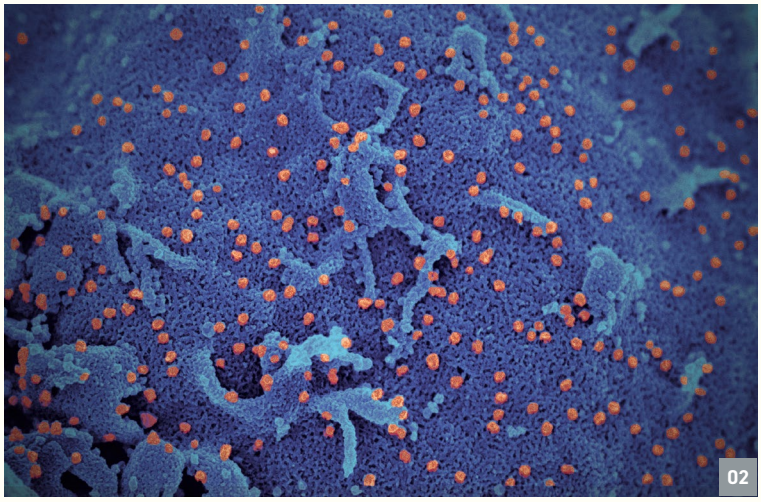
Our "Firsts" on COVID-19

As soon as stories began circulating about a mystery virus in Mainland China in early January, HKUMed scholars were on the case. Within a few weeks, we were able to show what the virus looked like and provide early indications of how it spread:



01

- By mid-January, we had developed a protocol for detecting COVID-19 in suspected human cases which was one of the earliest diagnostic methods shared on the WHO website. Reagents and methods were shared with over 70 countries and territories.
- By the end of January, we reported the first evidence of human-to-human transmission of the virus involving a family case diagnosed and managed at HKU-Shenzhen Hospital.
- By early February, we had documented that the viral shedding profile of SARS-CoV-2 indicated transmission early in the course of the illness, highlighting that it was unlikely to be contained in the way that SARS had been in 2003.
- By early February, we proposed the use of deep throat saliva as a diagnostic specimen type for the detection of SARS-CoV-2.



01 HKU researchers showed that SARS-CoV-2 had infected a Shenzhen family cluster of 6 patients, of whom 5 had travelled to Wuhan. This study is the first demonstration of human to human transmission. The infection can be asymptomatic or mildly symptomatic. Their work included epidemiological, clinical, radiological, laboratory, and genomic studies.

02 A pseudo-colour scan electron micrograph of SARS-CoV-2 grown in culture from a patient isolate. After 24 hours, large numbers of viral particles (orange) appeared on the surface of the cell (blue).

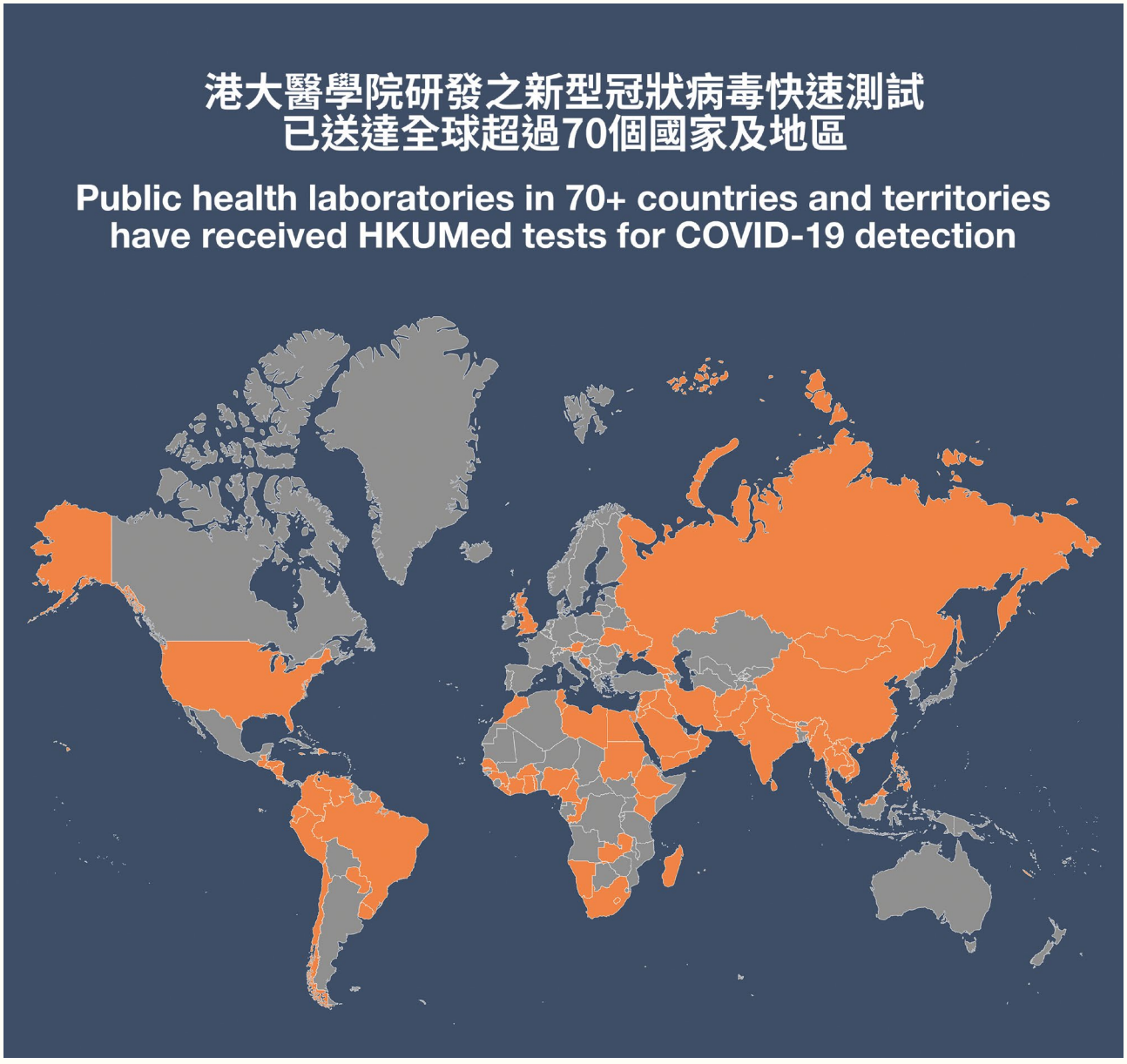
03 Our researchers developed a vaccine candidate based on the established flu-based DelNS1 live attenuated influenza virus (LAIV) platform. It was one of five vaccine technologies selected by China's Ministry of Science and Technology for further evaluation.

- Some of the first electron microscope images of the SARS-CoV-2 virus came from HKUMed labs working with the Faculty of Engineering, which helped other researchers and medical professionals to identify the virus in their own work.
- Two studies produced through the WHO Collaboration Centre alerted the world to the pandemic and the threat it posed, based on the pattern of case arisings in the first half of January. One study analysed the transmission dynamics of infection and provided rules for quarantine and isolation (the Chinese Center for Disease Control and Prevention also participated), the other study modelled and forecast the spread of infection across Mainland China and the world through a mathematical dispersion model. The projections, produced in late January, were in many ways materialised.
- We also showed that China's nationwide aggressive control measures halted the first wave of COVID-19 in provinces outside Hubei province, the epicentre of the epidemic. And we were the first to model the potential adverse consequences of prematurely relaxing interventions, showing how such a decision might lead to a subsequent wave of COVID-19.

Later, in early May, we showed that the triple combination antiviral therapy of interferon beta-1b, lopinavir-ritonavir and ribavirin could effectively suppress the SARS-CoV-2 viral load and cytokine, which resulted in the earlier clinical improvement and discharge of COVID-19 patients.

By the end of summer 2020, HKUMed scholars were also the first in the world to document that a patient previously recovered from COVID-19 had been reinfected with SARS-CoV-2. Samples taken from the patient at each time of infection were compared and shown to be two different lineages of the virus.

The world's first nasal spray COVID-19 vaccine was also given the green light for human clinical trials in September. This flu-based vaccine is being developed by the State Key Laboratory of Emerging Infectious Diseases in partnership with Xiamen University (see Treatments and Targets, page 18).



Diagnosing the Disease

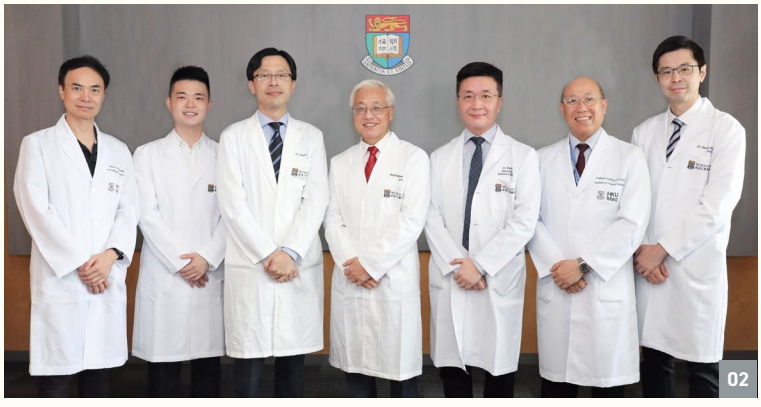
COVID-19's manifestation in patients is now well-known, such as the loss of smell and the fact it is infectious before symptoms appear. HKUMed scholars have contributed to that understanding and are working to identify potential targets for treatment and vaccine.

» To detect COVID-19 virus in patients, we developed rapid nucleic acid amplification tests that were quickly circulated and, by mid-March, had been used by public healthcare laboratories in more than 70 countries and territories.

» We showed that deep throat saliva samples, especially if taken early in the morning, were highly sensitive and effective for diagnosis.

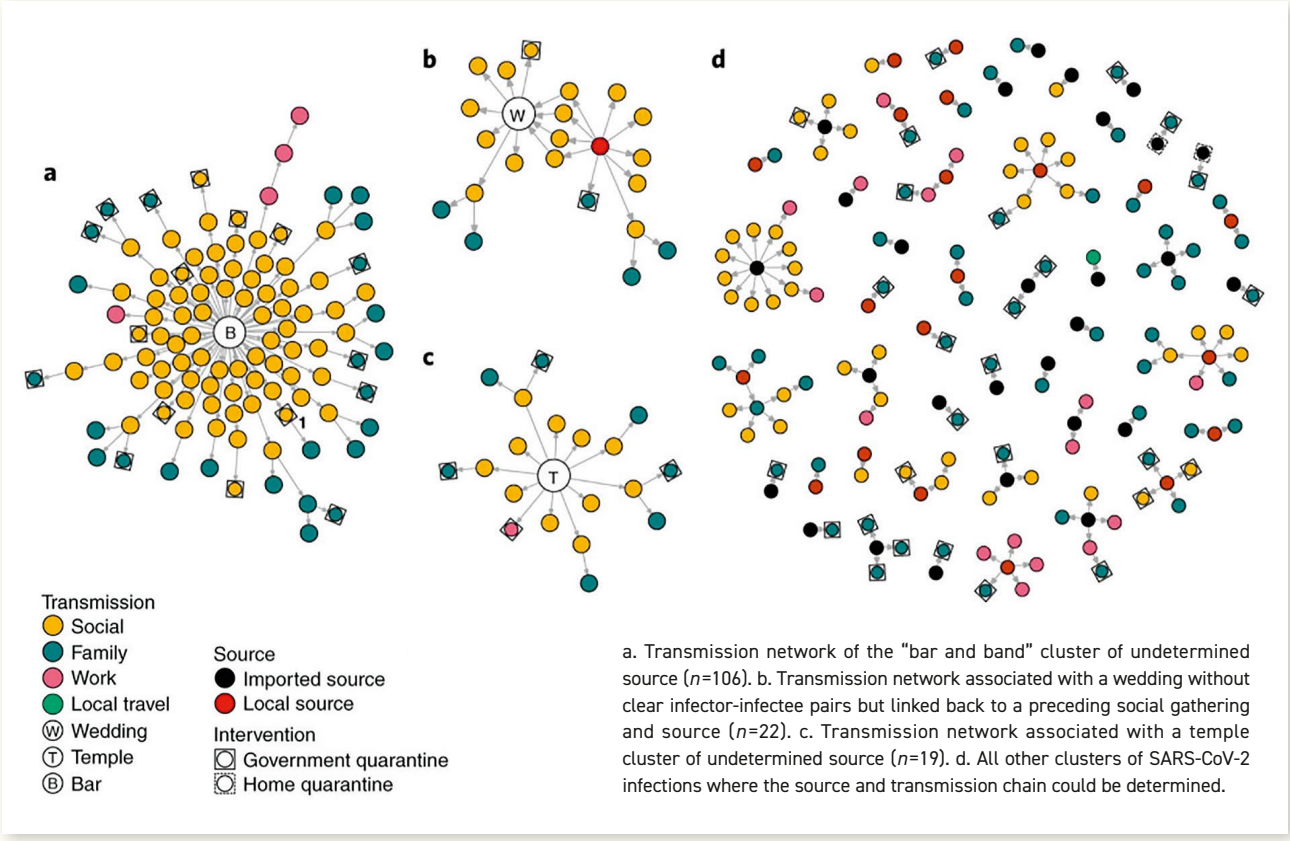
01

- Temporal profiles of the viral load in posterior oropharyngeal saliva samples and serum antibody responses in infected patients suggested that the load was highest near presentation and the serological assay could complement RT-qPCR for diagnosis.
- Viral load was also identified as a potential marker for assessing disease severity and prognosis, after a study of samples showed the viral load to be much higher in severe cases.
- The loss of the sense of smell was explored and a mechanism discovered that may explain this temporary symptom in patients. It was also shown that loss of smell is a common symptom and may, in some cases, be the only symptom. We also demonstrated that SARS-CoV-2 could infect and damage the olfactory sensory neuron of hamsters.
- The gastrointestinal effects of COVID-19 were found to be slightly more prevalent in children than adults, especially children aged under two years. This study provided further evidence that this may be a route of infection. In addition, the enteric involvement of COVID-19 was verified in human intestinal organoids, an ex vivo human intestinal organ tissue culture model, and our golden Syrian hamster model (see Treatments and Targets, page 18).
- Based on evidence from Wuhan, the overall fatality rate of patients with symptoms was estimated to be about 1.4 per cent in a study published in March – well above the rate for seasonal flu. HKUMed scholars also identified groups at greater risk of dying after developing symptoms, and of being infected.
- Auto-antibodies that attack the immune system were detected in more than one in 10 people who developed severe COVID-19, regardless of age and pre-existing medical conditions. The international study, which includes HKUMed scientists, found another 3.5 per cent of patients had genetic diseases called inborn errors of immunity. The findings explain why some patients suffer a more severe disease than others of the same age.


02

01 Our research team discovered a mechanism that may explain the temporary loss of smell in COVID-19 patients by using a golden hamster model.

02 A study on infected children in Wuhan, conducted with a research team from there, found that nearly 14% had gastrointestinal symptoms and that SARS-CoV-2 virus could be detected in the stool samples in about 35% of patients with or without any GI symptoms.



a. Transmission network of the "bar and band" cluster of undetermined source (*n*=106). b. Transmission network associated with a wedding without clear infector-infectee pairs but linked back to a preceding social gathering and source (*n*=22). c. Transmission network associated with a temple cluster of undetermined source (*n*=19). d. All other clusters of SARS-CoV-2 infections where the source and transmission chain could be determined.

"Superspreading" was shown to be a feature of COVID-19 in a study that used contact tracing data to identify all clusters of COVID-19 in Hong Kong from January 23 to April 28.

Tracking Transmission

The rapid transmission dynamics of the disease have been a focus of our work from the outset. Since publishing early findings in January on the spread of the disease, described on page 10, we have continued to deepen knowledge about the infectiousness of SARS-CoV-2 and how it might be controlled.

» Some patients infected with COVID-19 were shown to be shedding the virus 2-3 days before the first symptoms appear – an early and important finding concerning infectiveness.

» The eyes were singled out as an important route of infection after a study showed SARS-CoV-2 can infect human airways and eyes more efficiently than SARS. SARS-CoV-2 was also detected in the conjunctival secretions of patients without ocular symptoms, suggesting this is a possible route of transmission.

» Prolonged survival of the virus on smooth surfaces highlighted that the virus may be transmitted indirectly via contaminated fomites and hands.

» Shedding of the infectious virus was shown to occur for at least 9-10 days after the onset of symptoms, a finding that led the Hong Kong Hospital Authority and WHO to amend their policy on discharging patients from hospital isolation.

» The prevalence of the disease in the population has been the subject of several studies. One study found 3.8 per cent of Hong Kong residents returning from Hubei in February/March 2020 were asymptomatic carriers of the virus. Another estimated that the early spread of the pandemic in Wuhan and Seattle was far more extensive than initially reported, based on a comparison between influenza cases and confirmed COVID-19 cases.

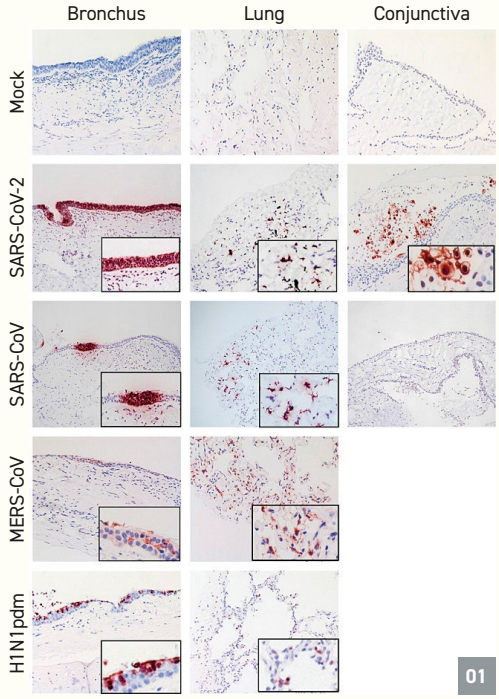
» Asymptomatic cases were also found among passengers quarantined on a cruise ship, based on seroprevalence and virus shedding there, adding more evidence to the challenge of infection control.

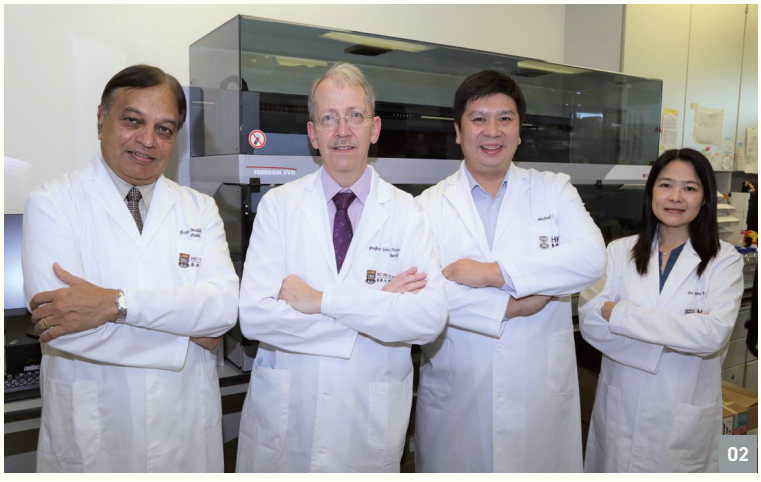
» In the environment around hospitalised patients with SARS-CoV-2, patients' phones were found to be the most contaminated with the virus, followed by their bed rails and toilet door handles.

» A new wave of infections in Hong Kong in summer 2020 was shown to be caused by two unique clusters of SARS-CoV-2 that were both closely related to imported strains. This suggested the outbreak was likely not precipitated by silent carriers from previous waves.

» Superspreading events, in which a few infected patients infect many people, were identified in a study of 1,038 SARS-CoV-2 cases who were confirmed between January 23 and April 28. HKUMed researchers estimated 19 per cent of the cases seeded 80 per cent of local transmission.

» Proof of in-flight transmission aboard aircraft was provided in September when an international team of researchers, including HKUMed, showed that four patients confirmed with the virus after a 15-hour flight had identical viral genomes and were not all likely to have encountered each other before the flight.



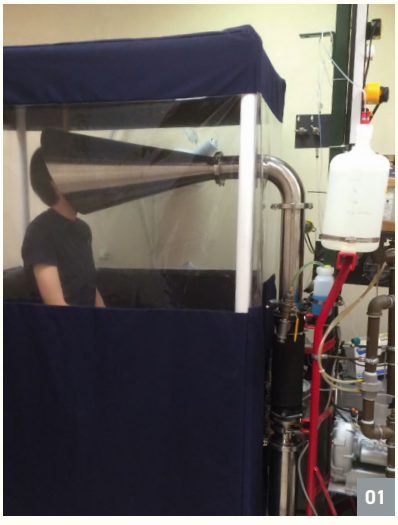


01 The SARS-CoV-2 virus was shown to infect human airways and eyes more efficiently than SARS-CoV, implying that the eyes may be an important route of SARS-CoV-2 infection.

02 Over the past 15 years, researchers in the School of Public Health have developed methods for culturing human tissues in the laboratory and applying them to study a range of respiratory viruses, such as avian flu H5N1, H5N6, H7N9, H1N1 and MERS-CoV, as well as SARS-CoV-2.

Testing, contact tracing and population behavioural changes — measures which have less disruptive social and economic impacts than total lockdown — were shown to meaningfully control COVID-19.

Controlling through Non-Drug Measures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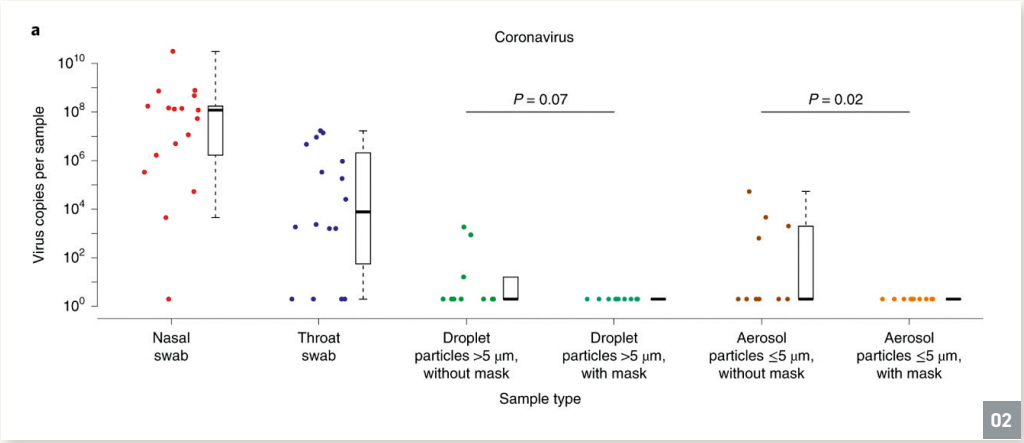
While drug treatments and vaccines are necessary protections against the disease, the best and often only option for individuals and communities at this stage is to halt COVID-19's spread through non-pharmaceutical measures. HKUMed has been researching such measures for years in relation to controlling other diseases and we continued to provide evidence on the effectiveness of this approach.

» Face masks were confirmed to help limit the transmission of pre-COVID-19 respiratory viruses from symptomatic people. The finding, based on research underway before the pandemic started, was published in April and attracted significant coverage from social media and mainstream news outlets around the world.



02

» We were also the first group in the world to demonstrate experimentally that surgical mask partition can effectively reduce COVID-19 transmission between hamsters. Using epidemiological data from Hong Kong, we also showed that transmission tends to occur significantly more often in settings where masks are taken off, such as eateries and bars.

» In terms of the effectiveness of social restrictions, the Hong Kong government's response during the first wave of COVID-19, which did not involve a total lockdown, was considered to have had a meaningful impact based on a sharp drop in cases of another easily-transmitted disease, influenza. The government relied on testing for COVID-19, contact tracing and population behavioural changes, which have less disruptive social and economic impacts than total lockdown.

» Nonetheless, tougher measures were shown to be effective, too. A study of 54 countries and four epicentres found that national containment measures, such as stay at home orders, curfews and lockdowns, lowered the daily increase in new cases to less than five per cent within one month.

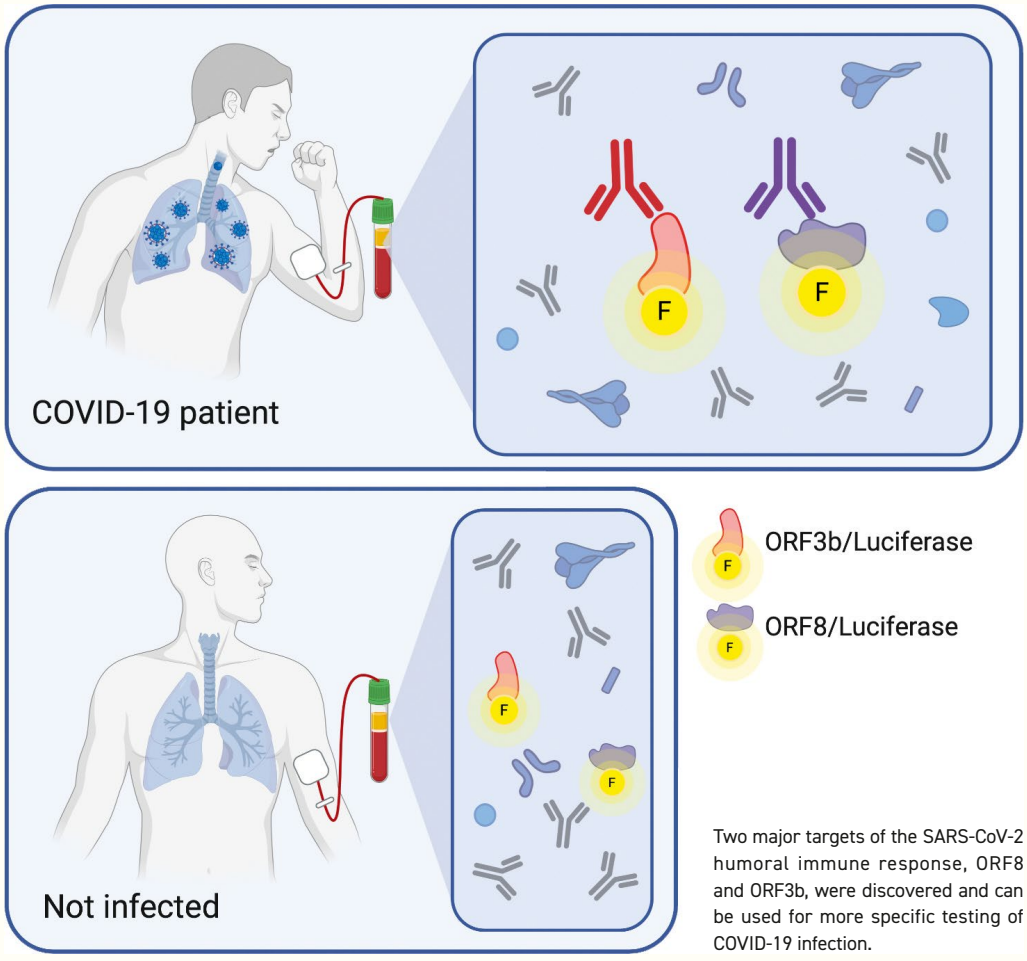
» Better identification and isolation of cases early on in the pandemic was also shown to reduce the chance of transmission later on. The serial interval of cases – used to measure transmission – was cut by more than half, from 7.8 days on January 9 to 2.6 days by February 13.

» Air sampling for SARS-CoV-2 around hospitalised patients in negative-pressure facilities demonstrated that SARS-CoV-2 RNA was not detectable by air samplers.

03

01-02 Surgical face masks were demonstrated to prevent transmission of seasonal coronaviruses, in a study that had 246 participants with suspected respiratory viral infections breathe into a machine and measured exhaled virus levels with and without a mask.

03 HKUMed researchers showed that the serial interval of infection – from when one infected person starts to show symptoms to when the next person infected becomes symptomatic – was shortened by nonpharmaceutical interventions.



Two major targets of the SARS-CoV-2 humoral immune response, ORF8 and ORF3b, were discovered and can be used for more specific testing of COVID-19 infection.

Treatments and Targets

HKUMed has been exploring a range of molecular pathways for treatments and potential vaccines, as well as developing effective means to develop and test them. It also has a vaccine under trial.

Lab-based tools and insights

» An important early need was to find animal models that were suitable for COVID-19 research. HKUMed scholars developed a golden Syrian hamster model in which SARS-CoV-2 infection and transmission resembles that found in humans and which is more physiological than transgenic mice models and more accessible than macaque models. This has enabled researchers to explore a number of treatment and vaccine options. For instance, one study found that when plasma from recovered hamsters was injected into infected hamsters, it reduced their lung viral load by 10 times.

» Researchers also used a human lung explant model to demonstrate that SARS-CoV-2 virus has low induction of interferons with higher transmissibility than SARS-CoV, and presented with milder symptoms.

» SARS-CoV-2 virus tropism, replication kinetics and cell damage were also studied

and compared with SARS-CoV, providing new insights on COVID-19's reduced disease severity, mortality and diarrhoea incidence, but higher transmissibility.

- The screening of broad-spectrum host-based antivirals identified interferon and lipogenesis pathways as a main treatment option for COVID-19.
- Human brain organoids and human neural progenitor cells were another part of our testing kit and we were the first to discover that SARS-CoV-2 could infect these, too, and thus enter the human central nervous system.
- We provided the first comprehensive cell-line tropism report, demonstrating the tissue and species tropism of SARS-CoV-2.
- The human immune response to SARS-CoV-2 has also been probed. One study showed that the levels of bacterial products released in infected human plasma correlated with disease severity and that the virus evaded the innate host responses normally marshalled to combat virus infections.
- Potent neutralising antibodies against multiple epitopes on the SARS-CoV-2 spike protein were identified as promising monoclonal antibodies for therapeutic/prophylactic agents against SARS-CoV-2.
- Stronger antibody responses were also found to be associated with more severe COVID-19, including the neutralising antibody response. Systematic neutralising antibodies may be insufficient for inhibiting SARS-CoV-2 infection at the mucosal portal of viral entry. Acute SARS-CoV-2 infection also results in broad immune cell reduction and functional impairment, including both dendritic cells and T cells. While neutralising antibodies are rapidly generated, antigen-specific T cells are delayed at the acute stage of infection.
- We identified two novel virus protein targets, ORF8 and ORF3b, which facilitate antibody testing for COVID-19.

Treatment and vaccine development

- A finding that acute SARS-CoV-2 infection impaired human immune defences pointed to treatment that could jump-start the immune response, in particular the early use of drugs with immune-boosting and antiviral properties.
- An international study involving HKUMed also identified 13 existing antiviral drugs with effective enough concentrations to be potential therapeutic treatments for COVID-19 patients, from a field of 12,000 such drugs. The advantage of this approach is that many of these drugs have already been tested in clinical settings for other purposes.

HKUMed researchers found that acute SARS-CoV-2 infection was shown to impair human immune defences, with significant implications for viral transmission, disease severity and vaccine research.

» The clinically approved metallodrug ranitidine bismuth citrate was found to have potent antiviral activity against SARS-CoV-2 through inhibition of the viral helicase and possibly other mechanisms.

» Potential targets for drugs were also identified. Neutralising monoclonal antibodies were discovered that may have potential for the development of antibody-based drugs, as they were potent actors against SARS-CoV-2 in vitro and in infected hamsters.

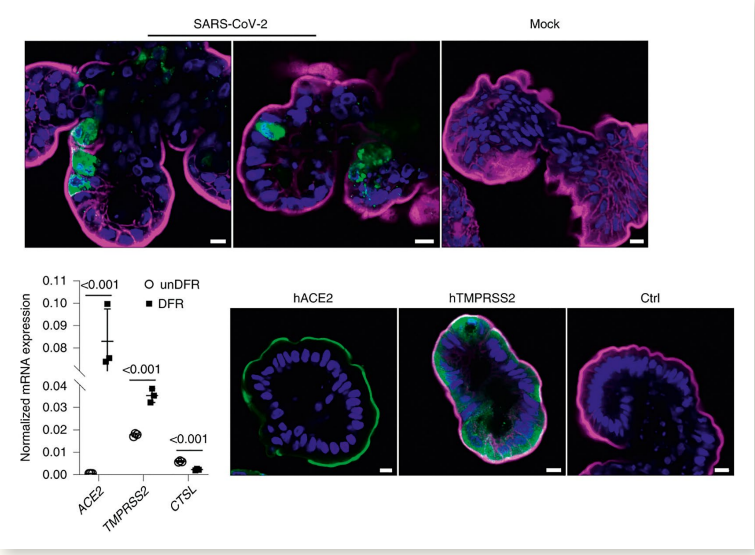
» Among potential treatments tested, a triple combination treatment was found to be safe and highly effective, in a randomised phase 2 trial, in suppressing the viral load and shortening the duration of virus shedding, decreasing the cytokine response and resulting in earlier clinical improvement and hospital discharge. The treatment included interferon beta-1b, lopinavir-ritonavir and ribavirin, in which interferon beta-1b was the backbone of the treatment.

» Broad-spectrum treatments, that would attack not only SARS-CoV-2 but other viruses, have also been explored. A vulnerable target for broad-spectrum antivirals has been identified, the YxxØ-motif. And a broad-spectrum peptide targeting virus and host was shown to be effective against pH-dependent respiratory viruses, which include influenza viruses and SARS-CoV-2.

» The influenza-based nasal spray COVID-19 vaccine developed by a HKUMed team involved establishing and utilising a DelNS1 live attenuated influenza virus platform to construct a COVID-19 vaccine targeting the receptor binding domain of SARS-CoV-2. A vaccine candidate was approved for clinical trial in September 2020, in collaboration with vaccine manufacturers in Mainland China, and further collaboration is underway on its clinical development.

» Another vaccine candidate has also been established, a PD1-based DNA vaccine encoding the receptor binding domain of SARS-CoV-2. This vaccine has been successfully licenced for industry collaboration and received funding support from Shenzhen and Hong Kong for clinical trials.

» Eight potent human monoclonal neutralising antibodies have been cloned for future passive immunisation therapy.



Our research team established the world's first bat intestinal organoids for successful infection by SARS-CoV-2 which implicates bats as the origin of this novel virus. The bat and human organoids will serve as a model system for understanding interspecies jumping.

01 Pangolins were identified as carriers of a coronavirus that is highly related to the human SARS-CoV-2 virus, bringing us closer towards identifying the virus's source.

02 SARS-CoV-2 was shown to multiply rapidly in bat intestinal cells grown in a laboratory. These bat cells are useful to study the trans-species jumping potential of bat viruses.

Adding to Our Knowledge of the Virus

The animal origins of SARS-CoV-2 and its manifestation in humans is still not wholly understood. Our researchers have been tackling this angle, too.

- The origins of the virus have been the subject of several HKUMed studies. One discovered SARS-CoV-2-related coronaviruses in Malayan pangolins seized in anti-smuggling operations in southern China, while another showed that the SARS-CoV-2-related coronavirus has likely been circulating unnoticed in bats for decades. Yet another study found bat-like SARS-CoV-2PRRA in human COVID-19 patients, shedding light on the animal origins and natural evolution of the virus. And the first organoid culture of bat intestinal epithelium was established, which supports robust replication of SARS-CoV-2. This supports the hypothesis of a bat origin for SARS-CoV-2.
- The infection of pet dogs with SARS-CoV-2 was demonstrated for the first time indicating that the virus may potentially infect peri-domestic animals. Cats were subsequently also found to have been infected by humans.
- HKUMed scholars also addressed the political and economic dimensions of the public health challenges posed by COVID-19 through analyses of the international governance structures needed to address the threat.
- An HKUMed scholar was also part of an international group that classified and named SARS-CoV-2.

photo courtesy of Agriculture, Fisheries and Conservation Department, HKSAR Government

01 image courtesy of Information Services Department, HKSAR Government

02 photo courtesy of Information Services Department, HKSAR Government

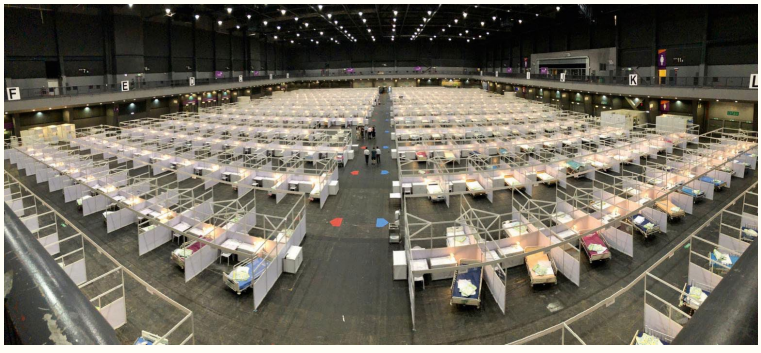
Contributing to Decision-making

The expertise of HKUMed scholars has been sought by local and international organisations throughout the year. Key highlights include:

- Professor Gabriel Leung, Dean of Medicine, and Professor Yuen Kwok-yung were appointed to the 25-member World Health Organization (WHO)-China Joint Mission to the Mainland, which visited five cities over two weeks in February to assess the state of the epidemic there and the effectiveness of its response.
- Professor Leung and Professor Yuen have also been appointed members of the Chinese National Experts Group.
- Professor Leung co-convenes the WHO research group on the epidemiology of COVID-19.
- Professor Leung has provided expert input to the governments of Canada, Chile, Malta, New Zealand, Singapore, Thailand and the UK, as well as supranational agencies including the Asian Development Bank, Bank of International Settlements and WHO.
- Professor Leung, Professor Yuen, and Professor Keiji Fukuda of the School of Public Health have all been appointed to the Hong Kong government's four-member expert advisory group on COVID-19.
- Professor Yuen has inspected sites of COVID-19 outbreaks in Hong Kong with the Hong Kong Hospital Authority (HA) more than 10 times, including the Princess Diamond cruise ship, markets, restaurants, bars, gyms, residential estates, elderly homes, and hospitals.
- Professor Ivan Hung Fan-ngai was involved in designing the treatment and discharge protocol for COVID-19 patients in all HA hospitals. He was also involved in setting up the admission, monitoring and discharge protocol for the Asia World-Expo (AWE) Community Hospital. He and his team also worked with other infectious diseases specialists to provide a consultation service to the AWE team.
- Professor Malik Peiris and Professor Leo Poon helped the HA to establish evidence-based patient discharge criteria.
- Professor Peiris and Professor Poon also served as WHO experts in advising laboratory diagnosis of COVID-19.

01 Professor Gabriel Leung joined a COVID-19 press conference held by the Hong Kong SAR Government on January 25, 2020.

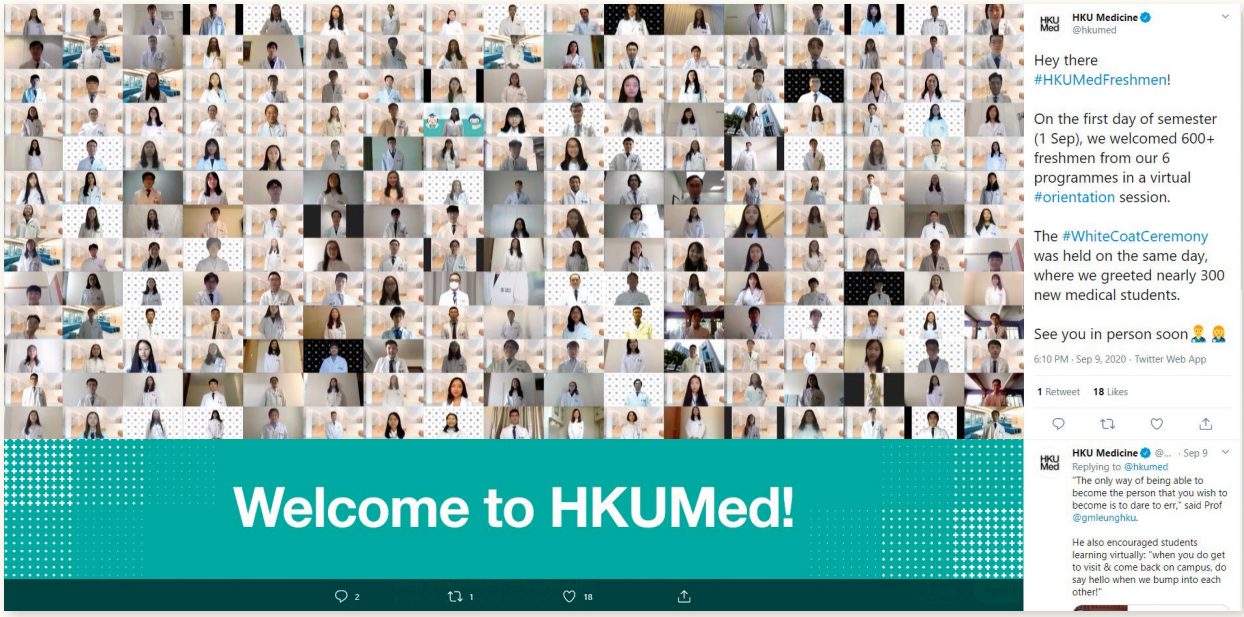
02 Professor Yuen Kwok-yung visited wet markets in Hung Hom and To Kwa Wan after several people who contracted COVID-19 were linked to these facilities.



HKUMed scholars helped to devise Hong Kong's first makeshift COVID-19 hospital, located at AsiaWorld-Expo, to treat patients aged 18 to 60, except those in an unstable or severe condition.

As of 30/10/2020

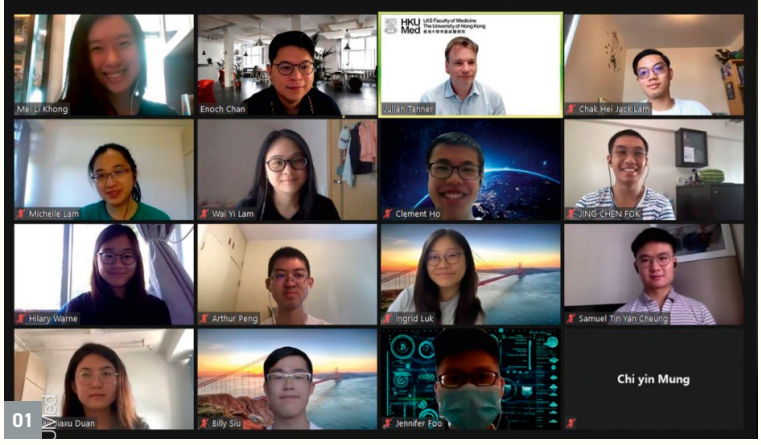
STAYING THE COURSE



HKUMed provides a world-class education for our students, which has been invigorated in recent years with initiatives to meet the demands of 21st century medicine and healthcare, such as interprofessional training, use of new technologies and programmes to deepen students' appreciation of the person behind the disease. Fortuitously, some of these efforts have helped us to deal with the disruptions caused by COVID-19.

Most of our teaching programmes are based on face-to-face contact, whether in the classroom, laboratory bench or hospital bedside. Much of this became impossible when the pandemic took hold, yet we had already been building experience with online and virtual learning. In the autumn semester of 2019, we began experimenting quite aggressively with online teaching because our rising student numbers were eclipsing the seating capacity of our largest theatres, and we had converted 57 per cent of first-year didactic lectures in the MBBS programme to online formats. We had also developed simulation laboratories in recent years, such as a virtual anatomy laboratory, that could be transformed to online purposes. COVID-19 has accelerated these trends, and more.

Early in the year, just as the outbreak was beginning to spread beyond Wuhan, HKUMed and all of HKU made a swift transition to safe learning – which meant moving almost all learning online. Since then, all HKUMed undergraduate lectures have been recorded and professionally edited and made available online.



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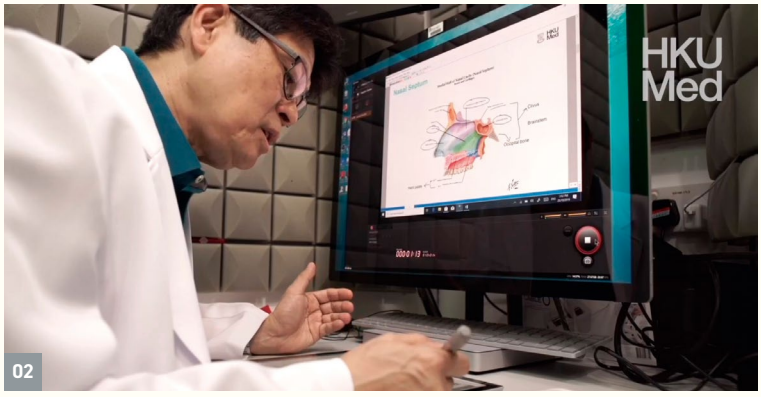


02

Online Innovations

Various teams and individuals have worked very hard to ensure students in all programmes continue to receive a high-quality education and rigorous training in their disciplines. Although we are moving back to face-to-face teaching as much as possible, the outbreak has propelled us to turn our earlier experiments into something more substantial.

Some of the highlights include:

» **Online medical apprenticeship.** Zoom enables students to submit questions during lessons, which generates discussion just as in in-person clinical rounds. It also opens an avenue for collaborative teaching with overseas institutions. A joint grand round was organised with the University of Ottawa, giving students virtual exposure to a non-local setting.

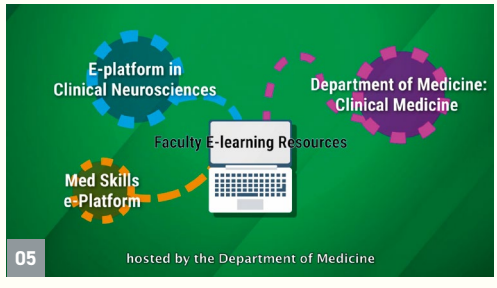

04


03

» **Virtual reality for anatomy teaching.** This was already in place prior to COVID-19 and that early start has paid off. VR has made it possible to continue cadaver-based anatomy teaching throughout the pandemic and to bring in innovations, such as gamification, to deepen student engagement.

» **Telemedicine in clinical education**. Bedside teaching was converted to web-side teaching, a move that not only enabled learning to continue but provided an opportunity to train students in telemedicine – a format that is likely to grow in future and requires different kinds of skills from bedside consultations. A Teaching Development Grant has now been awarded to formally introduce telemedicine to the MBBS curriculum.

Alongside these innovations, the Faculty provided regular updates to staff and students on teaching and learning arrangements in line with the University's Task Force on Infectious Diseases and our own requirements. Special notifications were sent to students in their clinical and final years and those on their Enrichment Year abroad.



05

01 Whether in a face-to-face or virtual class, our teachers aim to develop a collaborative learning culture that fosters deep understanding and intellectual exchange.

02-03 HKUMed had developed a robust and innovative e-learning strategy well before the onset of the COVID-19 pandemic, as well as introducing VR.

04 To minimise risk, we advise students to stay vigilant at all times by following the universal precautions in infection control. Here, a handshake is transformed into an elbow bump.

05 Our rich and high quality e-learning resources offer students the flexibility to learn at their own pace and time, individually or together with fellow students.

Safe In-person Examinations

HKUMed sailed through the significant challenge posed by the COVID-19 pandemic in conducting in-person statutory examinations for professional degrees in spring/summer 2020. All examinations were successfully held to the required standards without a single case of cross-infection.

Stringent infection control protocols were developed for the MBBS Final Summative Assessment, with nine written and five clinical examinations held during the April-May peak of the pandemic. All students and staff members involved had to submit a health declaration form one day before each examination; only those with no issues declared could take part. In addition to universal precautions, all personnel also had their body temperature measured by nurses at the venue on the day of the examination. In the examination halls, candidates' seats were separated by a two-metre radius to ensure safe distancing. There were also medical doctors stationed on site to oversee the infection control measures.

For clinical examinations involving physical contact, a PCR test was arranged for participating members of the public, staff and students a couple of days in advance of the examination, giving all participants a further level of protection and reassurance. In cases where students were initially barred from the examination but subsequently found to be COVID-19 negative, most were scheduled to sit the examination early as their first attempt. A total of 195 MBBS graduates passed the qualifying examinations and proceeded to internships in July 2020.

The same infection control measures were adopted in subsequent examinations for Chinese Medicine, Nursing, Pharmacy, and junior MBBS students, which were held over the summer. In total, more than 1,000 PCR tests were performed for various examinations.

MOOCs

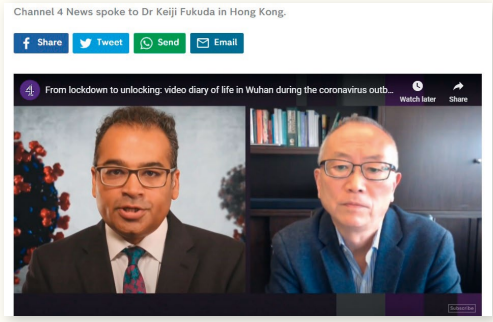
HKUMed has four MOOCs (massive open online courses), which provide the public with free access to specially designed classes led by our professors. Before the pandemic, two MOOCs had been launched, Epidemics I and Epidemics II, and since then Epidemics III and IV have been introduced with COVID-19 content, featuring top instructors in HKUMed as well as some of our international collaborators. Together, the four courses provide an accessible overview of the fundamental scientific principles underlying epidemics and the public health responses to prevent and control them.

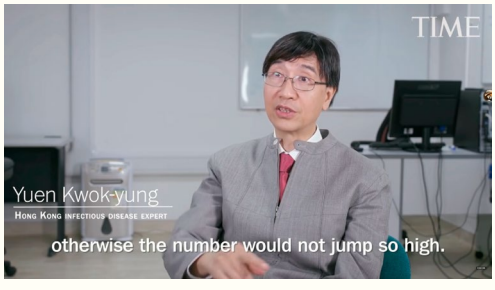
As of 30/10/2020

HKUMed's first press conference on COVID-19 was held on January 21, 2020.

A COMMUNITY ASSET

To combat the "infodemic" of misinformation about COVID-19, HKUMed has been providing evidence-based information to governments and international organisations, disseminating information through our website and in media outlets around the world, reaching out to the community through social media, and providing materials to help individuals and organisations better understand how to protect themselves against this disease. Our aim is to share our know-how and expertise as widely as possible.

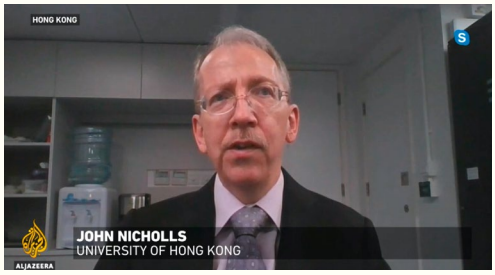




In the News

The media interest in our experts' views and research has been phenomenal. From mid-January 2020, news agencies, television and radio stations, newspapers, magazines, journals and other outlets from all five continents have been contacting and quoting HKUMed on a daily basis. More than 10,000 media stories and news clips featured our Faculty by the end of the summer.

The sheer volume of this coverage is breathtaking, reaching billions of readers/viewers worldwide, especially considering HKUMed is a small faculty by the standard of other international institutions of comparable quality. But we have given priority to providing evidence-based information to as many people as possible in order to promote a rational response to this pandemic.

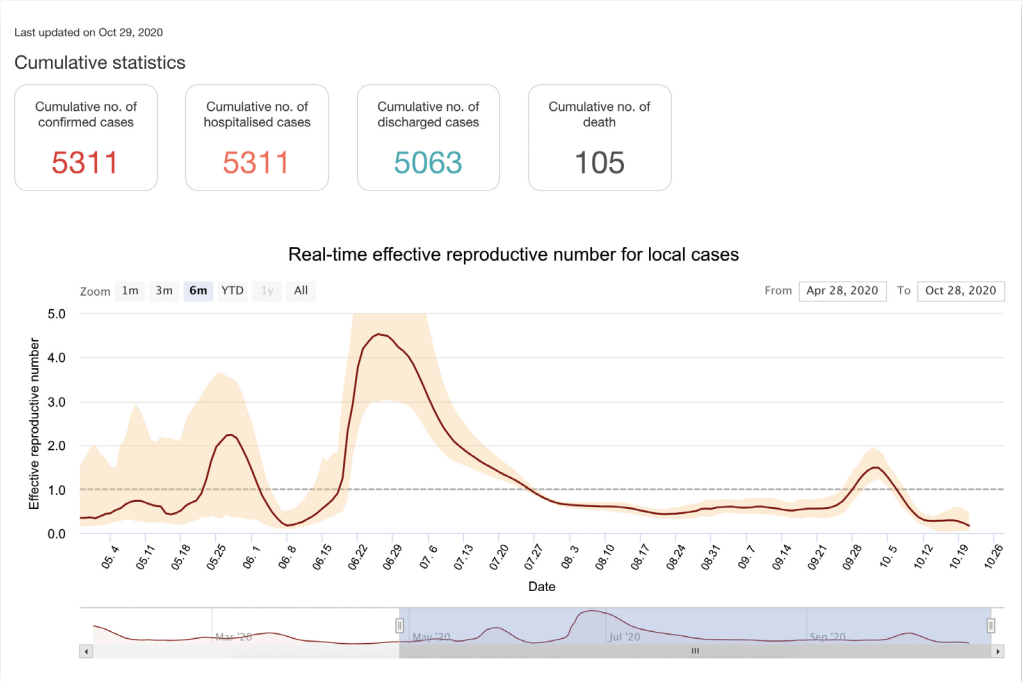


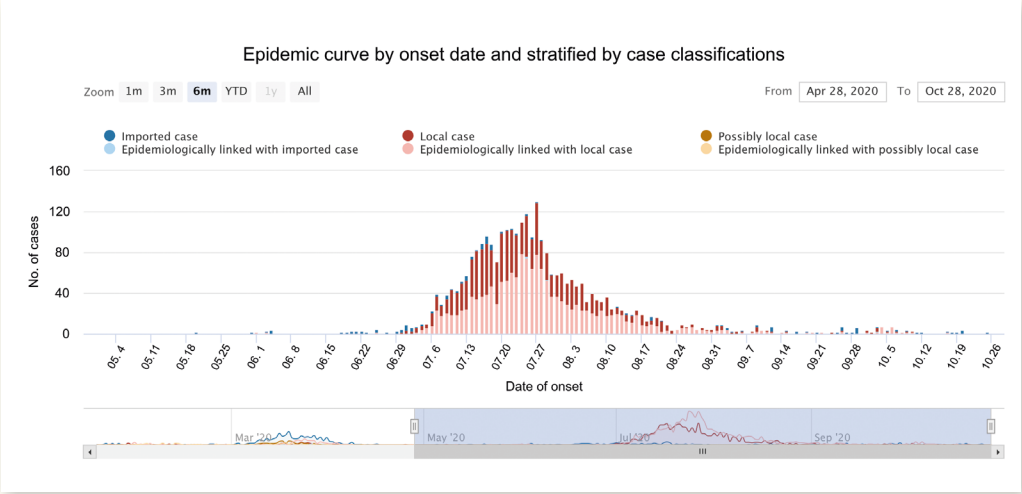
» **Media outlets:** Hundreds of interviews have been given to local and international media by HKUMed experts (including, for example, Professors Ben Cowling, Keiji Fukuda, Ivan Hung, Jin Don-yang, Gabriel Leung, John Nicholls, Malik Peiris, Leo Poon and Yuen Kwok-yung); opinion pieces have also been contributed.

» Outlets include some of the top news organisations in the world, such as BBC, CNN, CCTV, NHK, Al Jazeera English, Reuters, Der Spiegel, The Financial Times, La Repubblica and The New York Times. A full list is on pages 34-35.

» The School of Public Health and HKU Journalism and Media Studies Centre held a joint workshop, "Learn to Decode What You Hear about Covid-19" that was livestreamed on March 30 and is available on YouTube.

» **Nowcasts:** The HKUMed-WHO Collaborating Centre has organised several live "nowcasts" to provide updated information to the media and the public. These have covered such topics as the likely extent of the Wuhan epidemic in January and its forecast spread; a real-time situation report on the reproductive number in March; superspreading and epidemiologic updates in June; and universal testing and vaccine procurement in September.





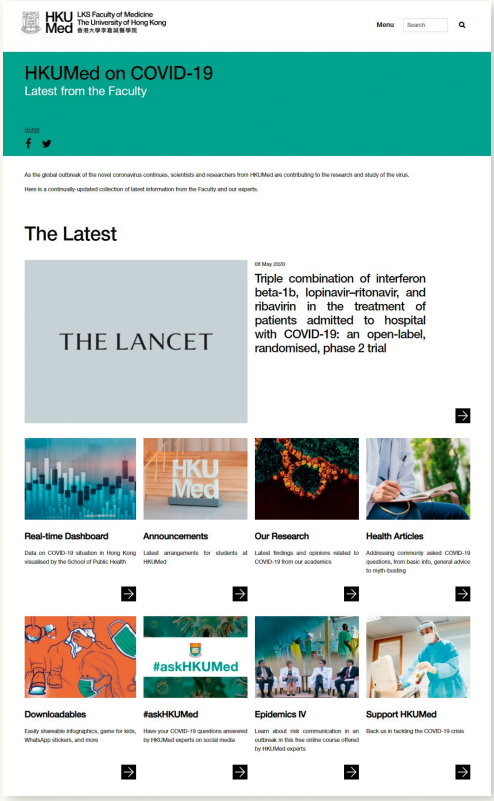
Real-time Dashboard

The Real-time Dashboard, produced by the School of Public Health, has been a widely-used reference for helping the public to understand the facts about COVID-19 cases in Hong Kong. It provides basic up-to-date information on the number of cases, hospitalised, discharged and deaths, and much more. For example, it shows the real-time effective reproductive number for local cases, the epidemic curve based on onset and confirmed dates and case classification, and breakdown by ages.

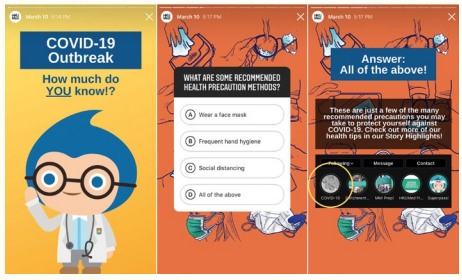
The Real-time Dashboard has also been an important tool in media briefings, providing a snapshot of the COVID-19 situation in Hong Kong and the likely trends going forward.

Dedicated COVID-19 Website

HKUMed set up a website where it has gathered, in one place, all of our research findings, announcements, advice and materials on COVID-19. All initiatives described on these pages can be found there, with updates. Please visit http://www.med.hku.hk/covid-19



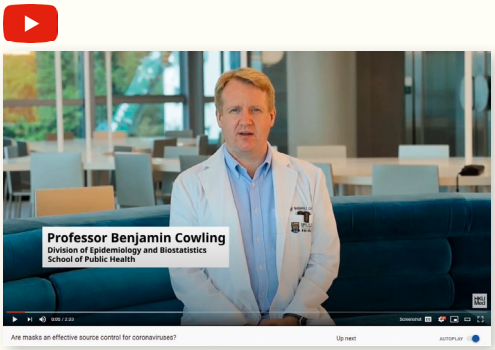
Social Media



As the COVID-19 epidemic grew, our social media accounts kicked into action to provide a steady-stream of the latest science-backed information. The aim was to ensure individuals and the media had a reliable place to go for facts in the face of misguided or false information that has been circulating.

HKUMed has accounts on Twitter, LinkedIn, Facebook, Instagram, WeChat, and YouTube. Postings have ranged from our latest research findings to short videos on keeping COVID-19 at bay (see opposite page) to profiles of our researchers. We have used the accounts to target specific audiences. For instance, on Twitter, which is used to communicate with international and English-speaking audiences, we posted the infographic "Disinfectant suitable for surfaces (not for drinking)" to address misinformation that drinking bleach could cure COVID-19. On Facebook, which is a major platform for communicating with people in Hong Kong, we posted "What should you do if a lab-confirmed case of COVID-19 is in your building?" to address concerns related to the fact that most people here live and work in high-rises and share common areas.

Since January, our social media sites have received a combined number of over 37 million impressions across platforms.



Just the facts, in plain language

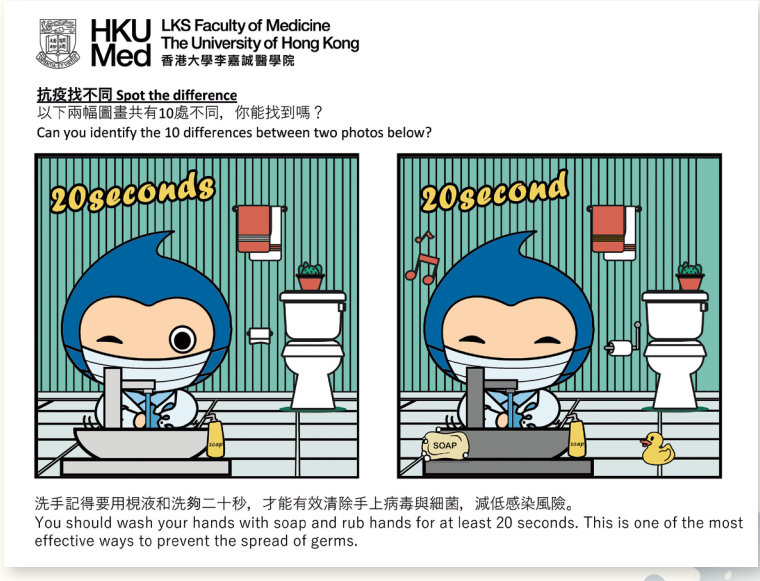
Scientific information presented in a clear, easy-to-understand format, is critical to public health. People need to understand measures they can take to protect themselves and their families, and to separate fact and fiction. To address the COVID-19 challenge, HKUMed has developed infographics and videos, had our experts respond to people's questions and concerns, and created materials for children so they, too, can learn how to stay safe.

» **Healthographics:** These are infographics that provide a snapshot of key information and advice, such as how to practice social distancing, the meaning of "effective reproduction number", what disinfectants can work against the virus, and the latest research findings from HKUMed. They are produced in English and Chinese.

» **Multilingual Tips:** Selected healthographics have been translated into nine other languages in collaboration with the School of Modern Languages and Cultures. The languages include Arabic, French, German, Italian, Japanese, Korean, Portuguese, Spanish and Thai.

» **#askHKUMed:** Questions submitted by the public via Twitter are answered by HKUMed experts in short, 1-2 minute videos. Examples include whether COVID-19 is airborne, whether it affects men and women differently, the best way to protect seniors post-lockdown, where the virus may have come from, whether children and healthy people should wear a mask whenever they go outside, comments on control measures in other countries, whether it is advisable to travel, etc.

» **Interactive Materials:** Game-based and other engaging options have been developed to help people of all ages understand how to be safe during the COVID-19 pandemic. These include bingo, children's games such as spot the difference and find the match, and colouring pages.



In the Community

Where circumstances are safe, HKUMed staff and students have been providing direct assistance to members of the community. In September, more than 200 HKUMed students and another 200 staff and alumni were recruited to operate the HKSAR Government's Universal Community Testing Programme at sites in Kennedy Town and Wong Chuk Hang over 11 days.

HKU, the HKU-Shenzhen Hospital and Hong Kong's Elderly Commission also bought 50,000 masks in early February for 5,000 elderly people in need, which were packed by student volunteers.

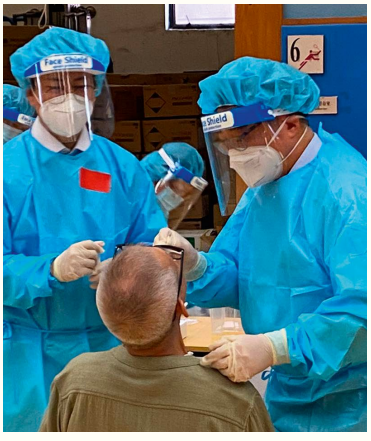
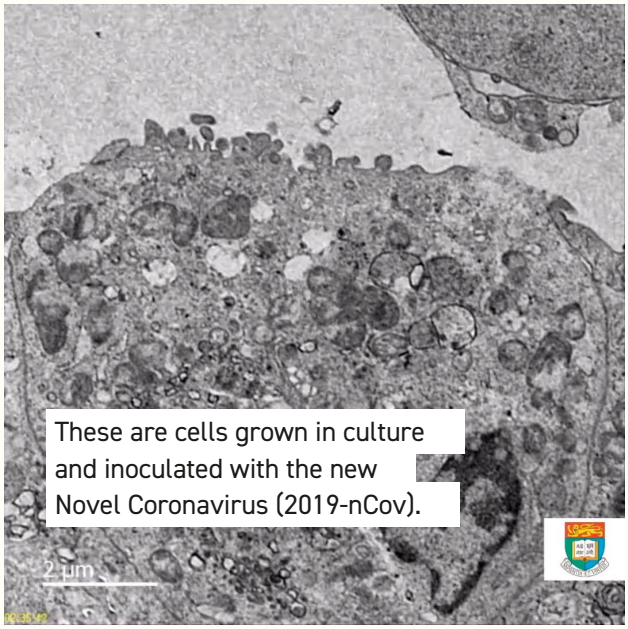
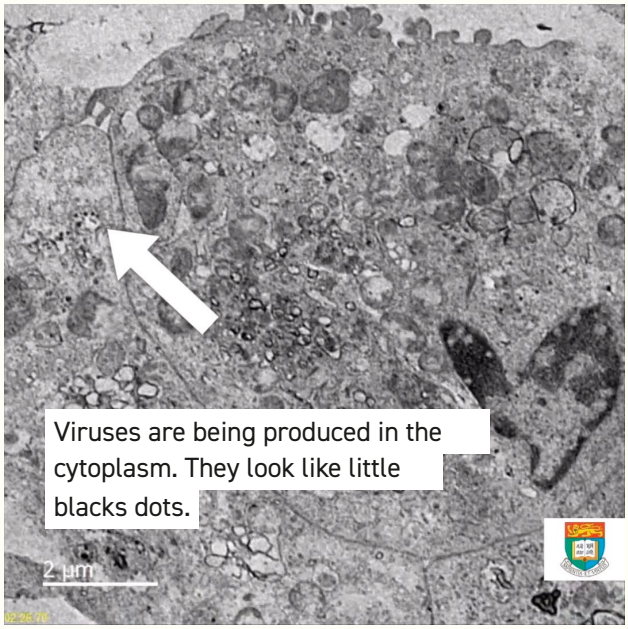
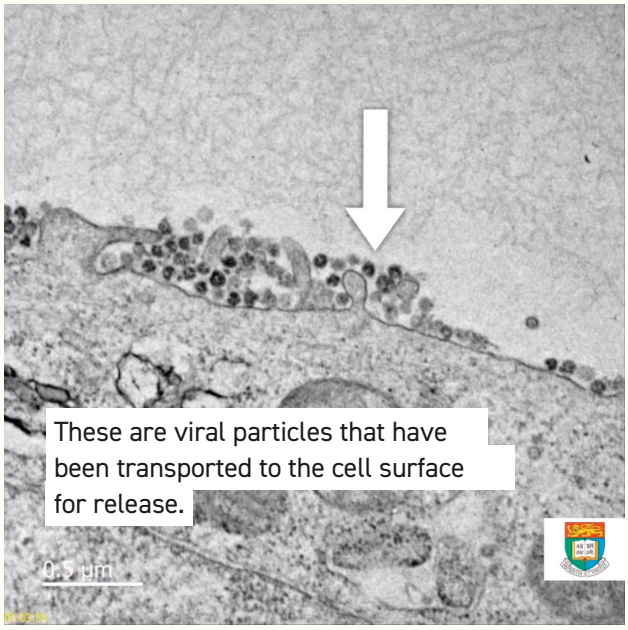
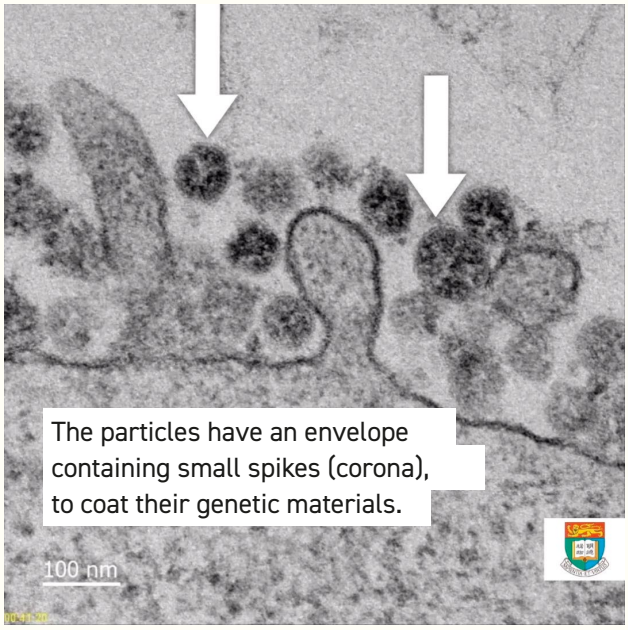


image courtesy of HKU U-Vision









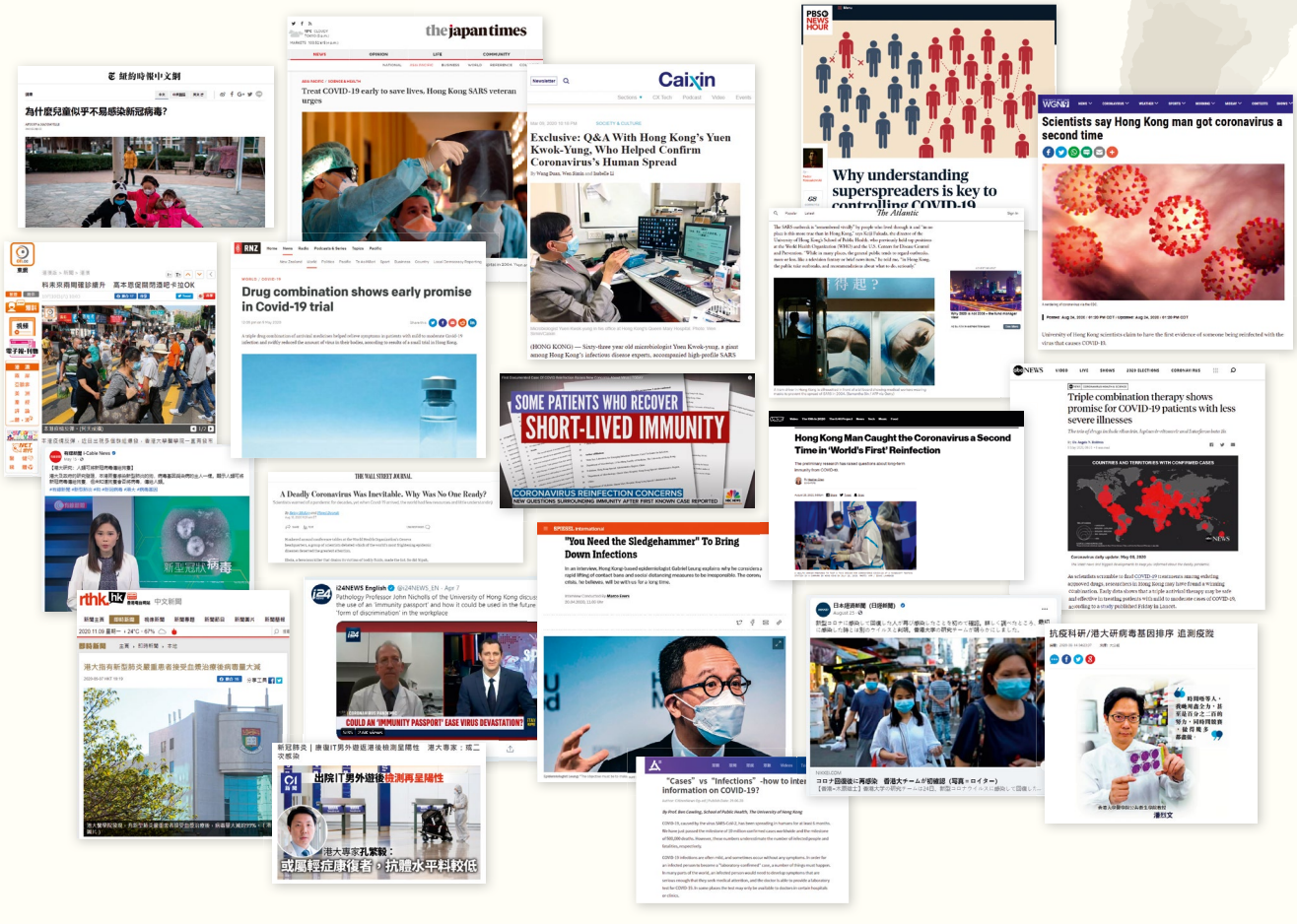
Visualising COVID-19

HKUMed published one of the first hi-resolution images of SARS-Cov-2 back in January. Our images show the virus growing in cells in HKUMed laboratories and are in black-and-white, colour and video formats. They have been freely shared through our website and Twitter accounts for use by other researchers, media outlets and any other interested parties.

As of 30/10/2020

SHARING OUR KNOWLEDGE

HKUMed's research and insights on COVID-19 and other infectious diseases have been shared with media in more than 45 countries and territories in 2020, in outlets ranging from local newspapers and radio stations to large international broadcasters and publishers.



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China Daily
China News Service
China Radio International
CNBC
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CTV News
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De Standaard
Der Spiegel
Deutsche Welle
El Mercurio
Folha de S Paolo
Fortune Magazine
France 24
Haaretz
Headline Daily
Hír TV
HK01
Hong Kong China News Agency
Hong Kong Citizen News
Hong Kong Commercial Daily
Hong Kong Economic Journal
Hong Kong Economic Times
i24News
Initium Media
InmediaHK
KTLA5 News
L'Orient-Le Jour
La Repubblica
La Tercera
Le Journal du Dimanche
Le Soir
Le Point
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Lion Rock Daily
Los Angeles Times
Metro Radio
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National Geographic
National Public Radio
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The Financial Times
The Guardian
The New York Times
The New Yorker
The Standard
The Straits Times
The Times of India
The Wall Street Journal
Time Magazine
Todo Noticias
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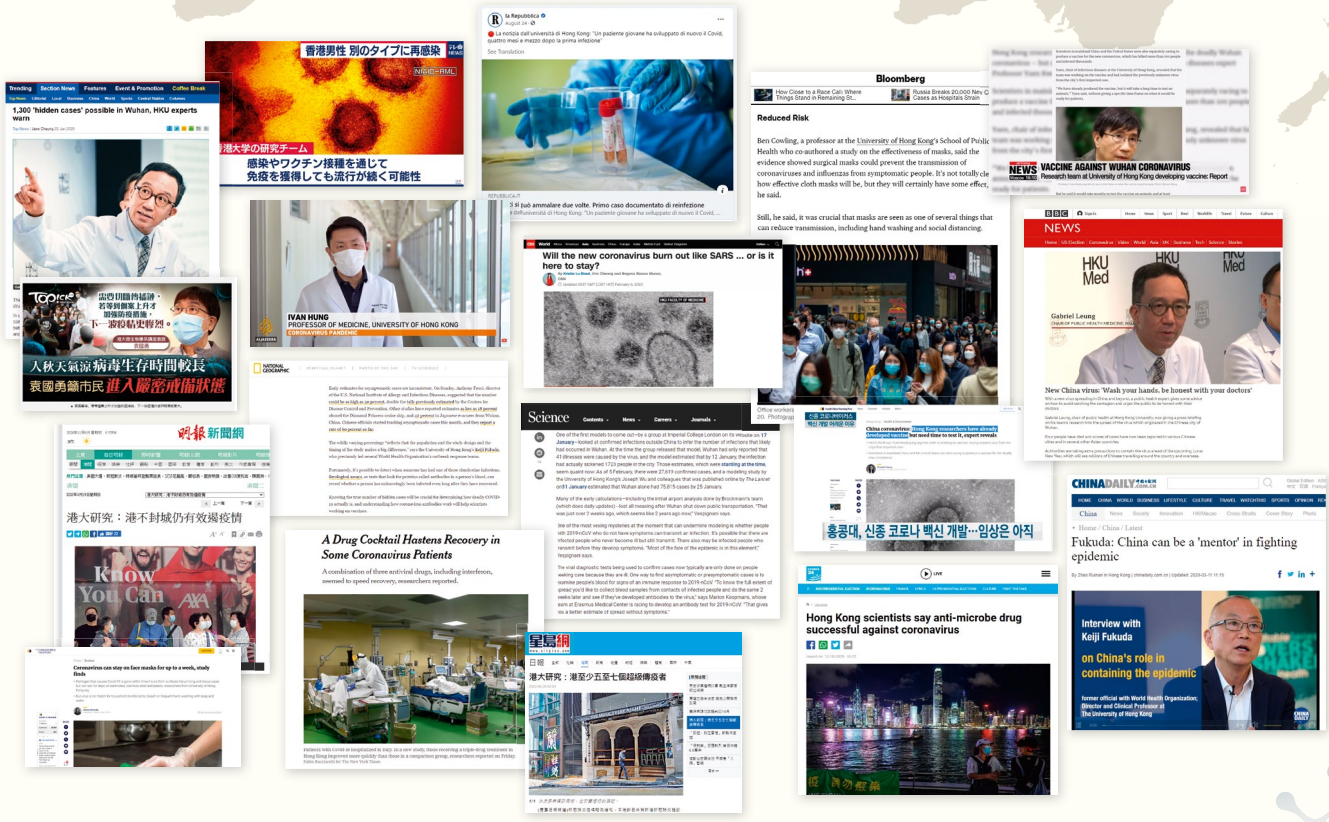
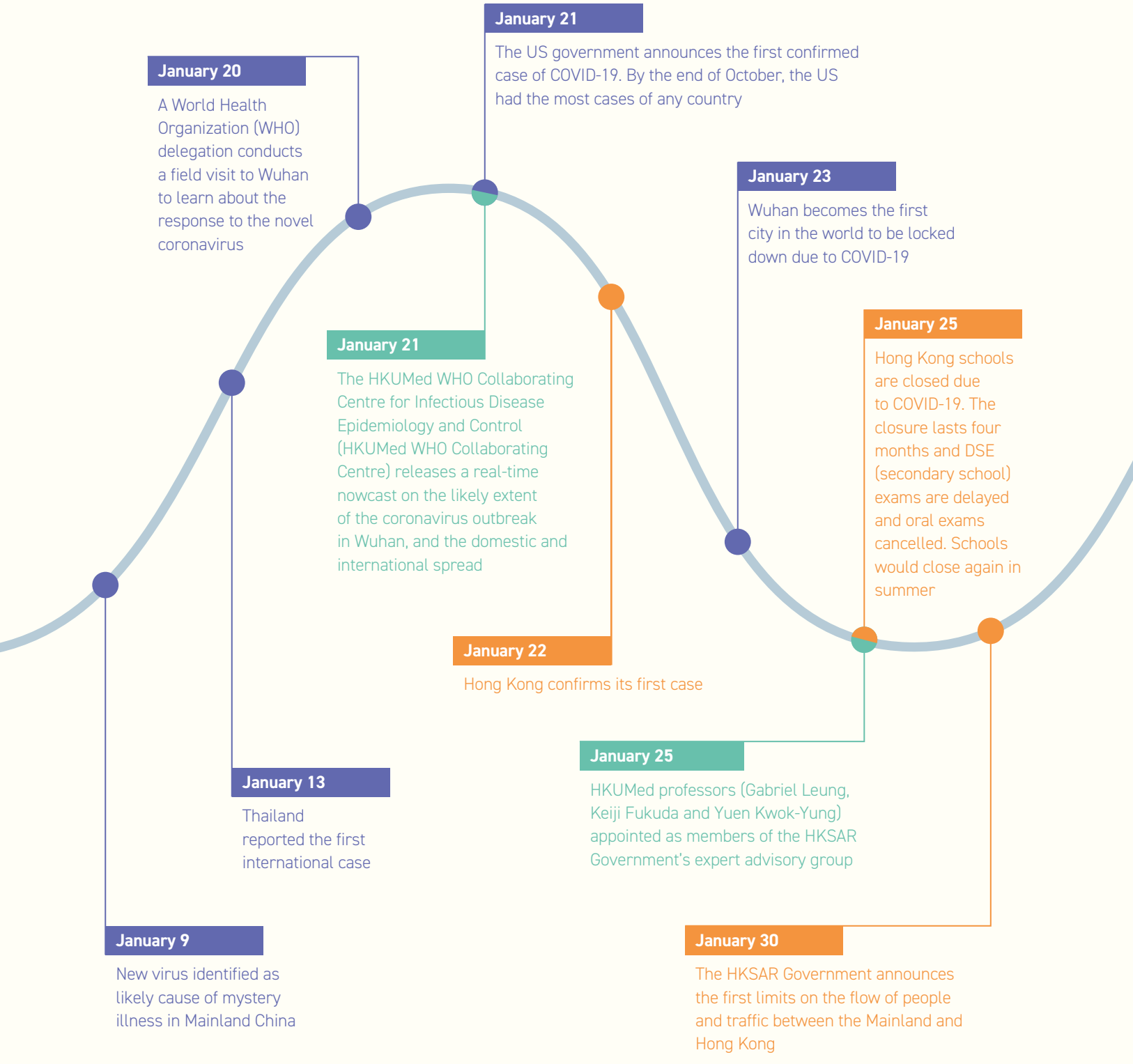


THE UNFOLDING PANDEMIC

The COVID-19 pandemic that began to spread in January 2020 is far from over. Over these pages, we attempt to mark some of the key local, national and global events that have occurred to date, and our research contributions towards controlling the pandemic. For the latest updates, please refer to http://www.med.hku.hk/en/covid-19. We sincerely hope there will soon be an end to this timeline.



January 9

New virus identified as likely cause of mystery illness in Mainland China

January 13

Thailand reported the first international case

January 20

A World Health Organization (WHO) delegation conducts a field visit to Wuhan to learn about the response to the novel coronavirus

January 21

The US government announces the first confirmed case of COVID-19. By the end of October, the US had the most cases of any country

January 21

The HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control (HKUMed WHO Collaborating Centre) releases a real-time nowcast on the likely extent of the coronavirus outbreak in Wuhan, and the domestic and international spread

January 22

Hong Kong confirms its first case

January 23

Wuhan becomes the first city in the world to be locked down due to COVID-19

January 25

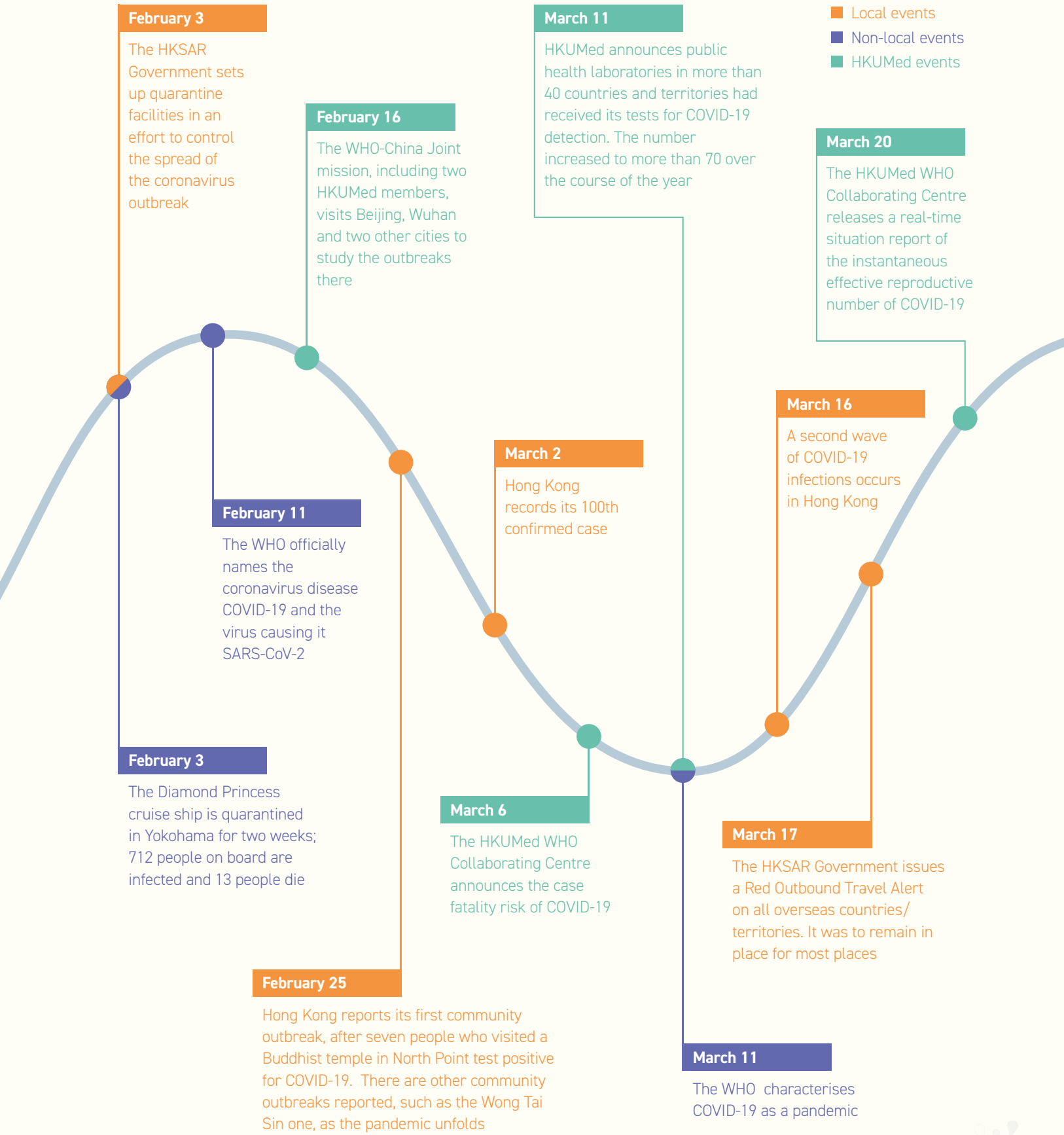
HKUMed professors (Gabriel Leung, Keiji Fukuda and Yuen Kwok-Yung) appointed as members of the HKSAR Government's expert advisory group

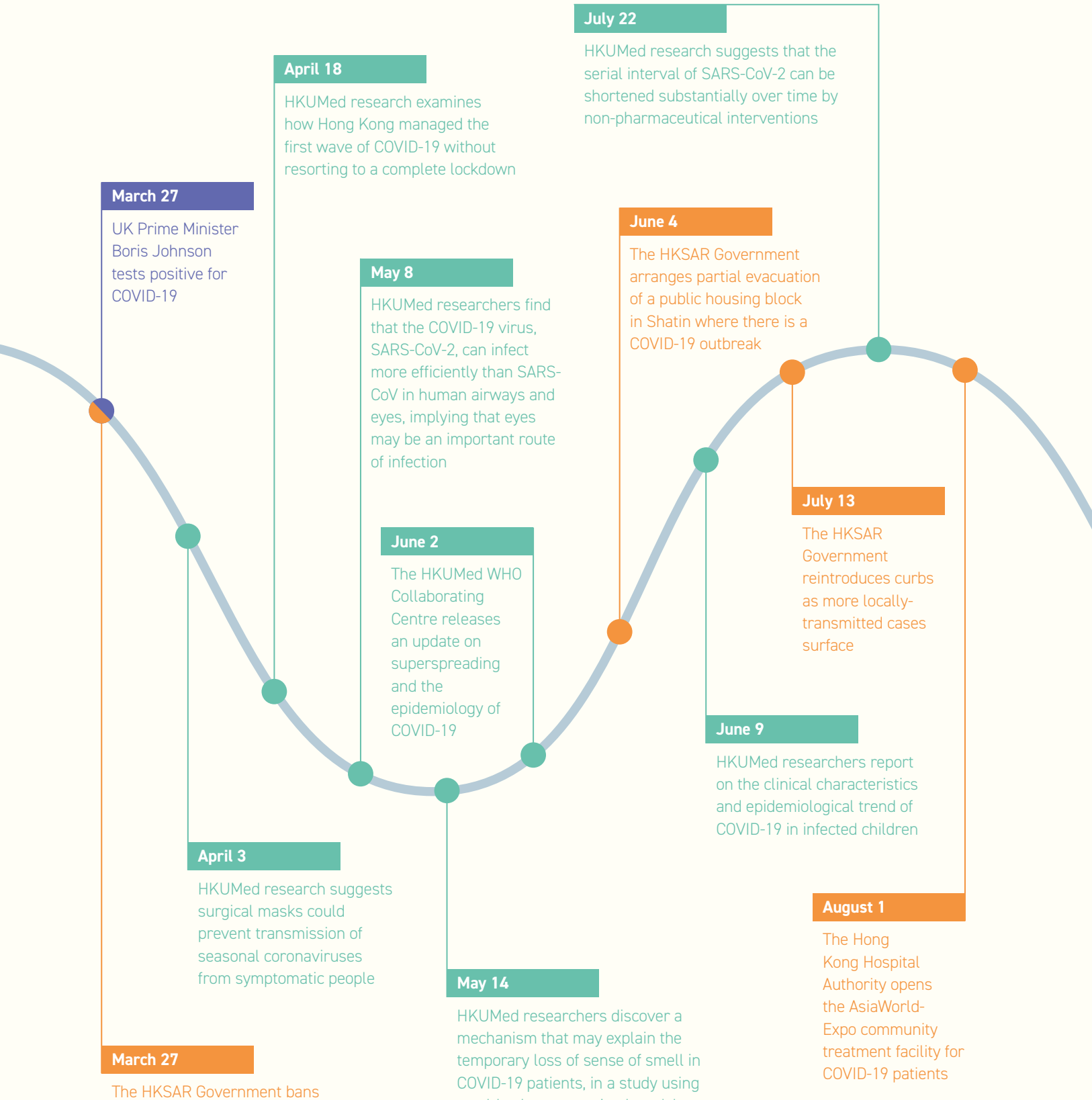
January 25

Hong Kong schools are closed due to COVID-19. The closure lasts four months and DSE (secondary school) exams are delayed and oral exams cancelled. Schools would close again in summer

January 30

The HKSAR Government announces the first limits on the flow of people and traffic between the Mainland and Hong Kong


Local events
Non-local events
HKUMed events
February 3
The HKSAR Government sets up quarantine facilities in an effort to control the spread of the coronavirus outbreak
February 16
The WHO-China Joint mission, including two HKUMed members, visits Beijing, Wuhan and two other cities to study the outbreaks there
March 11
HKUMed announces public health laboratories in more than 40 countries and territories had received its tests for COVID-19 detection. The number increased to more than 70 over the course of the year
March 20
The HKUMed WHO Collaborating Centre releases a real-time situation report of the instantaneous effective reproductive number of COVID-19
March 16
A second wave of COVID-19 infections occurs in Hong Kong
February 11
The WHO officially names the coronavirus disease COVID-19 and the virus causing it SARS-CoV-2
March 2
Hong Kong records its 100th confirmed case
February 3
The Diamond Princess cruise ship is quarantined in Yokohama for two weeks; 712 people on board are infected and 13 people die
March 6
The HKUMed WHO Collaborating Centre announces the case fatality risk of COVID-19
March 17
The HKSAR Government issues a Red Outbound Travel Alert on all overseas countries/ territories. It was to remain in place for most places
February 25
Hong Kong reports its first community outbreak, after seven people who visited a Buddhist temple in North Point test positive for COVID-19. There are other community outbreaks reported, such as the Wong Tai Sin one, as the pandemic unfolds
March 11
The WHO characterises COVID-19 as a pandemic



March 27

UK Prime Minister Boris Johnson tests positive for COVID-19

March 27

The HKSAR Government bans gatherings of more than four people in public spaces

April 3

HKUMed research suggests surgical masks could prevent transmission of seasonal coronaviruses from symptomatic people

April 18

HKUMed research examines how Hong Kong managed the first wave of COVID-19 without resorting to a complete lockdown

May 8

HKUMed researchers find that the COVID-19 virus, SARS-CoV-2, can infect more efficiently than SARS-CoV in human airways and eyes, implying that eyes may be an important route of infection

June 2

The HKUMed WHO Collaborating Centre releases an update on superspreading and the epidemiology of COVID-19

May 14

HKUMed researchers discover a mechanism that may explain the temporary loss of sense of smell in COVID-19 patients, in a study using a golden hamster animal model

June 4

The HKSAR Government arranges partial evacuation of a public housing block in Shatin where there is a COVID-19 outbreak

June 9

HKUMed researchers report on the clinical characteristics and epidemiological trend of COVID-19 in infected children

July 13

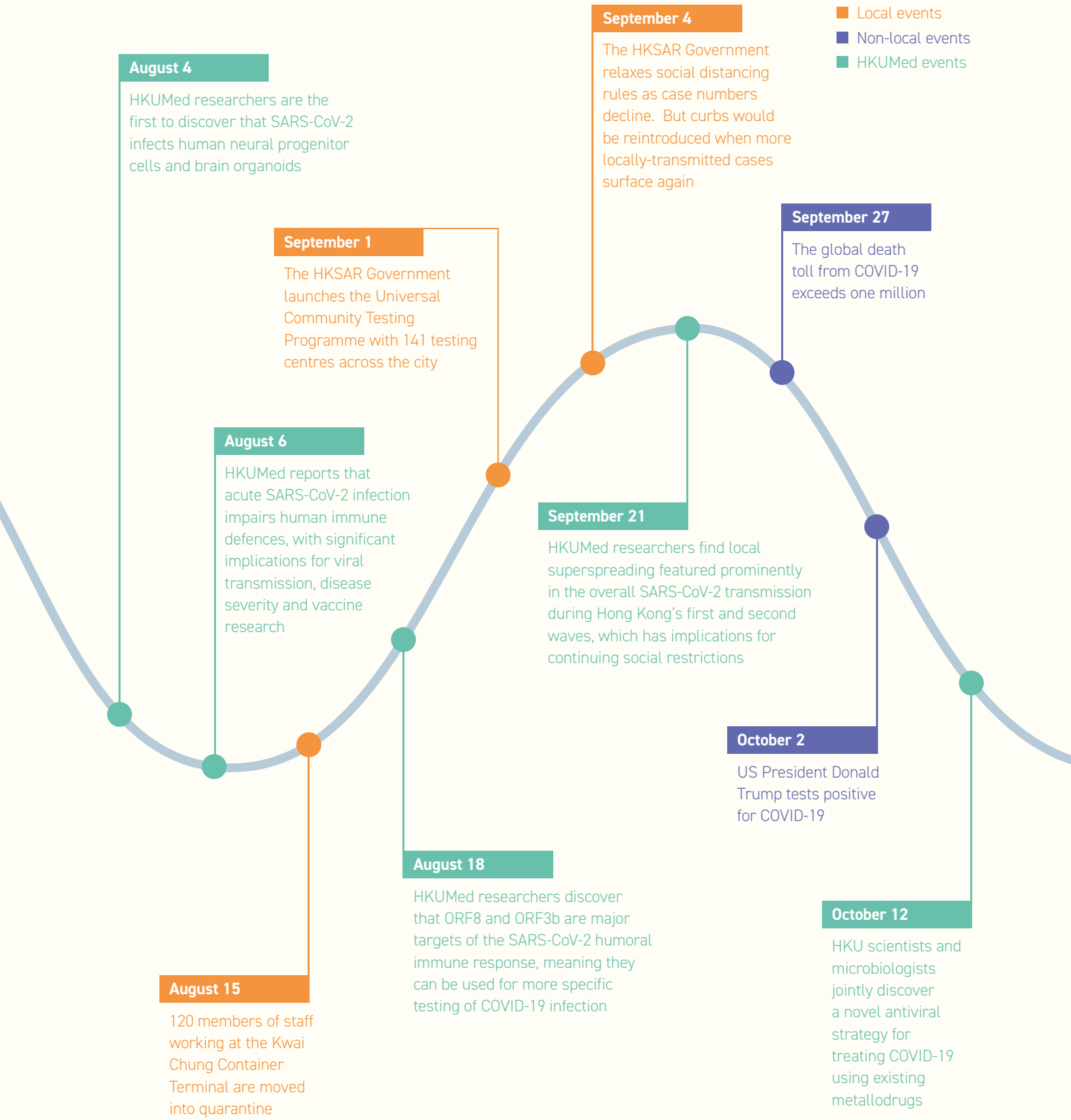
The HKSAR Government reintroduces curbs as more locally-transmitted cases surface

July 22

HKUMed research suggests that the serial interval of SARS-CoV-2 can be shortened substantially over time by non-pharmaceutical interventions

August 1

The Hong Kong Hospital Authority opens the AsiaWorld-Expo community treatment facility for COVID-19 patients



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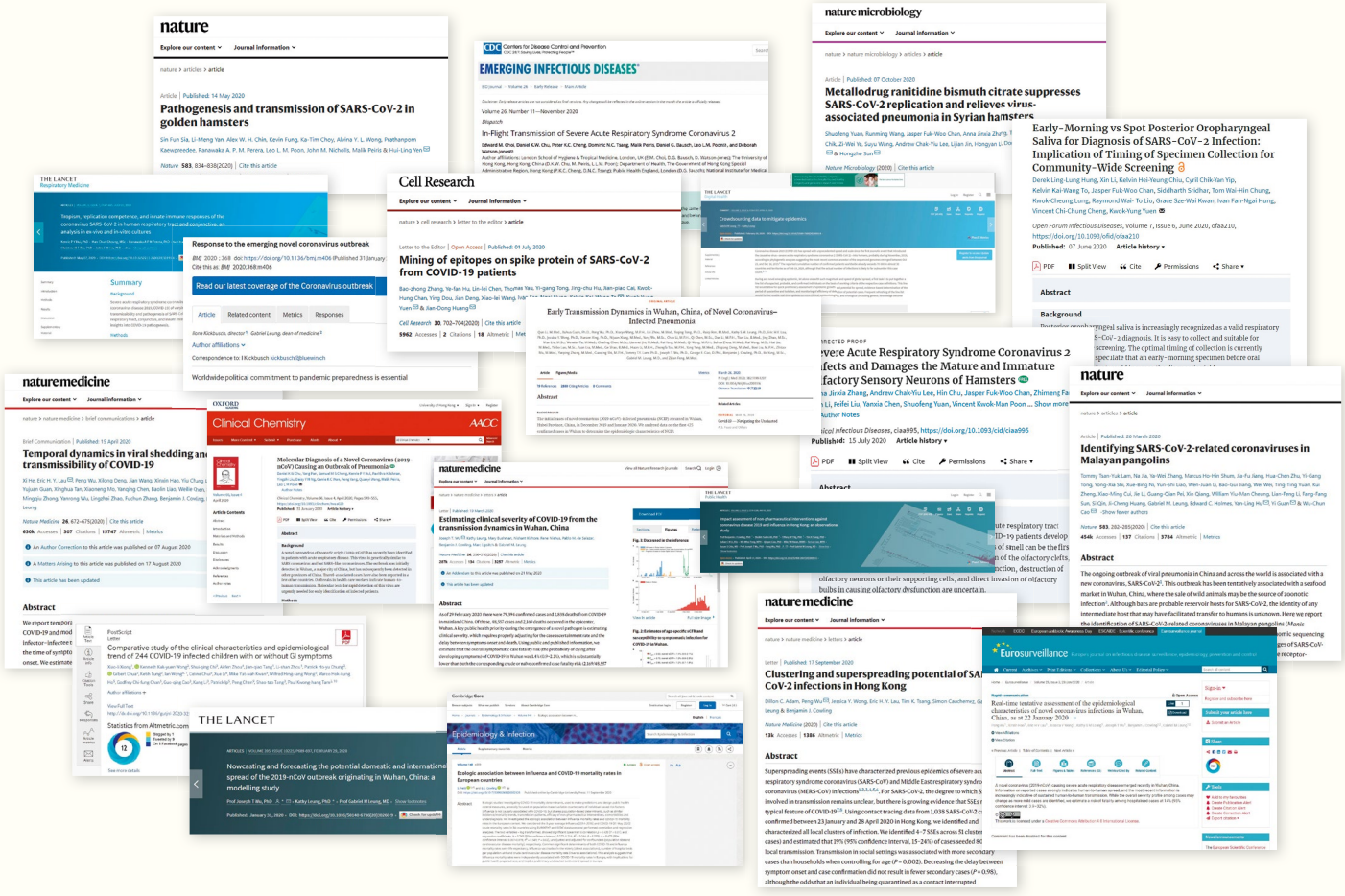

HKUMed on COVID-19: Our Research

16 January 2020

WHO: Detection of 2019 novel coronavirus (2019-nCoV) in suspected human cases by RT-PCR

18 January 2020

Journal of Hospital Infection: Preparedness and proactive infection control measures against the emerging novel coronavirus in China

21 January 2020

HKUMed: Statistical Tool for Predictive Analytics to Provide Real Time Estimates

HKUMed: HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control releases real-time nowcast on the likely extent of the Wuhan coronavirus outbreak, domestic and international spread with the forecast for chunyun

22 January 2020

Eurosurveillance: Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR

Eurosurveillance: Real-time tentative assessment of the epidemiological characteristics of novel coronavirus infections in Wuhan, China, as at 22 January 2020

24 January 2020

The Lancet: A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster

27 January 2020

HKUMed: HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control releases real-time nowcast on the likely extent of the Wuhan coronavirus outbreak, and forecasts domestic and international spread – UPDATE

29 January 2020

The New England Journal of Medicine: Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia

31 January 2020

Clinical Chemistry: Molecular diagnosis of a novel coronavirus (2019-nCoV) causing an outbreak of pneumonia

The BMJ: Response to the emerging novel coronavirus outbreak

The Lancet: Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study

03 February 2020

The BMJ Opinion: We need new forms of governance to better manage our response to pandemics

05 February 2020

HKUMed: Short Video of the new Novel Coronavirus Growing in Culture

06 February 2020

Emerging Infectious Diseases: Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings — Social Distancing Measures

HKUMed: Thin-section electron micrographs of the 2019 novel coronavirus grown in cells at The University of Hong Kong.

10 February 2020

The Lancet Infectious Diseases: The first 2019 novel coronavirus case in Nepal

12 February 2020

Clinical Infectious Diseases: Consistent Detection of 2019 Novel Coronavirus in Saliva

13 February 2020

Emerging Infectious Diseases: Risk for Transportation of 2019 Novel Coronavirus Disease from Wuhan to Other Cities in China

Eurosurveillance: Epidemiological research priorities for public health control of the ongoing global novel coronavirus (2019-nCoV) outbreak

19 February 2020

The New England Journal of Medicine: SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients

20 February 2020

HKUMed: Pseudo-colour scanning electron micrograph of SARS-CoV-2 grown in culture from a patient isolate.

The Lancet Digital Health: Crowdsourcing data to mitigate epidemics

21 February 2020

The Journal of the American Medical Association: Presumed Asymptomatic Carrier Transmission of COVID-19

24 February 2020

The Lancet Infectious Diseases: COVID-19 pneumonia: what has CT taught us?

The Lancet Infectious Diseases: Viral load of SARS-CoV-2 in clinical samples

26 February 2020

Clinical Chemistry: The SARS-CoV-2 Outbreak: Diagnosis, Infection Prevention, and Public Perception

27 February 2020

Nature Medicine: Emergence of a novel human coronavirus threatening human health

British Journal of Anaesthesia: Outbreak of a new coronavirus: what anaesthetists should know

28 February 2020

The New England Journal of Medicine: Clinical Characteristics of Coronavirus Disease 2019 in China

02 March 2020

Nature Microbiology: The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2

04 March 2020

Journal of Clinical Microbiology: Improved Molecular Diagnosis of COVID-19 by the Novel, Highly Sensitive and Specific COVID-19-RdRp/Hel Real-Time Reverse Transcription-PCR Assay Validated In Vitro and with Clinical Specimens

05 March 2020

Infection Control & Hospital Epidemiology: Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong

06 March 2020

The Lancet: COVID-19: the gendered impacts of the outbreak

HKUMed: HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control releases case fatality risk of COVID-19

The Lancet: Are high-performing health systems resilient against the COVID-19 epidemic?

The Lancet: SARS-CoV-2 is an appropriate name for the new coronavirus

12 March 2020

The New England Journal of Medicine: Detection of Covid-19 in Children in Early January 2020 in Wuhan, China

Microbiology Resource Announcements: Complete Genome Sequence of a 2019 Novel Coronavirus (SARS-CoV-2) Strain Isolated in Nepal

14 March 2020

Emerging Microbes & Infections: A tug-of-war between severe acute respiratory syndrome coronavirus 2 and host antiviral defence: lessons from other pathogenic viruses

16 March 2020

Cell & Bioscience: SARS-CoV-2 and COVID-19: The most important research questions

19 March 2020

The Lancet: Viral dynamics in mild and severe cases of COVID-19

Nature Medicine: Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China

Emerging Infectious Diseases: Serial Interval of COVID-19 among Publicly Reported Confirmed Cases

20 March 2020

HKUMed: HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control releases real-time situation report by the instantaneous effective reproductive number (Rt) of COVID-19

The Lancet Respiratory Medicine: Rational use of face masks in the COVID-19 pandemic

JAMA Otolaryngology – Head & Neck Surgery: Practical Aspects of Otolaryngologic Clinical Services During the 2019 Novel Coronavirus Epidemic: An Experience in Hong Kong

23 March 2020

The Lancet Infectious Diseases: Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study

26 March 2020

Nature: Identifying SARS-CoV-2 related coronaviruses in Malayan pangolins

Clinical Infectious Diseases: Simulation of the clinical and pathological manifestations of Coronavirus Disease 2019 (COVID-19) in golden Syrian hamster model: implications for disease pathogenesis and transmissibility

The New England Journal of Medicine: Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia

31 March 2020

International Journal of Epidemiology: COVID-19 epidemic: disentangling the re-emerging controversy about medical facemasks from an epidemiological perspective

02 April 2020

The Lancet Microbe: Stability of SARS-CoV-2 in different environmental conditions

03 April 2020

Disaster Medicine and Public Health Preparedness: Limited early warnings and public attention to COVID-19 in China, January-February, 2020: a longitudinal cohort of randomly sampled Weibo users

Gastroenterology: Gastrointestinal Manifestations of SARS-CoV-2 Infection and Virus Load in Fecal Samples from the Hong Kong Cohort and Systematic Review and Meta-analysis

Nature Medicine: Respiratory virus shedding in exhaled breath and efficacy of face masks

The BMJ: Covid-19: how a virus is turning the world upside down

Antiviral Research: Remdesivir, lopinavir, emetine, and homoharringtonine inhibit SARS-CoV-2 replication in vitro

08 April 2020

The Lancet: First-wave COVID-19 transmissibility and severity in China outside Hubei after control measures, and second-wave scenario planning: a modelling impact assessment

International Journal of Molecular Sciences: Development of a Novel, Genome Subtraction-Derived, SARS-CoV-2-Specific COVID-19-nsp2 Real-Time RT-PCR Assay and Its Evaluation Using Clinical Specimens

Journal of Hospital Infection: Disinfection of N95 respirators by ionized hydrogen peroxide during pandemic coronavirus disease 2019 (COVID-19) due to SARS-CoV-2

09 April 2020

Clinical Infectious Diseases: Comparative replication and immune activation profiles of SARS-CoV-2 and SARS-CoV in human lungs: an ex vivo study with implications for the pathogenesis of COVID-19

15 April 2020

HKUMed: HKUMed research shows that stroke patients are presenting to hospitals one hour later during COVID-19, potentially jeopardising the patients' eligibility for treatments and affecting the outcome

Nature Medicine: Temporal dynamics in viral shedding and transmissibility of COVID-19

The New England Journal of Medicine: From a Sprint to a Marathon in Hong Kong

17 April 2020

The Lancet Public Health: Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study

21 April 2020

The Lancet Public Health: Effect of changing case definitions for COVID-19 on the epidemic curve and transmission parameters in mainland China: a modelling study

Eye: Maintenance of ophthalmic specialist out-patient service during the COVID-19 outbreak: The University of Hong Kong experience

22 April 2020

Clinical Infectious Diseases: A case series of children with Coronavirus Disease 2019: what have we learned?

23 April 2020

Medical Education: Ophthalmic clinical skills teaching in the time of COVID-19: A crisis and opportunity

Journal of Infection: The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2

Eurosurveillance: Serological assays for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), March 2020

25 April 2020

Chinese Journal of Biotechnology: Diagnosis, Treatment, Control and Prevention of SARS-CoV-2 and Coronavirus Disease 2019: Back to the Future

01 May 2020

Journal of Cataract and Refractive Surgery: The case for continuing elective cataract surgery during the COVID-19 pandemic

04 May 2020

The BMJ: Monitoring respiratory infections in COVID-19 epidemics

Eye: Diabetic retinopathy screening during the coronavirus disease 2019 pandemic

Emerging Microbes & Infections: Attenuated SARS-CoV-2 variants with deletions at the S1/S2 junction

06 May 2020

Nature Reviews Physics: Modelling COVID-19

07 May 2020

The Lancet Respiratory Medicine: Tropism, replication competence, and innate immune responses of the coronavirus SARS-CoV-2 in human respiratory tract and conjunctiva: an analysis in ex-vivo and in-vitro cultures

08 May 2020

The Lancet: Triple combination of interferon beta-1b, lopinavir–ritonavir, and ribavirin in the treatment of patients admitted to hospital with COVID-19: an open-label, randomised, phase 2 trial

12 May 2020

JMIR Mental Health: Mental Health, Risk Factors, and Social Media Use During the COVID-19 Epidemic and Cordon Sanitaire Among the Community and Health Professionals in Wuhan, China: Cross-Sectional Survey

13 May 2020

Nature Medicine: Infection of bat and human intestinal organoids by SARS-CoV-2

14 May 2020

Nature: Pathogenesis and transmission of SARS-CoV-2 in golden hamsters

Nature: Infection of dogs with SARS-CoV-2

The Lancet: Global coordination on cross-border travel and trade measures crucial to COVID-19 response

Virus Evolution: Multivariate analyses of codon usage of SARS-CoV-2 and other betacoronaviruses

Cell: Structural and Functional Basis of SARS-CoV-2 Entry by Using Human ACE2

15 May 2020

Journal of Hospital Infection: Is it possible to achieve 100 percent hand hygiene compliance during the COVID-19 pandemic?

Clinical Infectious Diseases: Case fatality risk of the first pandemic wave of novel coronavirus disease 2019 (COVID-19) in China

17 May 2020

Cell Reports: Cross-reactive antibody response between SARS-CoV-2 and SARS-CoV infections

21 May 2020

JAMA Network Open: Estimating Coronavirus Disease 2019 Infection Risk in Health Care Workers

24 May 2020

American Journal of Infection Control: Absence of nosocomial transmission of coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in the pre-pandemic phase in Hong Kong

27 May 2020

Journal of Clinical Virology: Evaluation of the commercially available LightMix® Modular E-gene kit using clinical and proficiency testing specimens for SARS-CoV-2 detection

Emerging Microbes & Infections: Evaluating the use of posterior oropharyngeal saliva in a point-of-care assay for the detection of SARS-CoV-2

28 May 2020

Pharmacological Research: Discovery of the FDA-approved drugs bexarotene, cetilistat, diiodohydroxyquinoline, and abiraterone as potential COVID-19 treatments with a robust two-tier screening system

Gastroenterology: Association between famotidine use and COVID-19 severity in Hong Kong: a territory-wide study

29 May 2020

Graefe's Archive for Clinical and Experimental Ophthalmology: Tele-ophthalmology amid COVID-19 pandemic—Hong Kong experience

30 May 2020

Clinical Infectious Diseases: Surgical mask partition reduces the risk of non-contact transmission in a golden Syrian hamster model for Coronavirus Disease 2019 (COVID-19)

01 June 2020

Pediatric Pulmonology: Overview: The history and pediatric perspectives of severe acute respiratory syndromes: Novel or just like SARS

Journal of Clinical Microbiology: Clinical performance of the Luminex NxTAG CoV Extended Panel for SARS-CoV-2 detection in nasopharyngeal specimens of COVID-19 patients in Hong Kong

02 June 2020

HKUMed: HKUMed WHO Collaborating Centre for Infectious Disease Epidemiology and Control Releases Superspreading and Latest Epidemiologic Update of COVID-19

Emerging Infectious Diseases: Effect of Nonpharmaceutical Interventions on Transmission of Severe Acute Respiratory Syndrome Coronavirus 2, South Korea, 2020

03 June 2020

The Lancet Microbe: Seroprevalence of SARS-CoV-2 in Hong Kong and in residents evacuated from Hubei province, China: a multicohort study

04 June 2020

Psycho-Oncology: Psychological distress during the 2019 Coronavirus Disease (COVID -19) pandemic among cancer survivors and healthy controls

05 June 2020

Open Forum Infectious Diseases: Olfactory dysfunction in COVID-19 patients: observational cohort study and systematic review

Journal of Medical Virology: Identification of nsp1 gene as the target of SARS-CoV-2 real-time RT-PCR using nanopore whole genome sequencing

07 June 2020

Open Forum Infectious Diseases: Early Morning Versus Spot Posterior Oropharyngeal Saliva for Diagnosis of SARS-CoV-2 Infection: Implication of Timing of Specimen Collection for Community-wide Screening

08 June 2020

Infection Control & Hospital Epidemiology: Air and environmental sampling for SARS-CoV-2 around hospitalized patients with coronavirus disease 2019 (COVID-19)

PLOS Pathogens: Virus subtype-specific suppression of MAVS aggregation and activation by PB1-F2 protein of influenza A (H7N9) virus

10 June 2020

Viruses: Broad-Spectrum Host-Based Antivirals Targeting the Interferon and Lipogenesis Pathways as Potential Treatment Options for the Pandemic Coronavirus Disease 2019 (COVID-19)

11 June 2020
Hong Kong Medical Journal: Responding to COVID-19 in Hong Kong

12 June 2020
The Lancet Infectious Diseases: SARS-CoV-2 shedding and seroconversion among passengers quarantined after disembarking a cruise ship: a case series

18 June 2020
Clinical Infectious Diseases: Reconstruction of Transmission Pairs for Novel Coronavirus Disease 2019 (COVID-19) in Mainland China: Estimation of Super-spreading Events, Serial Interval, and Hazard of Infection

20 June 2020
Emerging Microbes & Infections: SARS-CoV-2 nsp13, nsp14, nsp15 and orf6 function as potent interferon antagonists

21 June 2020
Journal of Infectious Diseases: Attenuated interferon and pro-inflammatory response in SARS-CoV-2-infected human dendritic cells is associated with viral antagonism of STAT1 phosphorylation

23 June 2020
Journal of Clinical Virology: Evaluation of simple nucleic acid extraction methods for the detection of SARS-CoV-2 in nasopharyngeal and saliva specimens during global shortage of extraction kits

24 June 2020
Influenza and Other Respiratory Viruses: SARS-CoV-2 environmental contamination associated with persistently infected COVID-19 patients

01 July 2020
Cell Research: Mining of epitopes on spike protein of SARS-CoV-2 from COVID-19 patients

02 July 2020
Clinical Infectious Diseases: Importance of face masks for COVID-19 – a call for effective public education

03 July 2020
Emerging Microbes & Infections: High neutralizing antibody titer in intensive care unit patients with COVID-19

08 July 2020
Journal of Hospital Infection: Factors affecting stability and infectivity of SARS-CoV-2

13 July 2020
ACS Applied Materials & Interfaces: A Surface Coating that Rapidly Inactivates SARS-CoV-2

15 July 2020
Clinical Infectious Diseases: SARS-CoV-2 infects and damages the mature and immature olfactory sensory neurons of hamsters

21 July 2020
Science: Serial interval of SARS-CoV-2 was shortened over time by nonpharmaceutical interventions

Journal of Neuroimmune Pharmacology: The Natural History, Pathobiology, and Clinical Manifestations of SARS-CoV-2 Infections

22 July 2020
Journal of Medical Internet Research: Impact of National Containment Measures on Decelerating the Increase in Daily New Cases of COVID-19 in 54 Countries and 4 Epicenters of the Pandemic: Comparative Observational Study

BMJ Open: Artificial intelligence mobile health platform for early detection of COVID-19 in quarantine subjects using a wearable biosensor: protocol for a randomised controlled trial

28 July 2020
International Journal of Molecular Sciences: A Rapid, Simple, Inexpensive, and Mobile Colorimetric Assay COVID-19-LAMP for Mass On-Site Screening of COVID-19

Nature Microbiology: Evolutionary origins of the SARS-CoV-2 sarbecovirus lineage responsible for the COVID-19 pandemic

04 August 2020
Cell Research: SARS-CoV-2 infects human neural progenitor cells and brain organoids

05 August 2020
Clinical Infectious Diseases: Unique SARS-CoV-2 clusters causing a large COVID-19 outbreak in Hong Kong

07 August 2020
Journal of Clinical Pathology: COVID-19 salivary signature: diagnostic and research opportunities

11 August 2020
Science: Systems biological assessment of immunity to mild versus severe COVID-19 infection in humans

12 August 2020
EClinicalMedicine: Using the COVID-19 to influenza ratio to estimate early pandemic spread in Wuhan, China and Seattle, US

14 August 2020

Science Advances: Viruses harness YxxØ motif to interact with host AP2M1 for replication: a vulnerable broad-spectrum antiviral target

17 August 2020

Nature Immunology: ORF8 and ORF3b antibodies are accurate serological markers of early and late SARS-CoV-2 infection

Infection Control & Hospital Epidemiology: Absence of nosocomial influenza and respiratory syncytial virus infection in the coronavirus disease 2019 (COVID-19) era: implication of universal masking in hospitals

Nature Medicine: Reply to: Is presymptomatic spread a major contributor to COVID-19 transmission?

25 August 2020

Clinical Infectious Diseases: COVID-19 re-infection by a phylogenetically distinct SARS-coronavirus-2 strain confirmed by whole genome sequencing

Nature Communications: A broad-spectrum virus- and host-targeting peptide against respiratory viruses including influenza virus and SARS-CoV-2

Influenza and Other Respiratory Viruses: Human post-infection serological response to the spike and nucleocapsid proteins of SARS-CoV-2

28 August 2020

JACC Cardiovascular Imaging: Recovered COVID-19 Patients Show Ongoing Subclinical Myocarditis as Revealed by Cardiac Magnetic Resonance Imaging

11 September 2020

Emerging Infectious Diseases: Early Insights from Statistical and Mathematical Modeling of Key Epidemiologic Parameters of COVID-19

Epidemiology & Infection: Ecologic association between influenza and COVID-19 mortality rates in European countries

14 September 2020

International Journal of Environmental Research and Public Health: Social Distancing Compliance under COVID-19 Pandemic and Mental Health Impacts: A Population-Based Study

15 September 2020

International Journal of Infectious Diseases: Development and Validation of Risk Prediction Models for COVID-19 Positivity in a Hospital Setting

International Journal of Infectious Diseases: Mental health crisis under COVID-19 pandemic in Hong Kong, China

17 September 2020

Nature Medicine: Clustering and superspreading potential of SARS-CoV-2 infections in Hong Kong

Infection: Detection of SARS-CoV-2 in conjunctival secretions from patients without ocular symptoms

Emerging Microbes & Infections: Short- and Potential Long-term Adverse Health Outcomes of COVID-19: A Rapid Review

Eurosurveillance: Letter to the Editor: COVID-19 cases among school-aged children and school-based measures in Hong Kong, July 2020

18 September 2020

Emerging Infectious Diseases: In-Flight Transmission of Severe Acute Respiratory Syndrome Coronavirus 2

21 September 2020

The Lancet: What can we expect from first-generation COVID-19 vaccines?

Current Opinion in HIV and AIDS: The Coronavirus Disease 2019 pandemic - how does it spread and how do we stop it?

23 September 2020

Clinical Infectious Diseases: Serum antibody profile of a patient with COVID-19 reinfection

24 September 2020

The Lancet: Lessons learnt from easing COVID-19 restrictions: an analysis of countries and regions in Asia Pacific and Europe

29 September 2020

MedEdPublish: COVID-19 – A Covert Catalyst for Pedagogical Stocktake and Transformation: Perspectives of a Global Hub

04 October 2020

Transfusion Medicine: Absence of SARS-CoV-2 viraemia in a blood donor with COVID-19 post-donation

06 October 2020

British Journal of Clinical Pharmacology: Using genetics to understand the role of antihypertensive drugs modulating angiotensin-converting enzyme in immune function and inflammation

07 October 2020

Nature Microbiology: Metallodrug ranitidine bismuth citrate suppresses SARS-CoV-2 replication and relieves virus-associated pneumonia in Syrian hamsters

Clinical Chemistry and Laboratory Medicine: IFCC interim guidelines on molecular testing of SARS-CoV-2 infection

Clinical Chemistry and Laboratory Medicine: IFCC interim guidelines on serological testing of antibodies against SARS-CoV-2

Clinical Chemistry and Laboratory Medicine: IFCC interim guidelines on biochemical/hematological monitoring of COVID-19 patients

Journal of Medical Virology: Suppression of SARS-CoV-2 infection in ex-vivo human lung tissues by targeting class III phosphoinositide 3-kinase

Emerging Microbes & Infections: Short- and potential long-term adverse health outcomes of COVID-19: a rapid review

08 October 2020

BMJ Open: Anxiety levels, precautionary behaviours and public perceptions during the early phase of the COVID-19 outbreak in China: a population-based cross-sectional survey

20 October 2020

mBio: Accurate Diagnosis of COVID-19 by a Novel Immunogenic Secreted SARS-CoV-2 orf8 Protein

Clinical Infectious Diseases: Different transmission dynamics of COVID-19 and influenza suggest the relative efficiency of isolation/ quarantine and social distancing against COVID-19 in China

21 October 2020

Emerging Infectious Diseases: Serologic Responses in Healthy Adult with SARS-CoV-2 Reinfection, Hong Kong, August 2020

23 October 2020

Circulation Journal: Human-Induced Pluripotent Stem Cell-Derived Cardiomyocytes Platform to Study SARS-CoV-2 Related Myocardial Injury

The BMJ: Virology, transmission, and pathogenesis of SARS-CoV-2

Links to the full text of our research can be found at
http://www.med.hku.hk/en/covid-19/research

In memory of the Hongkongers who have lost their lives due to COVID-19 and
with prayers for survivors who are suffering longer-term consequences from their infection

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