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Review Article

Long-Term Care Facilities (LTCFs) During the COVID-19 Pandemic—Lessons From the Asian Approach: A Narrative Review

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ABSTRACT

Objectives: The COVID-19 pandemic put into question the organizational skills of LTCF. The containment measures implemented in several Asian countries avoided heavy death tolls in LTCF in contrast to other countries across the globe. The aim of this review is therefore to investigate and illustrate the measures that were undertaken in Asia to contain and prevent the spread of the COVID-19 pandemic in LTCF.
Design: Narrative review.
Setting and Participants: Asian older subjects institutionalized in LTCF.
Methods: Broad literature research from July 2020—April 2021. The following search terms were used: "COVID-19 Nursing homes" AND the country of interest or "contact tracing." Eligible categories for inclusion comprise editorials, reviews, government guidelines, letters to the editor, and perspectives. The COVID-19 measures were then subdivided into different sections and compiled into an evidence table.
Results: Prompt measures were put into action since the beginning of the pandemic that avoided the spread of COVID-19 in LTCF. Examples range from simple acts of proper hand hygiene and environmental disinfection, swab testing, social distancing, preventive measures on health care workers, organizational measures such as quarantine, outbreak control, visitor restrictions, relationship with acute hospitals, and admission policy. Technology also played a fundamental role in promoting social distancing by using specific robots and in managing contact tracing.
Conclusions and Implications: The Asian preventive control guidelines are similar to those recommended elsewhere. Difference in timing and past experience with prior outbreaks such as SARS and MERS might have favored the Asian response. Furthermore, sociocultural values toward older persons by protecting and making sure that LTCF are part of the health care system could have also played a role.

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In December 2019, a novel type of coronavirus (SARS-CoV-2) was identified as responsible for a cluster of cases of atypical pneumonia in the province of Wuhan, China. Following that discovery, cases of pneumonia caused by the SARS-CoV-2 were increasingly reported in different countries. On January 30, 2020, the SARS-CoV-2 disease (or COVID-19) was declared a "public health emergency of international concern" (PHEIC). A few weeks later (more precisely, on March 11, 2020), the existence of a COVID-19 pandemic was announced by the World Health Organization (WHO).[1]

COVID-19 encompasses a wide range of clinical presentations, from asymptomatic cases (predominantly occurring in young individuals) or flulike syndromes to very severe cases of respiratory distress.[2] Since the beginning of the COVID-19 pandemic, it appeared evident that the disease had a significant clinical impact on the most vulnerable individuals, particularly older persons with chronic conditions.[3] Unfortunately, atypical presentations (including absence of fever, decreased mobility, unexplained tachycardia, low blood pressure, decreased appetite, difficulties at swallowing, new-onset incontinence, gastrointestinal symptoms, and delirium) are frequently responsible for delayed diagnosis and treatment in frail older persons.

To limit the spread of COVID-19, public health preventive strategies have been applied across the world. Although social restriction measures have undoubtedly contributed to the containment of the pandemic, they have also resulted in major unintended consequences. In particular, older persons have suffered from the negative effects of the lockdowns, being adversely affected in terms of physical decline, mood disorders, cognitive decline, social isolation, and disruption in the continuity of their care.

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Long-term care facilities (LTCFs) are designed to ensure care for frailer older persons in need of assistance for activities of daily living. The high prevalence of functional impairment renders inevitable close physical contact between residents and health care workers (eg, during rehabilitation sessions or hygiene procedures).[4] It is also noteworthy that many persons living in LTCFs have underlying cognitive impairment or dementia, making it challenging to ensure compliance with recommendations aimed at preventing the spread of the infection. Furthermore, these settings usually have inclusive policies that are designed to promote social interaction among residents and to encourage participation of visitors (eg, family members and volunteers). Finally, it is timely to remember how LTCFs in many countries remain disconnected from the hospital-centered care network, are poorly resourced, and often stigmatized as places where "persons go to die." It becomes clear why, during the pandemic, LTCFs have been placed under the spotlight owing to the dramatic escalation of COVID-19 cases because of the difficulty faced in protecting their residents, health care professionals, and visitors.

During the COVID-19 outbreak in Europe, more than 60% of the deaths were reported in LTCFs.[5] Lower albeit still very high figures (ie, about 40%) were also reported in the LTCFs in the United States.[6] This is in contrast to the surprisingly low death toll from COVID-19 in LTCFs in several Asian countries, which have been able to draw on their prior experience with previous outbreaks such as SARS in 2003 and the 2009 H1N1 influenza pandemic. For example, in May 2020, Hong Kong declared no COVID-19 deaths in care homes.[7,8] A recent article by Comas et al[5] presented comparative data about mortality rates in LTCF. The document describes an important heterogeneity in how data were collected across countries. On the one hand, some countries (eg, Singapore) have collected and reported data in a very regular, accurate, and exhaustive way. Only partial data have instead been provided by others. For example, no information about death events was available for South Korea because all persons with suspected COVID-19 infection were immediately transferred to acute hospitals and cases lost to count. Similarly, in Japan, the government decided to not publicly report data.[9] In the study by Comas et al, the percentages of death events attributed to COVID-19 (over the total number of LTCF beds) were 0.02% and 0.04% in Singapore and Hong Kong, respectively. These figures are much lower than other countries (eg, Spain reported a rate of 7.88%).[5]

Therefore, the aim of this narrative review is to elucidate the practice and policy measures that were implemented in these Asian countries that allowed them to successfully contain the outbreak in the early stages. Through this, we hope to draw lessons that can inform the effective and timely implementation of policy measures to mitigate the adverse consequences of COVID-19 in a fragile setting such as LTCFs.

Methods

For the purpose of our narrative review, we conducted a literature search for the period July 2020—April 2021. A broad search on PubMed was done using key terms such as "COVID-19 Nursing homes" AND the country of interest or "contact tracing." In addition, we also searched newspaper websites, country government guidelines, and the WHO website. Eligible categories for inclusion comprise editorials, reviews, government guidelines, letters to the editor, and perspectives. The COVID-19 measures were divided into different sections and compiled into an evidence table.

Results

The preventive measures against COVID-19 ranged from simple acts of proper hand hygiene and environmental disinfection, swab testing, social distancing, preventive measures on health care workers,

organizational measures such as quarantine, outbreak control, visitor restrictions, relationship with acute hospitals, and admission policy. Technology also played a significant role (Table 1).

Environmental Disinfection and Airflow Room Ventilation

Environmental disinfection must be conducted on a daily basis. It should be done using a 2-step process: a preliminary cleaning with a regular detergent, followed by a hospital-grade disinfectant or a diluted bleach concentration.[10,11] It is essential to consider all the touched surfaces: door handles, bed rails, tables, light switches, and bathrooms.[12] For metallic surfaces, cleaning with a 70% alcohol solution is sufficient.

Drainage pipes should be cleaned by pouring about half a liter of water into each drainpipe once a week.[11] Residents' clothes and bedsheets must be disinfected by direct sunshine and/or ultraviolet rays.[13] To improve changes of air, windows should be opened at least twice a day and fans switched on. Dust filters and air conditioners also need to be regularly cleaned.

Visitor Restrictions

A common strategy shared by many Asian countries was the avoidance and cessation of all nonessential visits to avoid the entrance of SARS-CoV-2 into the facilities. The only exceptions to this critical rule were allowed on compassionate grounds, that is, when a severely sick resident required emotional care or support. Family members were usually allowed to bring and drop off necessities for residents at the facility main entrance. In Taiwan, the TOCC tool (ie, Travel, Occupation, Contact, Cluster) for visitor triage and surveillance was implemented using information from a national database system that integrated various sources such as immigration/emigration data and the National Health Insurance Research Database. With this system, a prompt will show up to alert the LTCF screeners of at-risk visitors prior to entry and to assist inquiry using the TOCC instrument.[12]

LTCF Staff

On April 21, 2020, the WHO reported that more than 35,000 health care workers had been infected by SARS-CoV-2. Health care professionals are at risk of infection because of different causes: late recognition or low level of suspicion of COVID-19 in patients, longer than usual duty hours, suboptimal adherence to infection prevention and control measures, and lack of or improper use of personal protective equipment (PPE). Not surprisingly, LTCF health care staff is also a potential source of infection. The WHO has established 3 basic principles for controlling the infectious disease: "do not carry in," "do not carry out," and "do not spread." Not surprisingly, one of the first strategies to be routinely implemented during the pandemic has been staff training for Infection and Prevention Control (IPC).[13] This strategy emphasizes active monitoring of staff's health status[13]: daily monitoring of body temperature is mandatory,[13,14,25] and periodic surveillance testing is done.[15] If an employee should present with signs of fever or upper respiratory tract infection, he or she is immediately put on sick leave.[12,26] From an organizational viewpoint, shifts have been rearranged with split zone work arrangements to minimize staff crossover so that everyone always works in the same unit with the same patients.[12–14,16] The staff has also been discouraged from working in more than 1 LTCF to avoid interfacility infections.[10] In Singapore, LTCF staff were offered alternative accommodation at the peak of the infection so as to reduce the risk of being infected through contact with family members. In Korea, staff members were also discouraged to dine together, gather in meetings, and encouraged to keep face masks on at all times.[22]

Table 1
List of Measures/Procedures Adopted to Reduce the COVID-19 Diffusion by Different Countries

Measures/Procedures	Description	Countries	References
Environmental/hand disinfection	- Proper hand hygiene using soap, alcohol hand rub - Alcohol-based stations are distributed in different areas of the LTCF (entrance, quarantine rooms, public spaces in clean zones) - Two-step process including preliminary cleaning with a regular detergent followed by disinfection with hospital-grade disinfectant or a diluted concentration of bleach - Clean touched surfaces (door handles, bed rails, tables, light switches, bathrooms)	TW, HK, SK, JP	9, 10, 11, 12, 13, 14, 15
Airflow/room ventilation + common areas	- Windows should be opened - Fans switched on or exhaust fans to enhance air flow - Clean dust filters of air conditioners - Maintain 1-2 m separation - No face-to-face sitting is allowed - Avoid speaking loudly or laughing in order to minimize droplet or contact/fomite transmission - Mealtimes at different time slots or provide meals in proper room	HK, TW, JP	9, 10, 11, 12, 14, 15
Health care workers	- Daily measurement of body temperature - Surgical masks on duty - IPC (infection prevention and control) training is done routinely - Staff members are arranged to work on the same floor or district to ensure no staff crossover - Discourage workers to work in more than 1 LTCF to avoid interfacility infection - Employees with an infectious disease are restricted to work - Hotels or designated accommodation facilities for staff are provided - Avoid contact with members outside of the workplace or family	HK, TW, SI, JP	4, 9, 10, 12, 13, 14, 15, 16, 17
Triage before entering the facility	- All entrants must be assessed based on history of TOCC (travel, occupation, contact, cluster-detailed below). - Staff that is allowed to enter: HCWs, nurse assistants, new resident and support personnel responsible for laundry, kitchen and daily tasks such as cleaning and waste disposal.	TW, SI	12, 18
Visitor restrictions	- Visitors must leave their names and phone numbers and take routine IPC precautions. - No nonessential visits are permitted - Relatives are only allowed to bring necessities to residents via LTCF staff at the facilitates' main entrance	HK, TW, SI, SK, JP	8, 9, 13, 14, 15
Patient admission in LTCF	- Patients are only admitted with discharge letters from acute hospitals that certify COVID-19 negativity - All cases are quarantined (temporary isolation wards) until proven multiple times not to be viremic - If acute respiratory infections on admission: isolate patient in negative-pressure room and test once for COVID 19 if the clinical suspicion is low - Repeat swab before transfer to a general ward	SI, HK	8, 10, 11, 18, 19
Quarantine rules	Resident + close contact: on-site quarantine (or quarantine camp if suitable) for 14 d followed by medical surveillance (daily temperature checking and observation for symptoms) for additional 14 d Staff + close contact: quarantine camp for 14 d followed by medical surveillance (daily temperature check and observation for symptoms before work) for additional 14 d - Cohort isolation, and transfer to COVID-19–designated hospitals.	HK, SK	11, 15, 20
Nasopharyngeal swab	- Massive testing on residents and staff - Conduct community testing - Frequent nasopharyngeal swab tests are performed on patient admission in LTCF	SI, SK	15, 16, 19, 20
Traffic control bundling	- Shown to limit droplet and fomite transmissions both within hospitals and between hospitals and the general community. Compartmentalizing areas with different checkpoints	TW	12, 21
Technology use to limit contact	- Autonomous robots set in isolation rooms to deliver meals and medication, monitor vital signs, and act as portals of communication between staff and patients. - Robots for sanitation: aerosol and UV light disinfection, hand disinfectant, and autonomous cleaning. - Video phone calls to replace physical visits - Contact tracing to contain transmission and reduce mortality in the general population	SI, HK, SK, TW	8, 10, 22, 23, 17, 24

HK, Hong Kong; JP, Japan; SI, Singapore; SK, South Korea; TW, Taiwan.

Residents

Residents of LTCFs, especially those with cognitive impairment,[5] tend to require assistance in activities of daily living. As such, they are especially vulnerable to the effect of social isolation arising from the social distancing measures that have been implemented in LTCFs. Residents have been maintained at a distance of 1 to 2 m from each other.[10,13] Speaking loudly or laughing has been discouraged to minimize droplet production, which has been recognized to be the potential vehicle of infection transmission.[10] During meals, some

LTCFs have directly served residents in their rooms. Others have arranged meals at different times to avoid overcrowding and face-to-face contact.[10,14,27] Group activities have also been avoided.

Despite the obvious role of such measures in preventing infections, they have proven quite controversial because of the substantial impact on mental health and well-being of frail residents.[28] This has renewed interest to incorporate means to circumvent the adverse effect of these restrictions. For instance, residents in China participated in exercises such as Tai Chi and Baduanjin while adhering to social distancing measures. Furthermore, staff members used cognitive training tools and accompanied residents with dementia on 30-minute walks.[16]

Admissions in LTCFs

A particularly critical moment in LTCFs is represented by the admission of a new resident during the pandemic. To prevent the entrance of the coronavirus in the facility, several countermeasures have been applied. First, it is requested that hospitals certify the status of noninfection for all patients who are discharged and transferred to the LTCF.[18] If a patient presents with signs of respiratory infection, he or she is promptly isolated in negative pressure rooms and tested.[11,18] For example, in Hong Kong, temporary isolation units have been created in LTCFs to quarantine and repeatedly test all the new residents before admission to the facility.[8]

A method used in Taiwan is the so-called Traffic Control Bundling, first used during the SARS outbreak and adapted to the COVID-19 pandemic.[12,19] It has been shown to prevent coronavirus diffusion by compartmentalizing areas with different checkpoints (including hand disinfection and the use of PPE areas). All the new residents have to reside in the transition zone for the entire COVID-19 incubation period before being allowed into the clean zone of the LTCF. The model was adapted to this pandemic by incorporating the "quarantine ward," which housed residents with atypical manifestations or those waiting for a definite diagnosis.

Proactive Response and Prevention to Control Internal Outbreaks

Another problem that emerged in LTCFs was the risk of spreading the infection because of internal COVID-19 cases. In South Korea, detailed guidelines were provided to assist LTCFs in infection control.[21,22] On January 29, 2020, the government introduced a monitoring system in LTCFs based on massive testing. Tests were immediately conducted on all suspicious cases. Furthermore, workers were invited to stay home if they arrived from highly epidemic areas such as China.

In China, the Ministry of Civil Affairs formulated "Guidelines on the Prevention and Control of the Pneumonia Epidemic caused by a Novel Coronavirus in Eldercare Institutions." The special role of "Dean" was created, a leading figure that does not have to be necessarily a doctor or a nurse but has the skills to manage nursing homes and avoid outbreaks. Each structure has its own Dean,[16] who implements a prevention and control plan and supervises different sectors and "teams" (ie, a medical team, an isolation team, and a psychological intervention team) to try and contain outbreaks.

In Hong Kong and Singapore, if a resident comes in contact with a positive resident, a 14-day quarantine is instituted, and medical surveillance (daily temperature and symptoms) is applied for an additional 2 weeks.[11] In addition, Singapore conducts rigorous contact tracing to identify the close contacts of a confirmed case to ringfence the spread of COVID-19. Furthermore, serial point prevalence surveys (PPS) are done to allow early detection of asymptomatic cases. Cohort isolation units have been organized to separate residents who present a high risk of COVID-19 infection, such as those returning after a hospital admission.[10]

At a diagnostic level, another way to control outbreaks and identify the COVID-19 virus is by genomic sequencing and phylogenetic analysis.[29] Performed to identify different mutations, it seeks to improve the understanding of the evolution of the virus, and can help in contact tracing.

LTCF and Acute Hospitals

The SARS outbreak in 2003, mainly in the East Asia and South-Eastern Asia regions, highlighted the need to build capability within the health care system to handle future outbreaks. From that experience, Singapore developed the National Centre for Infectious Disease, a 330-bed hospital dedicated for the treatment and emergency support of new outbreaks of infectious diseases.[20] Health care services were substantially reorganized into decentralized health care systems, which strengthened the connection between hospitals and nursing home, facilitating the containment of eventual clusters in LTCFs. This ensured that during the COVID-19 outbreak, LTCF residents with fever or respiratory symptoms were immediately sent to acute hospitals and continued to be monitored or tracked. Furthermore, specific COVID-19 advisories were also created to ensure that guidelines were respected. South Korea used the same approach, sending suspected cases in LTCFs immediately to acute hospitals.[25] On the other hand, in Hong Kong, another approach was used. Private practitioners and hospital employees (geriatricians, nurses, and other professionals) are organized into geriatric outreach teams (CGAT) that go to LTCFs to ensure that preventive measures are followed.[30] The aim is also to guarantee medical service to avoid resident transfer to acute hospitals.[20] Also, with the help of the Centre For Health Protection Infections Control Branch, they decide which COVID-19 patient can be transferred to quarantine sites to decongest LTCFs, where they guarantee further medical service.[30] This approach was also adopted in Singapore where medical mobile teams from acute hospitals were mobilized to support the NH outbreak. On the other hand, it is noteworthy that the Japanese government initially recommended the immediate transfer of suspected COVID-19 patients to acute hospitals but had had to modify its strategy in view of the resistance of private hospitals to admitting COVID-19 cases.[9]

Technology

During the pandemic, the role of technology took an important turn and became an important pillar to prevent and control the disease. Autonomous robots became essential to avoid frequent and close contact. They are able to monitor vital signs, deliver meals and medications, and act as portals of communication between staff and patients.

An example is the Shanghai IZhaohu created in 2007.[31] It was the first technological platform in China to use artificial intelligence and big data. It consists of 2 digital management systems. During the COVID-19 outbreak, it ensured to minimize transmission by making sure that protective gear use and disease prevention and control measures were properly followed. Furthermore, it monitors temperature and symptoms, dispense medications, provide teleconsultation with doctors from acute hospitals, provide WeChat video calls with families and offer personalized care and rehabilitation support for older adults.

In Hong Kong, local telecommunication societies have sponsored and partnered with nongovernmental organizations to provide videoconferences in nursing homes between patients and relatives.[10,22]

Other robots were created for sanitation purposes within and outside of medical environments, for example, aerosol disinfection, UV light disinfection, and autonomous cleaning robots. Some robots only dispense hand disinfectant,[23] whereas others are designed to

deliver food and medications to avoid interpersonal contact. This was also used in quarantine hotels.[32]

Technology has also allowed a broad implementation of telemedicine.[18,33] On a broader scale, technology was implemented for contact tracing in the community. The WHO report published in February 2021 explains that contact tracing is a suitable measure to contain transmission and reduce mortality.[17] Needless to say, contact tracing of the general population would have downstream benefits of better limiting the spread of COVID-19 into LTCFs. In Asia, digital contact tracing was largely used by the general population. Mobile phone applications were used to facilitate manual contact tracing, isolations, and quarantines using Bluetooth and geofencing technologies.[24] For instance, as early as March 2020, Singapore implemented various apps, such as TraceTogether. These records were not sent to the authorities but stored in the users' phones as anonymous numerical IDs and shared only if requested by the Ministry of Health. The government also created a system of monitoring for nonmobile users by producing specific ID cards for entering into public places. In Hong Kong, the StayHomeSafe App[34] was created to ensure that anyone who enters has to wear a wristband to detect if the person leaves home and breaks self-isolation. Taiwan and Korea used technologic contact tracing by using GPS, credit card transactions, and data analytics.[24] One of the issues of technology worldwide concerned the ethical issues around accessibility, privacy, security, and accountability.

Conclusions and Implications

The COVID-19 pandemic has challenged the organizational skills of health care systems worldwide. Europe and the United States have experienced an overwhelming number of cases in LTCFs. Why was there such a difference between Eastern and Western countries? The prevention and control recommendations for LTCFs published on March 21, 2020, by the WHO are designed to be global. Asian guidelines are generally not too different from those recommended elsewhere. However, closer inspection suggests that differences in timing and prior experience might have favored the Asian response.

One of the possible hypotheses is that the SARS experience of 2003, H1N1 in 2009, and MERS in 2012 have somehow made the Asian systems more prepared and responsive. As stated above, efficient contact tracing and the prompt use of isolation and quarantine have been pivotal to contain the spread of COVID-19 in LTCFs. Furthermore, the experience of earlier outbreaks promoted LTCFs to be more adequately prepared and trained in infection control. Emergency drills simulating viral outbreaks have been regularly tested.[7,8] The prior experience also laid the foundation for rapid mobilization of massive campaigns of testing in LTCFs.

It is also possible that differences in sociocultural values and attitudes toward older persons might have played a role. The phenomenon of ageism may be less of an issue owing to traditional values of filial piety in Asian societies. Also, the prominent role of the public health care system in many Asian countries facilitates the connectivity of LTCFs to the rest of the health care system (ie, primary care and hospital), guaranteeing higher qualitative standards in terms of staff training, resources, and infrastructure.

Till today, we cannot be sure of the overall exact number of deaths in LTCF. This is because deaths can be calculated based on a positive COVID-19 test, or suspected COVID-19 death based on symptoms, or excess deaths comparing the death rate from previous years in the same weeks.[35] We also have to take into account that during the first weeks of the pandemic, most patients lacked a confirmed diagnosis of COVID-19 owing to the absence of nasal swabs and undeclared deaths owing to transfer in acute hospitals.[25] Therefore, this is an important caveat to keep in mind when comparing COVID-19 statistics in LTCFs between countries with different health care systems and management approaches to the pandemic.

In conclusion, the example that LTCFs in Asia has offered during the terrible COVID-19 pandemic can yield insights that can be tapped on for future pandemic preparedness. It is critical that health care practitioners and policy makers ascribe the correct value to a critical setting that is still too often neglected. On a more optimistic note, by choosing to prioritize the COVID-19 vaccine to the most vulnerable such as LTCF residents, this is a strong statement of intent that will go a long way toward future prevention of the virus to "come in, to spread and to come out."

References

1. World Health Organization. Coronavirus (COVID-19) events as they happen. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen. Accessed May 19, 2021.
2. Zhu J, Ji P, Pang J, et al. Clinical characteristics of 3062 COVID-19 patients: a meta-analysis. J Med Virol 2020;92:1902–1914.
3. Jordan RE, Adab P, Cheng KK. Covid-19: risk factors for severe disease and death. BMJ 2020;368:m1198.
4. Dosa D, Jump RLP, LaPlante K, Gravenstein S. Long-term care facilities and the coronavirus epidemic: practical guidelines for a population at highest risk. J Am Med Dir Assoc 2020;21:569–571.
5. Comas-Herrera A, Zalakaín J, Lemmon E, et al. Mortality associated with COVID-19 in care homes: international evidence. LTCcovid.org, International Long-Term Care Policy Network, CPEC-LSE; 2021.
6. Nearly one-third of U.S. coronavirus deaths are linked to nursing homes. The New York Times. https://www.nytimes.com/interactive/2020/us/coronavirus-nursing-homes.html. Accessed May 19, 2021.
7. MPs hear why Hong Kong had no Covid-19 care home deaths. The Guardian. 2020. http://www.theguardian.com/world/2020/may/19/mps-hear-why-hong-kong-had-no-covid-19-care-home-deaths. Accessed May 19, 2021.
8. Lau-Ng R, Caruso LB, Perls TT. COVID-19 deaths in long-term care facilities: a critical piece of the pandemic puzzle. J Am Geriatr Soc 2020;68:1895–1898.
9. Estévez-Abe M, Ide H. COVID-19 and Japan's Long-Term Care System. LTCcovid.org, International Long-Term Care Policy Network, CPEC-LSE; 2021.
10. Wong K, Lum T, Wong G. The COVID-19 Long-Term Care situation in Hong Kong: impact and measures. LTCcovid.org, International Long-Term Care Policy Network, CPEC-LSE; 2020.
11. Guidelines for residential care homes for the elderly and residential care homes for persons with disabilities for the prevention of coronavirus disease. https://www.chp.gov.hk/files/pdf/advice_to_rche_rchd_on_prevention_of_nid_eng.pdf. Accessed May 19, 2021.
12. Yen MY, Schwartz J, King CC, Lee CM, Hsueh PR. Recommendations for protecting against and mitigating the COVID-19 pandemic in long-term care facilities. J Microbiol Immunol Infect 2020;53:447–453.
13. Yang P, Huang LK. Successful prevention of COVID-19 outbreak at elderly care institutions in Taiwan. J Formos Med Assoc 2020;119:1249–1250.
14. Shea YF, Lam HY, Yuen JKY, et al. Maintaining zero coronavirus disease 2019 infection among long-term care facility residents in Hong Kong. J Am Med Dir Assoc 2020;21:981–982.
15. Merchant RA. COVID-19: role of integrated regional health system towards controlling pandemic in the community, intermediate and long-term care. J Frailty Aging 2020;9:248–249.
16. Wang L, Qi N, Zhou Y, Zhang H. Prevention and infection control of COVID-19 in nursing homes: experience from China. Age Ageing 2020;49:894–895.
17. World Health Organization. Contact tracing in the context of COVID-19: interim guidance. 2021. https://apps.who.int/iris/handle/10665/339128. Accessed May 19, 2021.
18. Tan LF, Seetharaman S. Preventing the spread of COVID-19 to nursing homes: experience from a Singapore geriatric centre. J Am Geriatr Soc 2020;68:942.
19. Yen MY, Schwartz J, Chen SY, King CC, Yang GY, Hsueh PR. Interrupting COVID-19 transmission by implementing enhanced traffic control bundling: implications for global prevention and control efforts. J Microbiol Immunol Infect 2020;53:377–380.
20. Lim W, Liang C, Assantachai P, et al. COVID-19 and older people in Asia: Asian Working Group for Sarcopenia calls to actions. Geriatr Gerontol Int 2020;20:547–558.
21. Kim JH, An JAR, Pk Min, Bitton A, Gawande AA. How South Korea responded to the Covid-19 outbreak in Daegu. NEJM Catalyst 2020;1. CAT.20.0159.
22. Ga H, Won CW, Lee E, et al. The Korean Geriatrics Society COVID-19 strategy for older adults. Ann Geriatr Med Res 2020;24:59–61.
23. Meisenzahl M. How Asia, the US, and Europe are using robots to replace and help humans fight coronavirus by delivering groceries, sanitizing hospitals, and monitoring patients. Business Insider. https://www.businessinsider.com/robots-fighting-coronavirus-in-china-us-and-europe-2020-3. Accessed December 21, 2021.
24. Nageshwaran G, Harris RC, Guerche-Seblain CE. Review of the role of big data and digital technologies in controlling COVID-19 in Asia: Public health interest vs. privacy. Digit Health 2021;7. 205520762110029.

25. Kim H. The impact of COVID-19 on long-term care in South Korea and measures to address it. LTCcovid.org, International Long-Term Care Policy Network, CPEC-LSE; 2020.
26. COVID-19 testing started for 16,000 nursing home residents, 9,000 staff already tested with 1 positive case. CNA. https://www.channelnewsasia.com/news/singapore/covid-19-testing-nursing-home-residents-employees-ren-ci-amk-12714984. Accessed May 19, 2021.
27. A COVID-19 nursing home cluster linked to a household transmission: an epidemiological, clinical and phylogenetic investigation. Abstract. Europe PMC. https://europepmc.org/article/ppr/ppr260238. Accessed June 20, 2021.
28. Guidance on COVID-19 for the care of older people and people living in long-term care facilities, other nonacute care facilities and home care. Apps.who.int. 2020. https://apps.who.int/iris/bitstream/handle/10665/331913/COVID-19-emergency-guidance-ageing-eng.pdf?sequence=1&isAllowed=y. Accessed May 29, 2021.
29. Yang X, Dong N, Chan EWC, Chen S. Genetic cluster analysis of SARS-CoV-2 and the identification of those responsible for the major outbreaks in various countries. Emerg Microbes Infect 2020;9:1287–1299.
30. Auyeung TW, Chan FH, Chan T, et al. COVID-19 and older adults: experience in Hong Kong. Asian J Gerontol Geriatr 2021;15:54–59.
31. The Rockefeller Foundation. Tackling COVID-19 pandemic through integrating digital technology and public health. https://www.rockefellerfoundation.org/wp-content/uploads/2020/09/v7_RF-Final-Report_AHI_2020903_reduced.pdf. Accessed December 2, 2021.
32. Zhao Z, Ma Y, Mushtaq A, et al.. Applications of robotics, artificial intelligence, and digital technologies during COVID-19: a review. Disaster Med Public Health Prep. Published online January 8, 2021. https://doi.org/10.1017/dmp.2021.9.
33. Wee SL, Yap PLK. Timely lessons from a pandemic on the benefits of person centric care in long term care facilities. J Frailty Aging 2020;9:132–133.
34. COVID-19 thematic website - together, we fight the virus - "StayHomeSafe" mobile app user guide. https://www.coronavirus.gov.hk/eng/stay-home-safe.html. Accessed December 21, 2021.
35. Irving & Bloom. COVID-19, older adults and long-term care in Asia Pacific. Report prepared for HelpAge International, Asia Pacific. https://ageingasia.org/wp-content/uploads/2020/12/COVID_LTC_Report-Final-20-November-2020.pdf. Accessed December 2, 2021.