



**EMERGENCY
RESILIENCE
PROGRAM**

KFAS covid-19 weekly brief

7 June 2020



Introduction

As the COVID-19 continues to impact the wealth and welfare of our society, much remains to be understood about the pandemic and its impact. Hence, the importance of using scientific research, facts and data for a better understanding of the nature of the pandemic, as well as its associated public health issues, to drive policy making in addressing challenges related to healthcare and wellbeing of the population. This newsletter is intended to provide a weekly overview on the latest information on health-related topics surrounding the COVID-19 pandemic, covering five main themes: infection control and prevention, diagnosis and testing, treatment and therapy, training for healthcare professionals and exit strategies. Each edition of the newsletter will cover a specific sub-theme under the five main themes, providing up to date information on available resources, research, data and studies, along with policy recommendations and implications, based on scientific evidence and facts, for decision makers to utilize in developing policies and measures to address the challenges associated with COVID-19 within the healthcare sector.

News Highlights

(up to May 26th, 2020)

- Remdesivir alone is not enough, researchers conclude in first major Covid-19 trial of the drug: [CNN](#)
- Here's how Wuhan tested 6.5 million people for the coronavirus in days. [New York Times](#)
- 3D Printing the Novel Coronavirus. [NIH](#)
- Tokyo lifts state of emergency, braces for 'new lifestyle' with the virus. [Washington Post](#)
- Hospitals turn to big tech companies to store and analyze their data — leaving patients in the dark on privacy protection. [STAT](#)
- Immunity Passports and the Perils of Conferring Coronavirus Status. [The New Yorker](#)
- Large study finds drug Trump touted for Covid-19 is linked to greater risk of death and heart arrhythmia. [CNN](#)
- Find out which masks offer the most protection and why. [BBC](#)
- Coronavirus: Immune clue sparks treatment hope. [BBC](#)
- Coronavirus: Children and older adults to take part in vaccine trial. [BBC](#)

Key Takeaways

Infection Control and Prevention: Optimization of the Use of PPE:

1. We provide a “Cheat Sheet” for healthcare administrators for the use of CDC guidelines for optimization of PPE.
2. Vaporous hydrogen peroxide, ultraviolet germicidal irradiation, and moist heat may be safely used to decontaminate FFRs while using the appropriate recommended measures for each technique.

Diagnosis and Testing: The role of testing, tracking, tracing and assessing trends will play a central role in the lifting confinement restrictions in preparing for the “new normal”. Countries, as a part of their exit strategies will need to develop national testing plans, which should include testing strategy the role of both molecular and serology testing, and details as to how, what and when to test. Widespread testing plans should be complemented with tracking and tracing efforts and updated as more “rapid” tests are approved for use.

Treatment and Therapies: Although there are no specific treatments for COVID-19 to date, due to the success of Remdesivir for the treatment of COVID-19 in hospitalized patients with severe disease, the NIH Panel has recommended its use. At the same time, the World Health Organization (WHO) has suspended the trial of hydroxychloroquine as COVID-19 treatment over safety concerns. Recent concerns around the COVID-19 pandemic in children is due to the multisystem inflammatory syndrome affecting children, sharing symptoms similar to Kawasaki disease and toxic shock. Also, COVID-19 has been associated with inflammation and a pro-thrombotic state, but there are still insufficient data to recommend either for or against using therapeutic doses of antithrombotics as a potential therapy.

Training of Healthcare Professionals: Training Health Care Providers on Infection Control, And Essential Skills During the COVID-19 Pandemic:

1. Recommendations for healthcare providers and administrators for training in infection control and the use of PPE.
2. New innovative training opportunities for healthcare providers and administrators.

Exit Strategies: As countries start to devise their own measures to lift restrictions and define a “new normal”, lessons can be drawn upon from other countries that have already implemented measures, mainly through a phased approach, using scientific data and evidence to drive policies for revitalizing the economy and society.

Infection Control and Prevention

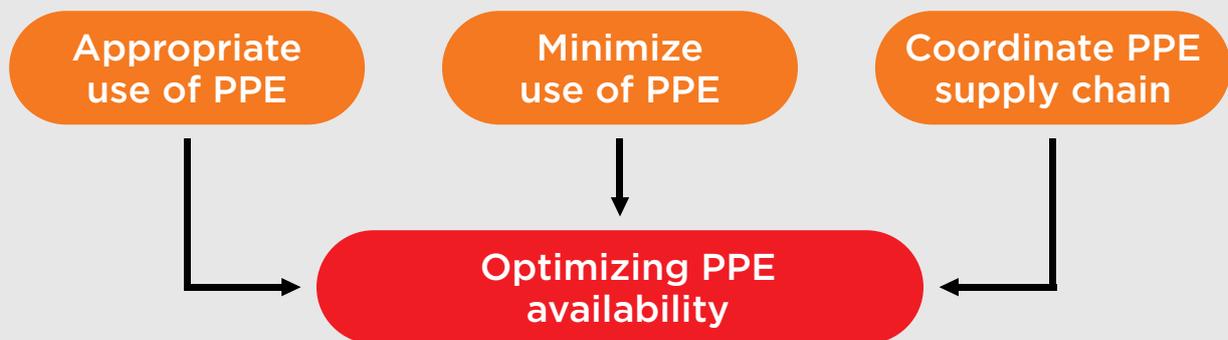
Optimization of the Use of PPE

Background:

Personal protective equipment (PPE) is used every day by healthcare workers (HCW) to protect themselves, patients, and others when providing care. PPE shortages are currently posing a challenge to healthcare systems around the world due to the COVID-19 pandemic. The current global stockpile of PPE is insufficient. This is especially true for medical masks and respirators. The supply of gowns and goggles is also expected to be insufficient. Surging global demand driven not only by the number of COVID-19 cases but also by misinformation, panic buying, and stockpiling is resulting in further shortages of PPE globally. The capacity to expand PPE production has been limited, and the current demand for respirators and masks cannot be met, especially if widespread inappropriate use of PPE continues.

Optimization of PPE availability:

The key to optimizing PPE availability is to use them in the proper settings, using them correctly and coordinating the PPE supply chain



The Center for Disease Control and Prevention (CDC) has created guidelines for health care institutions on what is acceptable for personal protective equipment (PPE) due to shortages of N95 respirators, facemasks, and gowns. The CDC shared strategies to optimize these PPE supplies in healthcare settings when there is limited supply. The CDC uses “surge capacity” as a framework to approach shortage in PPE supply. Surge capacity is the ability to manage a sudden, unexpected increase in patient volume. Three stages are used to describe surge capacity and can be used to prioritize actions of the healthcare facility to preserve PPE supplies during the COVID-19 response (Figure 1). This framework should be used by the MOH and any private sector healthcare provider.

Conventional Capacity	Strategies that should already be implemented in general infection prevention and control plans
Contingency Capacity	Strategies that may be used temporarily during periods of expected PPE shortages
Crisis capacity	Strategies that may need to be considered during periods of known PPE shortages

Figure 1: Summary of the stages of PPE capacity

The surge capacity framework was used by the CDC to guide healthcare facilities on the use of individual components of PPE. Below is a summary of the guidelines that may be adopted by the MOH and any private sector healthcare provider

	Conventional Capacity	Contingency Capacity	Crisis Capacity
N95 Respirators	Surgical N95 respirators recommended only for HCW who need protection from both airborne and fluid hazards.	<ul style="list-style-type: none"> - Use of N95 respirators beyond the manufacturer-designated shelf life for training and fit testing. - Extended use of N95 respirators. 	<ul style="list-style-type: none"> -Use of respirators beyond the manufacturer-designated shelf life for healthcare delivery. -Use of respirators approved under standards used in other countries that are similar to N95 respirators. -Limited re-use of N95 respirators for COVID-19 patients. -Prioritize the use of N95 respirators by activity type.
Facemask	Use facemasks according to product labeling and local requirements.	<ul style="list-style-type: none"> -Remove facemasks for visitors in public areas. -Implement extended use of facemasks. -Restrict facemasks to use by HCW rather than patients for source control. 	<ul style="list-style-type: none"> -Use facemasks beyond the manufacturer-designated shelf life during patient care activities. -Implement limited re-use of facemasks. -Prioritize facemasks for selected activities.
Isolation gown	Use isolation gown alternatives that offer equivalent or higher protection.	<ul style="list-style-type: none"> -Shift gown use towards cloth isolation gowns. -Consider the use of coveralls. -Use of expired gowns beyond the manufacturer-designated shelf life for training. -Use gowns or coveralls conforming to international standards. 	<ul style="list-style-type: none"> -Extended use of isolation gowns. -Re-use of cloth isolation gowns. -Prioritize gowns for certain activities

	Conventional Capacity	Contingency Capacity	Crisis Capacity
Eye protection	Use eye protection according to product labeling and local requirements.	-Shift eye protection supplies from disposable to re-usable devices (i.e., goggles and reusable face shields). -Implement extended use of eye protection.	-Use eye protection beyond the manufacturer-designated shelf life during patient care activities. -Prioritize eye protection for selected activities. -Consider using safety glasses that have extensions to cover the side of the eyes.

Decontamination and Reuse of Filtering Facepiece Respirators:

Decontamination filtering facepiece respirators (FFRs) is a way to optimize PPE in times of shortage. While disposable FFRs like N95s, are not approved for routine decontamination as conventional standards of care, FFR decontamination and reuse may be needed during times of shortage to ensure availability. There is still limited amount of research to prove safety, however the following methods have shown promise as potential decontamination methods:

- 1. Ultraviolet germicidal irradiation:** refers to using ultraviolet radiant energy to inactivate bacteria, mold spores, fungi or viruses in a given location.
- 2. Vaporous hydrogen peroxide:** is a broad-spectrum antimicrobial with viricidal, bactericidal, fungicidal, and sporicidal activity. VHP is a relatively rapid sterilization technology. VHP is produced by the vaporization (at 120°C) of liquid hydrogen peroxide to give a mixture of VHP and water vapor.
- 3. Moist heat:** The use of moist heat in the form of saturated steam under pressure accomplished in an autoclave.

Before using any decontamination method, it should be evaluated for its ability to retain:

1. Filtration performance
2. Fit characteristics achieved prior to decontamination
3. Safety of the FFR for the wearer by inactivating SARS-CoV2
4. Safety for the wearer by not leaving residual harmful chemicals

Vaporous hydrogen peroxide, ultraviolet germicidal irradiation, and moist heat are the most promising decontamination methods. If FFR decontamination is considered, these methods do not appear to break down filtration or compromise the FFR; however, many of these methods can only be used for limited times. Below is a summary of the current information available for the three decontamination techniques.

	Filtration	Fit test	Microbial Test	Potential Limitation
Vaporous hydrogen peroxide	passed	passed	99.9999% efficiency in killing bacterial spores	
Ultraviolet germicidal irradiation (UVGI)	passed	passed	Disinfection efficacy is dependent on dose: 0.5–1.8 J/cm ² Inactivation of 99.9% of: Influenza A (H1N1) Avian influenza A virus (H5N1), Low pathogenic Influenza A (H7N9), Influenza A (H7N9), MERS-CoV SARS-CoV H1N1 Influenza A/PR/8/34 MS2 bacteriophage	- Disinfection efficacy is dependent on dose. Not all UV lamps provide the same intensity thus treatment times would have to be adjusted accordingly. - UVGI is unlikely to kill all the viruses and bacteria on an FFR due to shadow effects produced by the multiple layers of the FFR's construction.
Moist heat	passed	passed	disinfected FFRs contaminated with H1N1 influenza using moist heat, of 65°C and 85% RH, and achieved a minimum of 99.99% reduction in virus	Moist heat method is the uncertainty of the disinfection efficacy for various pathogens.

In summary, vaporous hydrogen peroxide, ultraviolet germicidal irradiation, and moist heat may be safely used to decontaminate FFRs while using the appropriate recommended measures for each technique.

Cardboard Boxes as Hospital Beds

Aryan Paper Group, a paper and packaging company, designed hospital beds out of high strength paper, such as cardboard boxes. According to the company, these beds can support up to 200 kg in weight, with the added advantage of easy disposal. The beds are coated with a waterproof solution to avoid spills and water damages. The design provides an elevated head rest to support COVID patients, who may have difficult breathing when lying down.¹

Similarly in Columbia, a company called ABC Displays, which is in the marketing business, has designed cardboard bed-coffins, hospital beds that can be converted to coffins. Although the spread of COVID-19 has not overwhelmed the healthcare system in Columbia, there have been overcrowding at hospitals and funeral homes. Thus, to prepare the healthcare system in case of a surge of infections that may overtake existing hospital facilities, ABC developed these bed-coffins. The beds have the ability to incline, both in the up and down direction. They are also able to hold up to 150 kg, and include wheels with brakes for moving patients, when needed.

In April 2020, Tokyo's Narita Airport had transformed its arrival terminal into a zone with cardboard boxes as beds for travelers as they await the results of their tests. The Japanese have used cardboard boxes during previous disasters.

Reusable Elastomeric Half-Mask Respirators Compared With Disposable N95 Respirators

Concerns are growing over global shortages of respiratory protective devices during COVID-19 pandemic. A reusable alternative to N95 respirators for which health care personnel can be rapidly assessed for fit and trained for use is needed. Elastomeric half-mask respirators (EHMRs), which provide the same level of respiratory protection as N95 respirators, are one possible alternative (Figure 2). These reusable respirators are used in construction and manufacturing, but not widely used in health care because of uncertainty about disinfection methods and costs. A recent study in JAMA* found that health care personnel can be rapidly fit tested and trained to use the reusable EHMR. Time to achieve fit with EHMRs was not significantly different than with N95 respirators. High EHMR performance was demonstrated. They concluded that EHMR may serve as a suitable alternative to disposable N95 respirators during public health emergencies.

Recommendation: Based on this study reusable EHMRs can potentially be used as an alternative disposable FFRs to optimize PPE.



Disposable N95 Respirators



Reusable Elastomeric Half-Mask Respirators

Figure 2

* https://www.business-standard.com/article/companies/gujarat-based-company-makes-low-cost-cardboard-beds-for-covid-19-patients-120041701387_1.html

<https://www.usnews.com/news/world/articles/2020-05-22/colombian-businessman-makes-hospital-bed-coffin-combo-to-serve-coronavirus-dead>
https://edition.cnn.com/world/live-news/coronavirus-pandemic-04-13-20/h_d2d86008db145b42b8782ce054920ee0

Pompeii LA, Kraft CS, Brownsword EA, et al. Training and Fit Testing of Health Care Personnel for Reusable Elastomeric Half-Mask Respirators Compared With Disposable N95 Respirators. JAMA. 2020;323(18):1849-1852. doi:10.1001/jama.2020.4806

Diagnosis and Testing

Testing Strategies: Driving Force of the “New Normal”

Testing has been an essential component in combatting the COVID-19 pandemic and will continue to play a central role as most countries start to consider what the “new normal” would entail and how to best reduce strict restrictions, such as social distancing and even full lockdowns. Widespread testing, along with effective tracking and contact tracing for identifying symptomatic and asymptomatic individuals, are key components in enabling decision makers to assess what measures and interventions will need to be put in place, to combat a surge in the local outbreaks.¹ As countries start to devise their recovery or exit strategies, one of the critical components of these plans is the country’s testing strategy, which will consider the key aspects of how, when, who and what type of testing will be utilized. Testing strategies will need to consider the current available testing types suppressing the resurgence of local outbreaks, gaining intelligence on the epidemic, and identifying people who have developed some form of immunity, in an attempt to reach “herd immunity”. These strategies will also need to include how workplaces and organizations should address testing of their employees, to ensure that their businesses continue to thrive with a strong and health workforce.

Types of Tests

Diagnostic tests can be divided into three categories based on the technique: molecular diagnostic methods, serological methods (more commonly known as antibody tests or rapid tests), and computer tomography and imaging methods. The following paragraphs will focus on the latter two, which are considered the more commonly used testing types.

Molecular Diagnostics: RT-PCR

Most countries are currently relying heavily on the use of the Reverse-Transcriptase Polymerase Chain Reaction (RT-PCR) tests, a highly sensitive diagnostic test that detects the presence of the viral genetic material in a patient, indicative of an active infection.² Samples are taken from areas of high viral concentrations, such as the upper and lower respiratory tracts of subjects.^{1,2} A positive test, signaled by a change in fluorescence, indicates patient’s own genetic material has viral material present. While RT-PCR remains the primary means for an active infection, these tests are limited in their accuracy; it is reported that these tests are 66-80% accurate and require several repeats to ensure the correct diagnosis.^{1,3} One of the other main

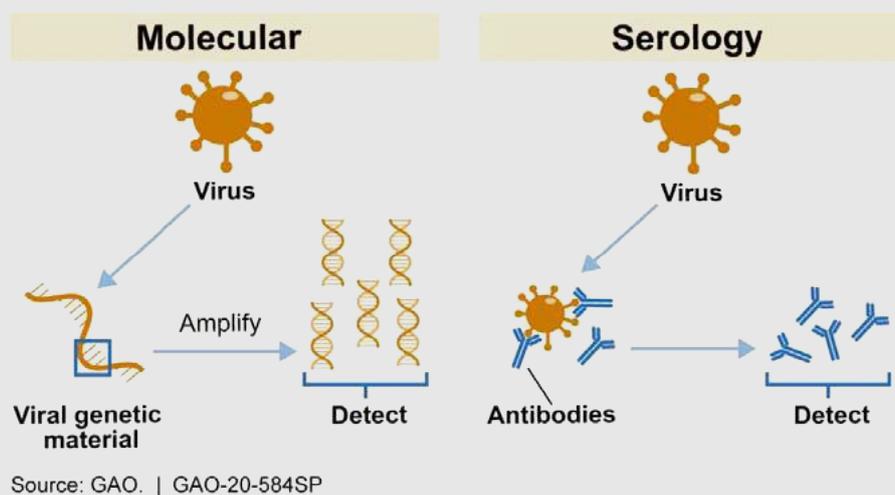
1. Testing for COVID-19: a way to lift confinement restrictions” OECD 2020.

2. Udugama et. al. “Diagnosing COVID-19: The Disease and Tools for Detection.” ACS nano vol. 14,4 (2020): 3822-3835 doi:10.1021/acsnano.0c02624; Deeks et al. “Diagnosis of SARS-CoV-2 Infection and COVID-19: accuracy of signs and symptoms; molecular antigen and antibody tests and routine laboratory markers.” Cochrane Database of Systematic Reviews 2020, Issue 4. Art. No.: CD013596. DOI: 10.1002/14651858.CD013596.; Kakodkar et al. “A Comprehensive Literature on the Clinical Presentation, and Management of the Pandemic Coronavirus Disease 2019 (COVID-19).” Cureus vol. 12,4 e7560. 6 Apr. 2020, doi: 10.7759/cureus.756; “Testing for COVID-19: a way to lift confinement restrictions” OECD 2020

3. What has been shown is that if the RT-PCR test is positive, then it is more than likely that the patient is positive (unless it is a false positive due to other circumstances, such as contamination). False negatives could be due to several reasons, but more often than not, linked to wrong patient sampling (i.e. sample not collected properly). Adopted from Reference #1.

challenges with these tests is mainly related to logistics: the process tends to be quite intense and long, and results may take days to reach the patient (at which point, they might have been exposed to the virus during that time). Furthermore, globally, there is a limitation in the materials and supplies needed to administer these tests, including the swabs, reagents, buffers, and other materials, leading the procurement issues.

To address some of the limitations of the standard RT-PCR test, a rapid PCR procedure was developed to assess a patient at the point of care (i.e. in emergency rooms) which would not require the intense, long and laborious procedures of a standard test, reducing the time to receive a result from days to and can provide a result within 30 minutes.⁴ However, these tests are also limited in that they require specific instrumentation, that are not available in every healthcare facility.⁵ In addition, these tests have lower sensitivity and miss a substantial number of positive patients, similar to the results that are observed with fast tests for the flu. The United States Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for two fast RT-PCR tests: Xpert Xpress SARS-CoV-2 from Cepheid and ID Now COVID-19 from Abbott. In a multicenter evaluation of Cepheid’s Xpert Xpress test, it was found that the test showed equal performance in comparison to routine tests with a limit of detection (LOD) of 8.26 copies/mL, and high specificity, with a run time of 40-45 minutes.⁶ The Abbott test was initially thought to have issues with sensitivity due to an independent study by researchers at New York University, which showed that the test was missing one third of the patients



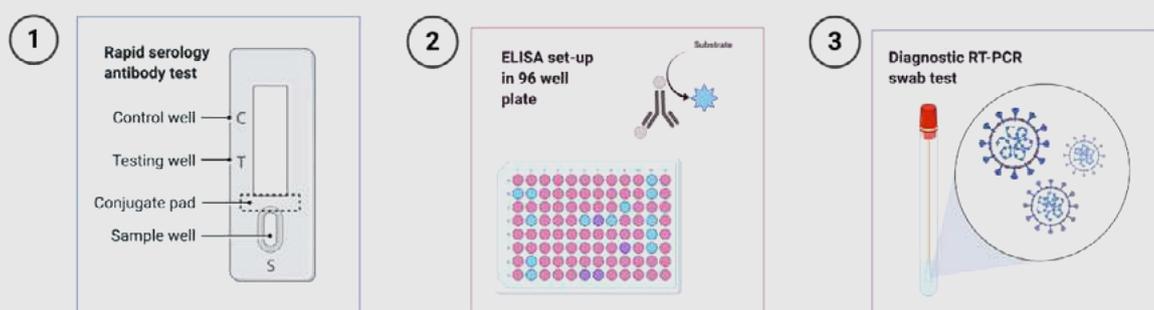
when the sample swabs were stored in chemicals and more than 48% when the swabs were kept dry.⁷ The company has criticized that study saying that the machine, as well as the patients’ samples, were not handled and stored properly. Partial data from an ongoing company-funded study showed 94.7% performance in relation to sensitivity and provided negative results 98.6% (specificity) of the time.⁸

4. fda.gov
 5. <https://time.com/5812664/5-minute-coronavirus-test/>; <https://a16z.com/2020/04/02/coronavirus-tests/>.
 6. Wolters, Femke et al. “Multi-center evaluation of cepheid xpert® xpress SARS-CoV-2 point-of-care test during the SARS-CoV-2 pandemic.” *Journal of clinical virology : the official publication of the Pan American Society for Clinical Virology*, vol. 128 104426. 11 May, 2020, doi:10.1016/j.jcv.2020.104426
 7. Basu et al. “Performance of the rapid Nucleic Acid Amplification by Abbott ID NOW COVID-19 in nasopharyngeal swabs transported in viral media and dry nasal swabs, in a New York City academic institution”_bioRxiv_May 12, 2020.
 8. <https://abbott.mediaroom.com/2020-05-21-Abbott-Releases-Interim-Clinical-Study-Data-on-ID-NOW-COVID-19-Rapid-Test-Showing-Strong-Agreement-to-Lab-Based-Molecular-PCR-Tests>

Serology Tests

Serological testing or antibody testing measure the body's immune response to the infection rather than the infection itself. The assay identifies the presence of anti-viral antibodies, IgG and IgM, present in the blood when the body responds specifically to COVID-19.⁹ The advantage of serology tests is that they allow for a more comprehensive understanding of who has had the disease, and what proportion of the population has immunity, as recovered patients, symptomatic and asymptomatic, can be identified. Serological tests are not ideal for detecting the presence of an active infection, as the majority of patients start producing antibodies between 7 and 11 days post exposure to the virus (some sooner).⁹

Comparison of main types of COVID-19 tests



	Rapid serology antibody test	ELISA	Diagnostic RT-PCR swab test
Sample input	Serum or plasma sample (whole blood or finger prick also possible)	Serum or plasma sample	Nasopharyngeal (NP) or Oropharyngeal (OP) swab sample
Result output	Detection of IgM/IgG antibodies via color change of strip in lateral flow assay	Detection of IgM/IgG or RBD IgG antibodies , via colorimetric assay	Detection of viral SARS-CoV-2 RNA via cDNA sequencing
Strengths	Very low relative cost , can be conducted at point-of-care or at home , ease-of-use, fast results (5-15 min, highly accurate detection of IgM/IgG several days after onset)	Robust detection of seroconversion status in a laboratory setting, can detect IgM/IgG highly accurately several days after onset or sooner	Gold-standard diagnostic test , directly detects virus presence (sequencing viral nucleic acids), most accurate results early in disease presentation
Limitations	Requires rigorous testing of cross-reactivity with other immune response, variation of test specificity & sensitivity among manufacturers	Requires rigorous testing of cross-reactivity with other immune response, requires laboratory setting	Labor intensive , requires numerous additional reagents and specialized equipment , can lose accuracy after ~5 days since symptom onset, sensitive to sample collection error

Comparing main types of COVID-19 testing. Adopted from <https://covidtestingproject.org/faq.html>.

9. Wölfel, R. et al. (2020), "Virological assessment of hospitalized patients with COVID-2019", Nature, pp. 1-10, <http://dx.doi.org/10.1038/s41586-020-2196-x>; Foundation for Innovative New Diagnostics (Finddx.org)"COVID-19 Diagnostics are tests used to detect infection with the SARS-COV-2 Virus" March 24, 2020

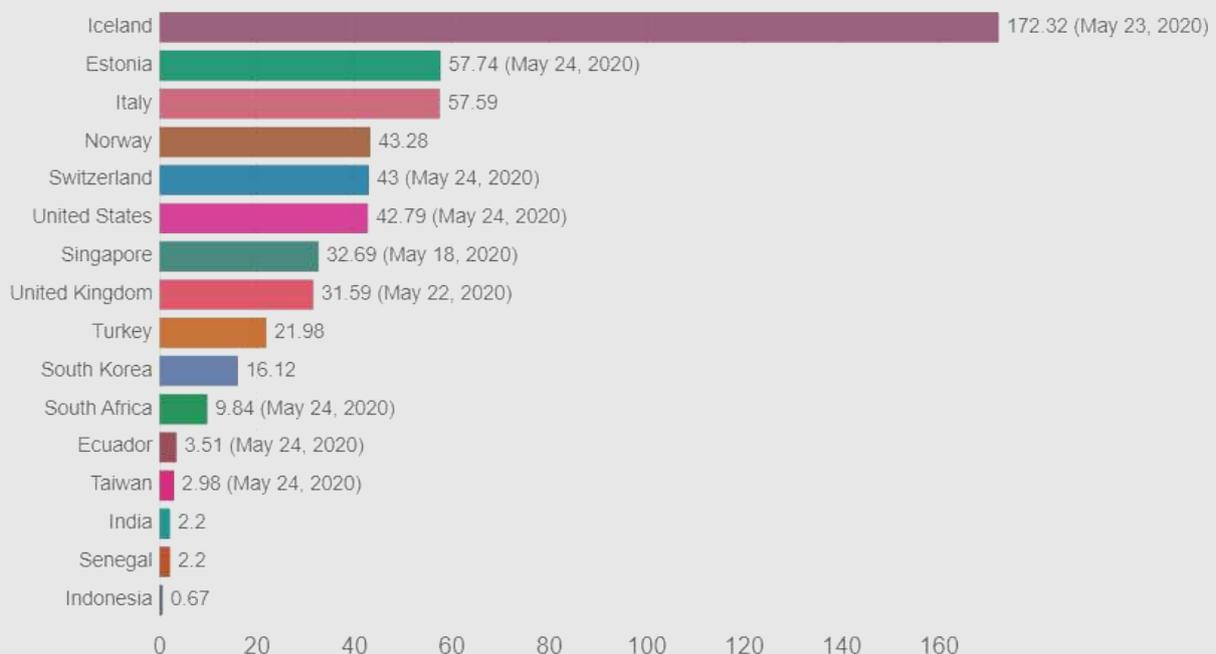
Currently, there are “rapid” serological tests under development, mainly reserved for professional use. These tests come with some caution, as a negative test does not rule out the possibility that an individual has not been infected, and vice-versa. There have been several tests that have been submitted as part of the EUA to the FDA.¹⁰ The pharmaceutical company, Roche, were granted emergency approval from the FDA for the production of rapid detection antibody tests, which allegedly had a specificity greater than 99.8% and a sensitivity of 100%, 14 days after an RT-PCR test confirmed an infection. Abbott Laboratories was also granted emergency approval for an antibody test kit on May 11, 2020, with similar sensitivity and specificity to the Roche test, delivering results in as little as five minutes.¹¹

Antigen testing has recently been granted emergency use authorization by the FDA to enable rapid point-of-care detection of COVID-19, without the need for specific laboratories. The test uses antibodies specific to the antigens of the COVID-19 virus and detects the presence of these viral antigens or proteins in the sample.¹² However, because these tests detect the presence of the virus in patients, these tests would not be useful to detect if someone has had the virus and recovered, and a negative result from an antigen test would have to be confirmed with a RT-PCR test.¹³ The FDA has authorized the use of the first antigen test to Quidel Corporation.^{12,14}

Total COVID-19 tests per 1,000 people, May 25, 2020



The most recent figures for selection of countries is shown (you can change the selection using '+ Add country'). Only data relating to the the last 10 days are included.



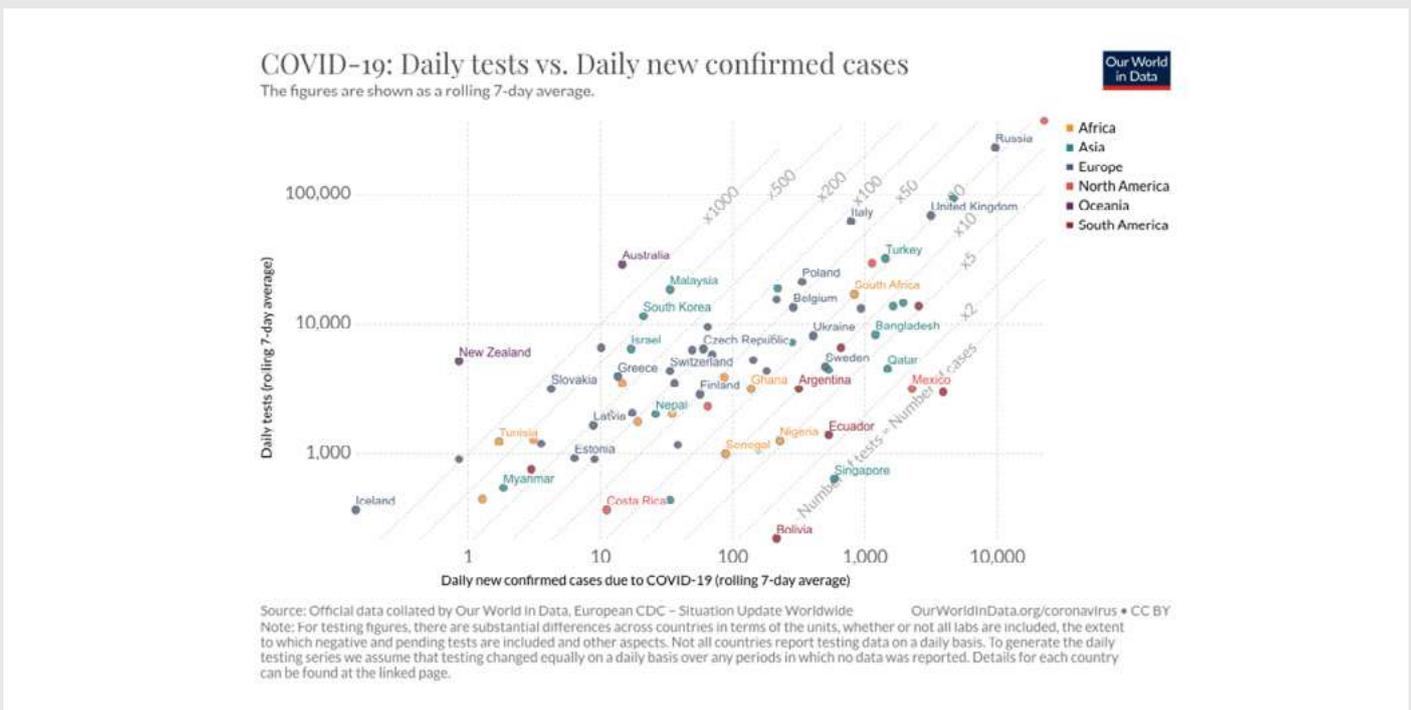
Source: Official sources collated by Our World in Data
 OurWorldInData.org/coronavirus • CC BY
 Note: For testing figures, there are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at the linked page.

10. Diagnostics.roche “Roche’s COVID-19 antibody test receives FDA Emergency Use Authorization and is available in markets accepting the CE mark” May 03, 2020; FDA.gov “FDA Statement COVID-19 Update Serological Tests” April 07, 2020
 11. Abbott.mediaroo.com “Abbott Receives FDA Emergency Use Authorization for COVID-19 Antibody Test on Alinity I System. May 11, 2020;
 12. FDA.gov “FDA Authorizes First Antigen Test to Help in the Rapid Detection of the Virus that Causes COVID-19 in Patients” May 09, 2020
 13. <https://www.health.com/condition/infectious-diseases/coronavirus/coronavirus-antigen-test>
 14. <https://www.massdevice.com/fda-authorizes-quidel-antigen-test-for-rapid-covid-19-detection/>

Managing COVID-19 with Testing

The mitigation efforts of the outbreak of the severe acute respiratory syndrome (SARS) in 2003, the Middle East respiratory syndrome (MERS) in 2012, and the Ebola virus disease in 2014 all involved the rapid implementation of a testing strategy, along tracking and tracing of infected individuals. The rapid implementation of these same measures, as well as additional approaches, will be essential in mitigating and preventing a further surges of the COVID-19 pandemic because of the virus's substantial proportion of secondary transmissions.¹ However, this has presented itself to be a challenge in large countries, as well as some developing countries.

With the onset of infections in South Korea, the country immediately revamped their local infrastructure to build a widespread, national testing platform, including ramping up kit production, distribution of these kits to local healthcare facilities and prepared the laboratories needed to run and analyze these tests.¹⁵ This also included developing -through testing centers. As a result, by the beginning of April, almost ten RT-PCR tests per thousand inhabitants were being conducted in South Korea. Other forms of surveillance were also used throughout the country, including thermal image cameras in office buildings, entertainment facilities and centers, as well as restaurants, to detect fevers. Individuals testing positive were tracked once in quarantine, these individuals were asked to download a mobile application that would be able to track their movement, which was also accompanied by the use of CCTV cameras to identify the contacts of these patients. In 2018, Korea had over 1 million CCTV cameras in public places.¹⁵ Similar measures were observed in Singapore and Taiwan, countries that have been successful in mitigating the dire impact of the pandemic, keeping mortality rates relatively low.¹⁵



15. <https://www.nytimes.com/2020/03/23/world/asia/coronavirus-south-korea-flatten-curve.html>; <https://theconversation.com/coronavirus-south-koreas-success-in-controlling-disease-is-due-to-its-acceptance-of-surveillance-134068>

Testing Strategies

Examples from successful testing strategies have shown the importance of assessing and understating the evolution of the virus, the infection and immunity profile of the country, as well as the capabilities of the national healthcare system for testing. This also includes considering the constraints and limitations of the testing capacity. These key indicators will drive the specifics in implementing the testing strategy, including providing guidelines in relation to the type and frequency of the tests, as well as determining a framework for prioritizing who should be tested in the community and when. The WHO provides detailed recommendations on how testing should be implemented, depending on the nature of the pandemic.¹⁶

Due to the limitations and considerations of each of the testing types, as countries devise their testing strategies, considerations should be given for who should be prioritized when testing, and what types of tests should be used. Molecular tests will continue to be at the forefront for most countries, especially those with rising to steady number of infections, to identify those that need patient care. Priority should be given to those that display symptoms, as well as frontline workers who continue to be exposed to those infected. If testing capacity is sufficient to cover these groups of individuals, and after considering the resource intensive and capacity limitations of the RT PCR test within a given country, then testing could be expanded to suspected non-severe cases and those in contact with infected individuals.¹ Germany, for example, built their capacity for molecular tests early in the outbreak, allowing a platform for more broad testing for the detection of infected individuals, especially those at high risk; hence Germany had lower mortality rates than other countries in Europe.¹⁷

Serology testing is essential as countries start to consider widespread and continuous testing. Some countries have implemented measures for sero-epidemiological studies to inform policymaking, especially as they consider to revitalize social and economic activity.¹⁸ Serological tests can be used through a targeted or random approach to estimate the prevalence and evaluate the rate of immunity within the population, known as “herd immunity”, which serves as a good indicator for decision makers as to how susceptible the population is and what policies and measures need to be in place.¹⁹ To assess herd immunity²⁰ within a country, the most direct approach is through the use of serological tests, called sero-surveillance, that can help determine the levels and duration of the antibodies present. Understanding this profile will be essential in driving a vaccination strategy, should a treatment be made available. The aim is to reach a point in which the infection is eradicated, and can no longer propagated efficiently within a population, known as “herd immunity for elimination”.²¹

16. WHO (2020), Laboratory testing strategy recommendations for COVID-19, World Health Organization, Geneva, https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab_testing-2020.1-eng.pdf (accessed on 3 April 2020).

17. <https://www.thelocal.de/20200327/germany-plans-mass-immunity-study-to-track-virus>.

18. Wilson, S. et al. (2012), The role of seroepidemiology in the comprehensive surveillance of vaccine-preventable diseases, Canadian Medical Association, <http://dx.doi.org/10.1503/cmaj.110506>.

19. Randolph et al. “Herd Immunity: Understanding COVID-19”; *Immunity*;52; May 19, 2020

20. Reid, D. and D. Goldberg (2012), “Epidemiology and control of community infections”, in *Medical Microbiology: Eighteenth Edition*, Elsevier Inc., <http://dx.doi.org/10.1016/B978-0-7020-4089-4.00082-2>.

21. Williams, J. (2006), “Models for the Study of Infection in Populations”, in Conn, P. (ed.), *Handbook of Models for Human Aging*, Academic Press

At this point, the virus's reproduction rate, would be less than one, and in relation to COVID-19, the OECD predicts that herd immunity would be achieved with 50% to 60% of the population being infected.¹ Introduction of sero-prevalence surveys are another mechanism for assessing the immunity profile of a country and its progression towards herd immunity, at least for the period of time during which immunity is active.

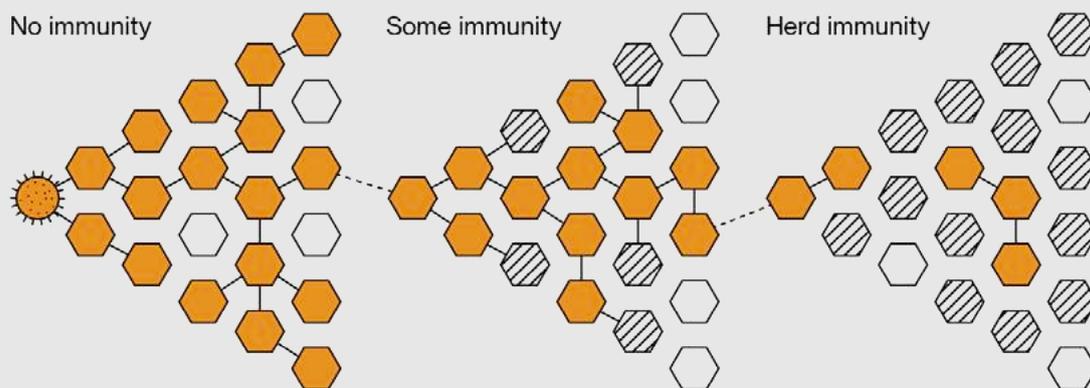
Nevertheless, several factors remain for consideration. One important factor to consider when assessing herd immunity is looking at the characteristics and evolution of the virus itself, and its mutation rate, as this may impact the immunity profile. Another question that remains to be answered is the duration of the immunity gained, in an individual has the antibodies against the virus.¹⁸

The Journey to Herd Immunity

① A novel pathogen is introduced to a community. Because it's new, no one has immunity and it begins to spread.

② Those who recover and those who receive a vaccine (if there is one) develop immunity, at least for a period of time. With the coronavirus, it's not known how long. So far, there is no proven vaccine.

③ Herd immunity takes hold when the pathogen can't find new hosts and stops spreading. That happens once a sufficient portion of the community is immune. For this virus, estimates range from 55% to 82%.*



*According to a study published April 7, 2020

BloombergQuickTake

Devising and Implementing Testing Strategies

As countries start to devise their testing strategies, the fundamental element at the core of any testing strategy is the use of scientific knowledge and data to drive the planning and implementing of these strategies, including building capacity and competencies to execute tests, and managing data and information. In addition, scientific research also needs to drive a better and more comprehensive understanding of the concept of herd immunity, especially in relation to the duration of protection. The essential components of any testing strategy involves enhancing the reliability and accuracy of serological testing needs, along with the resources to scale up molecular testing. This will require investment in R&D by companies or academic and research institutions, locally or regionally, to address the further development of tests or addressing the logistical limitations of molecular tests. As answers to these questions continue be investigated, there are several elements of national testing strategies can be developed now, based on what is known.

Once a reliable and accurate test is in place, countries need to develop their testing strategies, taking into consideration their capabilities in relation to procuring of equipment, materials and supplies, as well as manpower capabilities. Both of these might require elaborate plans for purchasing the materials and supplies needed or investing in local business and companies to develop these materials through innovative technologies, such as 3D printing. Regional procurement plans could also be a good source for acquiring the resources needed, such as the European Joint Procurement Agreement, that can be modeled. Furthermore, most countries will need to establish the infrastructure to support testing clinics, such as establishing make-shift clinics or drive through facilities, for widespread testing. Considerations must also be given on how to man these facilities and clinics, will require an intensive recruitment plan, as well as intensive training for these individuals to help build the capacity of the staff to run the testing facilities established.

The testing will need to be complemented by measures to track and trace infected individuals, but also continued epidemiological modeling to identify trends of the disease within a given population.²² While this information is important to collect, considerations must be made for respecting privacy, including the establishment of data protection and governance frameworks for the use of personal information to protect public health. While numerous surveillance technologies have emerged to monitor changes in the mobility, most of these utilize data from mobile phone apps where users have allowed access to the location information (i.e. Google COVID-19 Mobility Report and the Unacast Social Distancing Scoreboard (Google, 2020[27])).²³

22. Ferretti, L. et al. (2020), "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing", Science, p. eabb6936, <http://dx.doi.org/10.1126/science.abb6936>.

23. Unacast (2020), Unacast Social Distancing Scoreboard, <https://www.unacast.com/post/unacast-updates-social-distancing-scoreboard> (accessed on 2020).; Google (2020), Covid-19 Community Mobility Reports, <https://www.google.com/covid19/mobility/>.

The same approach can be used in relation to contact tracing, without sacrificing privacy issues, in which using location data can help notify individuals of their proximity to an infected individual.¹ The data are encrypted and stored on the phone, and health authorities will give them a code that they can voluntarily provide the information to a national agency, such as a Department or Ministry of Health, that will notify individuals that they have been in close contact with an infected person(s). However, issues around raising stigma around infected individuals or places that they have visited, need to be considered, as these may lead to loss of business, along with misinformation, counterproductive behaviors or even panic.¹

Other considerations need to be given for the challenges of contract tracing. The cost-effectiveness of the digital contact racing are yet to be fully assessed and understood. Most of the current assessments completed are from simulations which suggest that for digital contact tracing to be effective, near perfect compliance and adoption by the population are essential towards its successful implementation.²² Considerations must also be given for access and literacy in using these apps, as this might present to be a challenge in certain populations or subgroups of populations. Furthermore, as the number of cases increase, the ability to trace and resources needed to follow-up on each cases will also increase, where more resources, including manpower will be needed.¹

Policy Implications and Recommendations:

1. As countries consider easing lockdown restrictions and start to reopen their economies, as a part of the exit strategies developed, a national testing plan or strategy will need to be at the forefront of the measures implemented for a safe and controlled reopening, suppressing of new waves of viral infections.
2. In developing countries, successful testing strategies require addressing challenges associated with budgetary restrictions, institutional capacity for procurement of equipment and supplies, laboratory capacities, and human capacity development to collect, analyze, and report results, and logistics of ensuring that all communities are a part of the testing strategy.
3. For widespread and smart testing, both molecular and serology tests will need to be included in the testing strategy, especially to capture the high proportion of asymptomatic cases. This will require a detailed assessment of the country's infection and immunity profiles, as well as the resources and capabilities available or that could be made available. It is important that countries find innovative ways to address the limitations of both types of tests, including establishing regional and global partnerships that would help in enhancing testing capabilities and capacity of the country.

4. It is essential that testing is completed by effective tracking of infected people and tracing of their contacts. Furthermore, continuous efforts to assess and analyze trends in the evolution of the virus, as well as the epidemiological characteristics of immunity and infection within a given population, will allow for a better understanding of the progress towards herd immunity.
5. Given the challenges associated with the logistics and capacity constraints of current tests, the ability to develop rapid molecular and serology test, with high sensitivity and accuracy, should help improve the speed and effectiveness of testing, tracing and tracking strategies, as seen in some countries.
6. Testing and tracing measures should also provide adequate safeguards to protect civil rights and privacy of populations with apps-enabled tracking measures. It is also important to ensure broad public trust, acceptance and use of such tools and data, which will include a strong communications plan that will lead to a well-informed population on the risks and benefits of these measures.

Treatment and Therapy

Treatment and Therapy: Treatments in development

Who this is for: Healthcare policy makers and Providers.

What this is for: To inform healthcare providers of recent updates to the guidelines for the treatment of COVID-19.

How to use: Refer to this information when managing patients with confirmed or suspected COVID-19.

Association between COVID-19 and Thromboembolism

Infection with the novel coronavirus SARS-CoV-2 and the resulting syndrome coronavirus disease (COVID-19) has been associated with inflammation and a pro-thrombotic state, with increases in fibrin, fibrin degradation products, fibrinogen, and D-dimers.¹ Although the true incidence of these complications among those with different severities of disease is not completely defined, there have been reports of increased incidence of thromboembolic disease associated with COVID-19 in patients in the intensive care unit (ICU).²

Although the incidence of thromboembolic events, especially pulmonary emboli, can be quite high, there are, as of yet, no published data investigating the utility of routine surveillance for deep vein thrombosis via lower extremity ultrasound. However, for clinicians who routinely perform ultrasound examinations in critically ill patients, adding deep veins to the daily examination could be a useful adjunct to care.

There remains very little prospective data demonstrating the benefits of monitoring coagulation markers or the safety and efficacy of using therapeutic doses of anticoagulants in those with COVID-19 in the absence of other indications.

Monitoring Coagulation Markers in Patients with COVID-19:

- Non-hospitalized patients with COVID-19 should not routinely be tested for measures of coagulopathy. Although abnormalities of these markers have been associated with worse outcomes, there is a lack of prospective data demonstrating that they can be used for risk stratification in those who are asymptomatic or those with mild SARS-CoV-2 infection.²
- Hematologic and coagulation parameters are commonly measured in hospitalized patients with COVID-19. Nevertheless, there are currently insufficient data to recommend for or against using such data to guide management decisions.²

Managing Coagulopathy in Patients with COVID-19:²

- Any time anticoagulant or antiplatelet therapy is being used, consideration must be given to potential drug-drug interactions with other concomitant drugs. The University of Liverpool has collated a list of drug interactions in [covid19-druginteractions.org](https://www.covid19-druginteractions.org).
- Heparin may be preferred in hospitalized, critically ill patients because of their shorter half-lives, ability to be administered intravenously or subcutaneously, and fewer drug-drug interactions compared with oral anticoagulants.
- Outpatients and patients with mechanical heart valves, ventricular assist devices, valvular atrial fibrillation, or antiphospholipid antibody syndrome or patients who are lactating should continue treatment with warfarin therapy.

COVID-19 patients on anticoagulants:

- Patients with COVID-19 who are taking anticoagulant or antiplatelet therapy for underlying medical conditions should continue their treatment unless significant bleeding develops or other contraindications are present.

COVID-19 patients not on anticoagulants:

- For non-hospitalized patients with COVID-19, anticoagulant or antiplatelet therapy should not be initiated for venous thromboembolism (VTE) prophylaxis or at therapeutic doses.
- For adults who are admitted to a hospital with COVID-19, VTE prophylaxis, unless contraindicated, should be prescribed. Although data supporting this recommendation are limited, a retrospective study showed reduced mortality in patients who received prophylactic anticoagulation, particularly if the patient had a sepsis-induced coagulopathy score ≥ 4 .³
- Patients with COVID-19 who experience an incident thromboembolic event or who are highly suspected to have thromboembolic disease at a time when imaging is not possible should be managed with therapeutic doses of anticoagulant therapy as per the standard of care for patients without COVID-19.

Potential Antiviral Drugs under Evaluation for the Treatment of COVID-19

The following recommendations were added or revised:

1. Remdesivir:

- On the basis of preliminary clinical trial data, NIH Panel recommends the investigational antiviral agent Remdesivir for the treatment of COVID-19 in hospitalized patients with severe disease, defined as $\text{SpO}_2 \leq 94\%$ on ambient air (at sea level), requiring supplemental oxygen, mechanical ventilation, or extracorporeal membrane oxygenation. Dosing used in clinical trials: 200 mg as a single dose on day 1, followed by 100 mg once daily for a total duration of 5 to 10 days (Gilead 2020; NIH 2020a; NIH 2020b; NIH 2020c).
 - The study excluded people with Alanine transaminase (ALT) or Aspartate transaminase (AST) level >5 times upper limit of normal or Glomerular filtration rate (eGFR) <30 ml/min, and people who were pregnant or breastfeeding.
 - Remdesivir is not approved by the Food and Drug Administration (FDA); however, it is available through an FDA emergency use authorization for the treatment of hospitalized adults and children with COVID-19.
 - Remdesivir is still being investigated in clinical trials, and it is available through an emergency access program for children and pregnant patients.
- The NIH Panel does not recommend Remdesivir for the treatment of mild or moderate COVID-19 outside the setting of a clinical trial.
- The safety and effectiveness of Remdesivir for COVID-19 treatment have not been evaluated in paediatric patients.

2. Chloroquine/Hydroxychloroquine:

- The Panel recommends against using high-dose chloroquine (600 mg twice daily for 10 days) for the treatment of COVID-19, because the high dose carries a higher risk of toxicities than the lower dose.
- The FDA warning that cautioned against the use of chloroquine or hydroxychloroquine for COVID-19 outside the setting of a hospital or clinical trial was added to the guidelines.²

3. NIH begins clinical trial of hydroxychloroquine and azithromycin to treat COVID-19:²

Recent trial showed that out of 80 hospitalized patients with COVID-19, 56 patients were discharged to home or transferred to other units for continuing treatment; 14 patients remained hospitalized at the time the study results were published; 3 patients required ICU transfer, and one patient died.

They were treated with hydroxychloroquine sulfate 200 mg three times daily for 10 days plus azithromycin 500 mg for 1 day followed by 250 mg once daily for 4 days. Mean time from symptom onset to treatment was about 5 days.

Based on many promising trials similar to the one explained above, on May 14, 2020 a clinical trial has begun to evaluate whether the malaria drug hydroxychloroquine, given together with the antibiotic azithromycin, can prevent hospitalization and death from COVID-19.

The Phase 2b trial will enrol approximately 2,000 adults across the United States. Study participants must have confirmed infection with SARS-CoV-2, the virus that causes COVID-19, and be experiencing fever, cough and/or shortness of breath. The investigators anticipate that many of those enrolled will be 60 years of age or older or have a comorbidity associated with developing serious complications from COVID-19, such as cardiovascular disease or diabetes. Participants will be randomly assigned to receive short-term treatment with either hydroxychloroquine and azithromycin or matching placebos. People living with HIV and pregnant and breastfeeding women also are eligible to participate in the study. The first participant enrolled on May 14, in San Diego, California.

The main objective of the study is to determine whether hydroxychloroquine and azithromycin can prevent hospitalization and death due to COVID-19. Additionally, investigators will evaluate the safety and tolerability of the experimental treatment for people with SARS-CoV-2 infection.

Implications and Recommendations:

- There are currently insufficient data to recommend either for or against using therapeutic doses of antithrombotic for COVID-19 in patients who are admitted to a hospital. While there is evidence that multi-organ failure is more likely in patients with sepsis if they develop coagulopathy.
- MIS-C is a new health condition appearing in children. The connection with COVID-19 is still not clear. MIS-C children can have problems with their heart and other organs and need to be hospitalised to receive support in an intensive care unit. Treatments remains largely supportive and includes prevention and management of complications.
- On the basis of preliminary clinical trial data, NIH Panel recommends the investigational antiviral agent Remdesivir for the treatment of COVID-19 in hospitalized patients with severe disease. The NIH Panel does not recommend Remdesivir for the treatment of mild or moderate COVID-19 outside the setting of a clinical trial.
- The FDA warning that cautioned against the use of chloroquine or hydroxychloroquine for COVID-19 outside the setting of a hospital or clinical trial was added to the guidelines.²
- World health organization (WHO) suspends trial of hydroxychloroquine as COVID-19 treatment over safety concerns.
- On May 14, 2020 a clinical trial enrolling 2000 adults has begun to evaluate whether the malaria drug hydroxychloroquine, given together with the antibiotic azithromycin, can prevent hospitalization and death from coronavirus disease 2019 (COVID-19).

1. <https://www.ncbi.nlm.nih.gov/pubmed/32172226>.

2. www.nih.gov.

3. <https://www.ncbi.nlm.nih.gov/pubmed/32109013>.

4. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>

5. <https://covid19treatmentguidelines.nih.gov/antiviral-therapy/hydroxychloroquine-plus-azithromycin/>

Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with Coronavirus Disease 2019 (COVID-19)

Background:

As of May 14, 2020, both the Center for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have described a clinical phenomenon occurring in previously healthy children presenting with a severe inflammatory syndrome with Kawasaki disease-like features. The cases occurred in children testing positive for current or recent infection by SARS-CoV-2, the novel coronavirus that causes COVID-19, based on reverse-transcriptase polymerase chain reaction (RT-PCR) or serologic assay, or who had an epidemiologic link to a COVID-19 case. The reports have come from Europe and North America and described groups of children and adolescents requiring admission to intensive care units with a multisystem inflammatory condition with some features similar to those of Kawasaki disease and toxic shock syndrome. The case reports and small case series have described a presentation of acute illness accompanied by a hyperinflammatory syndrome, leading to multiorgan failure and shock. Children have been treated with anti-inflammatory treatment, including parenteral immunoglobulin and steroids. The clinical presentation has been called “Multisystem inflammatory syndrome in children and adolescents” (MIS-C). On May 14, 2020, the CDC issued an official Health Advisory alerting health authorities and the public about the condition.

Preliminary case definition: The preliminary definition serves to identify suspected or confirmed cases for the purpose of providing treatment and provisional reporting and surveillance. (WHO)

Children and adolescents 0–19 years of age with fever > 3 days

AND two of the following:

Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet).

Hypotension or shock.

Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities (including ECHO findings or elevated Troponin/NT-proBNP).

Evidence of coagulopathy (by PT, PTT, elevated d-Dimers).

Acute gastrointestinal problems (diarrhoea, vomiting, or abdominal pain).

AND

Elevated markers of inflammation such as ESR, C-reactive protein, or procalcitonin.

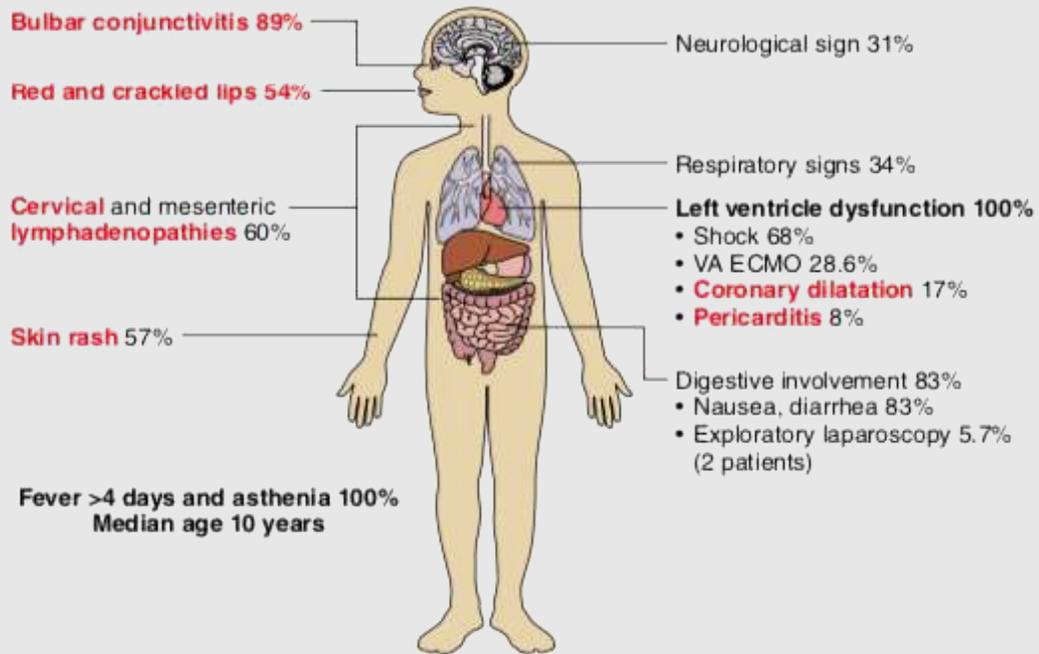
AND

No other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes.

AND

Evidence of COVID-19 (RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19.

SARS-COV-2 related multisystem inflammation



Courtesy of the American Heart Association

Recommendations:

Identification and tracking:

It is critical to characterize the syndrome and its risk factors, to understand causality, and develop treatment interventions. The full spectrum of disease is still unclear. Moreover, the geographical distribution of the disease outside Europe and North America has not been reported, or the condition has not been recognized elsewhere.

As the WHO and other major health outlets have developed a preliminary case definition for MIS-C, there remains an urgent need for the collection of standardized data describing: epidemiology, possible pathogenesis, clinical presentations, and clinical outcomes. Therefore, healthcare providers who have cared or are caring for patients younger than 21 years of age meeting MIS-C criteria should report suspected cases to the public health department at the Ministry of Health (MOH). A centralized national database should be created to report on MIS-C. A standardized form and procedure should be used across the MOH and the private sector healthcare providers to report suspected cases. The WHO has created a standardized form for reporting MIS-C that is readily available for use: Case Report Form . Kuwait may also become a contributor to the Global COVID-19 Clinical Data Platform created by the WHO, which collects data on MIS-C.

Treatment and management:

Currently, the treatment for MIS-C is a similar protocol to what is used to treat Kawasaki disease. The main goal is to reduce the inflammation to avoid long-term damage to arteries and the heart. Additionally, because MIS-C is rare, and the number of treated patients are low, treatment recommendations are scarce. Below are the recommendations by individuals that managed patients with MSI-C:

Demetre C. Daskalakis, M.D., MPH, deputy commissioner, Division of Disease Control, New York City Health Department recommends the following:

Pediatricians should immediately refer any patients who seem to have MIS-C to a specialist in pediatric infectious disease, rheumatology and/or critical care, as indicated. Early diagnosis and treatment of patients meeting full or partial criteria for Kawasaki disease is critical to preventing end-organ damage and other long-term complications.

Michael Levin, MBE, Ph.D., FRCPCH, FMedSci, professor of pediatrics and international child health Imperial College London recommends the following:

Intravenous immunoglobulin (IVIG) was the most common therapy used in 62 percent of patients. Others received immunoglobulin and steroids, and other immunomodulators. Inotropes were required in 70 percent of patients. Levin said 38 percent of children did not receive IVIG, only supportive care.

“The majority of patients responded quickly to treatment, but two children did require ECMO therapy, and one child died as a result of a complication from ECMO with an intracranial thrombus and hemorrhage,” Levin explained. “Many of them took quite a bit of time to come out of the intensive care unit.”

Training Healthcare Professionals

Training Health Care Providers on Infection Control, And Essential Skills During the COVID-19 Pandemic

Background:

Healthcare workers (HCW) are the cornerstone in the battle against the COVID-19 pandemic. Maintaining an adequate health care workforce in this crisis requires not only a sufficient number of physicians, nurses, advanced practice clinicians, pharmacists, respiratory therapists, and other clinicians, but also maximizing the ability of each clinician to care for a high volume of patients. It is essential to provide them with appropriate training to provide care and protect themselves and others from the virus. There has been a rapid proliferation of training programs and modules around the world to better prepared healthcare systems for the pandemic. Studies have described simulation-based learning involving high fidelity simulation centers and simulation involving actual hospital wards, emergency rooms, and intensive care units. For more accessible training, online modules, live online demonstrations, and quick technical references have been used to train HCWs.

Infection control and PPE:

One essential way to ensure the safety of HCW, first responders, and patients is to provide training programs for the proper use of personal protective equipment (PPE) and infection control. Formal training of HCWs on infection control protocols and PPE use has been shown to improve clinical outcomes. Simulation-based approaches have been widely used in protective skill training against infectious diseases. Simulation enables medical staff to become familiar with the actual environment and workflow. It can also help to identify potential deficiencies. A recent Cochrane review on PPE's effects on preventing self-contamination in HCW found that face-to-face training in PPE use may reduce errors more than "folder-based" training.

COVID-19 Testing:

Testing for COVID-19 is an essential part of dealing with the pandemic. New testing centers will have to be set up for widespread testing. With the pandemic putting extreme pressure on the health care system, students and volunteers from the healthcare system are stepping up to assist with the testing process. Testers will require training to ensure safe and correct testing of patients and the safety of those professionals who will be administering the tests.

Critical Care Training for the non-ICU clinician during COVID-19 pandemic:

Critically ill patients have increased significantly in the COVID19 pandemic surge. Consequently, healthcare systems have quickly become overwhelmed with patients. To cope with the high volume of patients that require critical care, healthcare workers from other clinical areas will be required to work in the ICU. This pattern has been seen in different parts of the world. Physicians, trainee doctors, nurses, and other health care providers from specialties areas other than critical care medicine may be required to practice in an acute care environment. In preparation for this scenario, training for the above groups must be provided.

Recommendations:

Training Health Care Providers on Personal Protective Equipment and Infection control:

- To ensure that PPE is properly utilized and to ease the demand for PPE, it is recommended that all HCW are adequately trained in the use of PPE. Training should include 1:
 - When to use PPE
 - What type of PPE is necessary
 - How to properly don (put on), and doff (take off) PPE
 - How to properly dispose of or disinfect, inspect for damage, and maintain PPE
 - The limitations of PPE
 - Minimizing self-contamination.
 - Guidance on extended use or limited re-use of PPE (in the case of any shortage)
- Simulation-based learning should be used when train HCW on the use of PPE and infection control protocols. The training should ideally take place in a high-fidelity simulation center that can be used by the MOH and private sector health care providers.
- If possible, simulation-based learning may be conducted within the existing healthcare facility if permitted. This may enable medical staff to become familiar with the actual environment and workflow. It can also help to identify potential deficiencies in the facility and lead to improved workflow.
- Training may have to be delivered online with the current restriction of social distancing and the high demand for trained HCW. Ideally, online training should be supplemented with live simulation and assessment for competence.
- Only trained and competent staff should be allowed to work with COVID-19 patients or patients under investigation.

- PPE should be part of a more extensive infection control protocol. It should be implemented as part of a multimodal strategy for the management of COVID-19 patients.
- Collaboration and joint training between the different clinical teams involved in the care of suspected or confirmed COVID-19 patients was proven to be one of the most effective ways of improving performance.
- Periodic refresher courses should also be conducted to maintain the quality of the procedures.

Appendix 1 Table 1: summarizes a list of accredited free online resources that may be utilized to train HCW on the use of PPE and infection control during the COVID-19 pandemic.

Training Health Care Providers on COVID-19 Testing:

- Testers will require training to ensure safe and correct testing of patients and the safety of those professionals who will be administering the tests.
- Testers must be trained on the preparation and the involved equipment.
- Testers must be trained on procedures.
- Handling of the specimen.
- Removing PPE after completion of the test

Appendix 1 Table 2: summarizes a list of accredited free online resources that may be utilized to train individuals that will be required to conduct testing during the COVID-19 pandemic.

Critical Care Training for the non-ICU clinician during COVID-19 pandemic:

- Physicians, trainee doctors, nurses, and other health care providers from specialties areas other than critical care medicine that are required to practice in an acute care environment must receive training before practicing in the ICU.
- Simulation-based learning should be used to train HCW on ICU procedures. Training should ideally take place in a high-fidelity simulation center that can be used by the MOH and private sector health care providers that will be seeing critically ill patients in the ICU.
- When simulation-based learning is not possible, online training may be used as a substitute. Ideally, online training should be supplemented with live simulation and assessment for competency.
- Only trained and competent HCW should be allowed to care for critically ill patients with COVID-19.

Appendix 1 Table 3: summarizes a list of free accredited online resources that may be utilized to train licensed healthcare providers to work in the ICU.

Innovative learning resources new this week:

1. WHO announces the launch of the WHO Academy app designed to support health workers during COVID-19? The app provides HCW with mobile access to a wealth of COVID-19 knowledge resources developed by the WHO. The app includes up-to-the-minute guidance, tools, training, and virtual workshops that will help HCW care for COVID-19 patients and protect themselves. “With this new mobile app, the WHO is putting the power of learning and knowledge-sharing directly into the hands of health workers everywhere,” said Dr. Tedros Adhanom Ghebreyesus, WHO Director-General. The application is available for free download from both the Apple App Store and Google Play Store in Arabic and English.
2. **VitalTalk:** A non-profit organization funded in part by the NIH provides innovative and interactive clinician and faculty development courses to improve communication skills on an individual and institutional level. VitalTalk builds on its foundation of communication maps and guides to help prepare HCW for communication in the age of COVID. Their COVID Ready Communication Playbook provides a compilation of scripts and tips for clinicians to reference. They also offer additional tools and resources to dive deeper with video examples, supplemental scripts, collaborative resources from VitalTalk faculty. The VitalTalk guidebook for COVID is available in English, Arabic, Urdu, Hindi, and Tagalog. VitalTalk

Appendix 1:

Training Opportunities for Health Care Providers

Table 1: The following chart is a list of accredited free online resources that may be utilized to train individuals that require to use PPE during the COVID-19 pandemic:

Source	Description of training materials	Recommended for	Link to PPE training
Center for Disease Control and Prevention (CDC)	<ol style="list-style-type: none"> 1. Video demonstrating donning PPE 2. Video demonstrating doffing PPE 3. Posters with a diagrammatic representation of preferred PPE use and acceptable alternative PPE use. Detailed steps to donning and doffing of PPE 	All healthcare workers and administrators	https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html
Center for Disease Control and Prevention (CDC) The National Personal Protective Technology Laboratory (NPPTL)	<p>Healthcare respiratory protection resources</p> <ol style="list-style-type: none"> 1. Training documents 2. Respiratory use toolkits 3. Posters and Infographics 4. Respiratory fit test videos 5. Links to more comprehensive training opportunities 	<p>MOH leadership</p> <p>Hospital administrators</p> <p>Heads of departments</p> <p>Preventative medicine officers</p>	https://www.cdc.gov/niosh/npptl/hospresptoolkit/training.html
Nation Institute of Health (NIH)- National Institute of Environmental Health Sciences	<p>In-depth webinars and training on a variety of issues related to PPE:</p> <ol style="list-style-type: none"> 1. The use of PPE in relation to modes of transmission. 2. Best practices in protecting HCW from exposure to COVID-29 3. Train the trainer on worker safety and infection control. <p>In-depth evidence-based training material in the form of PDF documents and slides related to protecting HCW through PPE and infection control</p>	<p>MOH leadership</p> <p>Hospital administrators</p> <p>Heads of departments</p> <p>Preventative medicine officers</p>	https://tools.niehs.nih.gov/wetp/index.cfm?id=2592

Source	Description of training materials	Recommended for	Link to PPE training
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World Health Organization (WHO)

Recommended courses:

1. How to put on and remove personal protective equipment (PPE): Two modules that detail donning and doffing of PPE according to droplet and airborne precautions for COVID-19

2. Standard precautions: Hand hygiene course

3. Infection Prevention and Control (IPC) for Novel Coronavirus (COVID-19): The course is a more comprehensive course that provides information on what facilities should be doing to be prepared to respond to a the novel coronavirus, how to identify a case once it occurs, and how to properly implement IPC measures to ensure there is no further transmission to HCW or to other patients and others in the healthcare facility. **The course is also offered in Arabic**

4. ePROTECT Respiratory Infections: This course provides a general introduction to acute respiratory infections and basic hygiene measures to protect against infection. The course consists of 4 modules that introduce the learner to the basic principles of acute respiratory infections, how to assess the risk of infection and basic hygiene measures to protect against infection.

WHO online course participants receive a certificate of achievement if they score at least 70% on a post-test

All healthcare workers and administrators

<https://openwho.org/courses/IPC-PPE-EN>

<https://openwho.org/courses/IPC-HH-en>

Healthcare workers
Hospital administrators
Heads of departments
Preventative medicine officers

<https://openwho.org/courses/COVID-19-IPC-EN>

All personnel responding to the COVID-19 outbreak

<https://openwho.org/courses/eprotect-acute-respiratory-infections>

High Speed Training

High speed training offers an online training course used by the NHS. The course provides trainees with the knowledge and techniques needed to safely use (PPE) within a healthcare setting. The course has 4 modules:

1. How to Use Healthcare PPE: Part 1
2. How to Use Healthcare PPE: Part 2
3. Changing, Disposal, Storage, and Maintenance of PPE
4. PPE Training for Healthcare Workers Assessment

Healthcare workers and front liners

<https://www.highspeedtraining.co.uk/health-and-safety/ppe-training-for-healthcare.aspx>

Source	Description of training materials	Recommended for	Link to PPE training
TRAIN	TRAIN is a learning network that provides quality training opportunities for professionals who protect and improve the public's health. Many COVID-19 specific courses are offered. The platform provides training material from multiple reputable organization under one roof. The courses offered are from multiple source: CDC, WHO, VHA...etc.	Healthcare workers and front liners	https://www.train.org/main/welcome

Other short credible videos to help with PPE:

1. NSH: https://www.youtube.com/watch?v=kKz_vNGsNhc&feature=youtu.be&app=desktop
2. OSLER: https://training.oslertechnology.com/ppe/ppe_v2/story_html5.html
3. Ministry of Health Manatū Hauora (New Zealand): <https://vimeo.com/396772975>

Table 2: The following chart is a list of free accredited online resources that may be utilized to train individuals that will be required to conduct testing during the COVID-19 pandemic:

Source	Description of training materials	Recommended for	Link to PPE training
Penn Foster in collaboration with Southern New Hampshire University	30-minute complete course on: <ul style="list-style-type: none"> • Content of the testing kit • Proper patient and specimen identification • Correct medical procedures for nasal and throat swabs • Guidelines for storing specimens • PPE 	Healthcare workers and front liners Medical students Healthcare volunteers (from allied health)	https://www.pennfoster.edu/covid19-testing-training
New England Journal of Medicine (NEJM)	Collection of specimens from the surface of the respiratory mucosa with nasopharyngeal swabs. Resource provides: <ol style="list-style-type: none"> 1. Video (procedure) 2. Document detailing: <ul style="list-style-type: none"> • Preparation and Equipment • Procedure • Handling of the Specimen • Removing Personal Protective Equipment 	Healthcare workers and front liners Medical students Healthcare volunteers	https://www.nejm.org/doi/full/10.1056/NEJMvcm2010260?query=featured_coronavirus

Table 3: following chart is a list of free accredited online resources that may be utilized to train licensed healthcare providers to work in the ICU:

Source	Description of training materials	Recommended for	Link to PPE training
<p>Critical Care Education Pandemic Preparedness University of Toronto Toronto Academic Health Sciences Network (TAHSN)</p>	<p>Quick, accessible learning resources and reference materials for those who are upskilling, renewing, or reviewing their knowledge and skill for redeployment to critical care during the COVID-19 global pandemic.</p> <ul style="list-style-type: none"> • Short lectures • Procedural videos • Pocket cards • Additional resources 	<p>Physicians</p> <p>Nurses</p> <p>Respiratory therapists</p> <p>Other Clinicians</p>	<p>https://www.quickicutraining.com</p>
<p>OSLER ICU skills for the non-intensivist</p>	<p>A collection of modules designed to support the upskilling of doctors who do not usually practice in the intensive care unit who are asked to work in the critical care setting during the COVID-19 outbreak. Modules cover theory, resuscitation, airway management, basic procedures, advanced procedures, and multiple simulation scenarios.</p>	<p>General practitioners</p> <p>Junior doctors</p> <p>Family medicine</p> <p>Internists</p> <p>Surgeons</p>	<p>https://osler.force.com/covid/s/ward-to-icu</p>
<p>edX Harvard University</p>	<p>Mechanical Ventilation for COVID-19 A comprehensive course that provides licensed medical professionals with an understanding of mechanical ventilation so they can support the critical care team caring for patients receiving mechanical ventilation during the COVID-19 pandemic.</p>	<p>Non-ICU hospital clinicians</p>	<p>https://www.edx.org/course/mechanical-ventilation-for-covid-1</p>
<p>World Health Organization (WHO)</p>	<p>Clinical Care of Severe Acute Respiratory Infection: A hands-on practical guide to be used by health care professionals involved in clinical care management during the COVID-19 pandemic. By the end of the course participants should possess some of the necessary tools that can be used to care for the critically ill patient from hospital entry to hospital discharge. The course consists of 14 modules and a total of 10 hours of training.</p>	<p>Clinicians who are working in the ICUs in low and middle-income countries and managing adult and pediatric patients with severe forms of acute respiratory infection</p>	<p>https://openwho.org/courses/severe-acute-respiratory-infection</p>

Exit Strategies

Case Studies and Policy Implications

The safest exit strategy is the development of a vaccine or treatment that would ensure that people feel safe to engage in their workplaces or amongst the community. However, it is anticipated that this will not be in effect for another 12-18 months; thus governments are scrambling to find ways to reopen their economies without compromising the health of the population. Most have focused on ramping up testing, introducing technologies for tracing infections and isolation for those that have been infected, as a means forward. Most have also continued social distancing measures, including the use of proper PPE, to reduce the spread of the infection.

As more and more countries start to lessen the lockdown restrictions put in place as a result of the COVID-19 pandemic, there are a number of lessons to be learned from countries that have eased restrictions. The lessons learned from their successes and challenges, can be used in driving national policies for their “new normal”. What is certain is that having an effective and clear exit strategy that is supported and led by science and data will be critical in ensuring a safe and efficient reopening of the economy. An exit strategy should consider a roadmap for:¹

1. A phased plan or action plan on how to reopen the society and the economy
2. The implementation of the action plan by organizations within both the private and public sectors, including engaging with the various organization to build a collaborative and cooperative approach to reopening
3. Continuous surveillance: Testing, tracing and isolation
4. Updating policies to address challenges associated with reopening the economy and other pressing concerns
5. Deriving policies to support regional and international cooperation on safer travel
6. Accelerating research and innovation to address national and regional challenges

The following are case studies of exist strategies that have been discussed and adopted (in some cases) by countries or within a specific region.

1. Petersen E, Wasserman S, Lee S-S, GO U, Holmes AH, Abri SA, McLellan S, Blumberg L, Tambyah P, COVID-19 We urgently need to start developing an exit strategy, International Journal of Infectious Diseases (2020),

Case Studies

Taiwan²

Taiwan's success in combatting the spread of the COVID-19 pandemic, despite its close proximity and strong cultural links to China, involved using data and information technology to drive policy, informed by lessons learned from the 2003 outbreak from SARS. The measures that were implemented in Taiwan led to their success in dealing with the COVID-19 pandemic and incorporating policies backed by real time data and scientific evidence. Examples of effective measures in place that could be used by other countries to draw exit strategies from are:

1. Robust healthcare systems to support the surge of medical care and testing, as well as a solid public health and insurance infrastructure. In Taiwan, the infrastructure consists of an interconnected system with local health departments and centers staffed by healthcare professionals, as well as clinics with well-coordinated infectious disease networks. Their comprehensive insurance plan, the National Health Insurance, covers >99% of the population. These facilities provide the tools and resources needed to support the effective diagnosis, tracking, and ultimately care if necessary, without straining their resources.
2. The centralization of real time data through a national database (National Health Insurance database), helped support disease surveillance and case detection, effectively delaying and containing transmission in the country. Centralized health records with the capability of merging information from other government databases proved to be a valuable tool during infectious disease outbreaks, such as COVID-19 pandemic.
3. Staff from Taiwan's Centers Disease Control (CDC) were stationed at all borders and incoming passengers were screened for temperature and other specific symptoms. Any suspected cases were reported to centralized database that provide access to the Taiwan CDC and local health departments.
4. Interagency collaboration, data sharing, and efficient mobilization of human resources were key in their response to COVID-19. These measures provided an effective way to share information and mobilize resources from other governmental agencies to support the national efforts in combatting the pandemic.

2. doi: <https://doi.org/10.1016/j.jiid.2020.04.035>; <https://www.nih.gov/news-events/news-releases/nih-clinical-trial-shows-remdesivir-accelerates-recovery-advanced-covid-19>

*Joint European Roadmap towards lifting COVID-19 containment measures*³

The Joint European Roadmap is an exit strategy that is coordinated with Member States of the European Union in preparation for a comprehensive recovery plan and unprecedented investment. The common framework for the region is based on the following main principles:

1. Action should be based on science and public health at its core
2. Action should be coordinated between the Member States
3. Respect and solidarity between Member States remains essential

For formulating the exit strategy for the EU as a whole, considerations were given for the 3Ts: finding a treatment, as well as ensuring that testing and tracing capabilities were developed and implemented. Much emphasis was given on finding a mechanism to increase the capacity and resilience of the healthcare system, continuing to find ways to support healthcare facilities and workers with the right tools, such as PPE. The report also provides a list of recommendations for each country in the region to use as a guideline, while ensuring harmonize the region.

United Kingdom

A recent article in the Lancet by Professor Julian Peto⁴ and his colleagues discussed a potential alternative exit strategy for the UK, which would involve weekly testing, repeated, for the whole population of a particular city or town, with isolation and quarantine measures for the entire household if a person tested positive. The quarantine measures would end once the entire household tested negative. The article notes that the feasibility of this type of an approach should be first tested in cities with roughly 200,000 to 300,000 people, once the lockdown ends, and assessed for efficacy and impact. Only then, can a decision on using this approach nationally, as a possible mechanism to control the pandemic and restore “normalcy” to a certain extent be considered.

3. Cheng, Hao-Yuan & Li, Shu-Ying & Yang, Chin-Hui. (2020). Initial rapid and proactive response for the COVID-19 outbreak – Taiwan's experience. Journal of the Formosan Medical Association. 119.

4. <https://www.clustercollaboration.eu/news/joint-european-roadmap-towards-lifting-covid-19-containment-measures>

Ireland⁵

The Irish government has been working on a roadmap for modifying restrictions imposed due to the COVID-19 pandemic, guided by a number of overarching principles:

1. Safe and informed public

Economic Activity (Work)

Economic Activity (Work)					
Phases	1	2	3	4	5
Economic Activity (work)	Applying a risk-based approach:	Applying a risk-based approach	Applying a risk-based approach:	Applying a risk-based return to onsite working	Applying a risk-based return to onsite working applicable fairly across all sectors:
(applying over and above currently permitted work-arrangements)	Permit phased return of outdoor workers (e.g. construction workers, gardeners, including people working on allotments), social distancing requirements continue to apply	Permit phased return of workers, such as solitary and other workers that due to nature of work can maintain 2m distance constantly. Social distancing requirement continue to apply	Organizations where employees have low levels of daily interaction with people and where social distancing can be maintained	Organizations where employees cannot remote work to be considered first for return to onsite working arrangements	Phased “return to onset working” arrangement
	Continue to maintain remote working for all workers/ business that can do so	Continue to maintain remote working for all workers/ businesses that can do so	Continue to maintain remote working for all workers/ business that can do so	Depending on business shift work, staggered hours etc. should be operated to increase % of workforce available for work in any 24-hour period, as long as they can limit the number of workers interacting with each other	‘Higher risk’ organizations which by their nature cannot easily maintain social distancing implement plans for how they can eventually progress towards onsite return of full staff complement

5. Peto et al. Lancet_2020

Economic Activity (Work)					
Phases	1	2	3	4	5
		Organizations to develop plans for return to onsite working by employees in light of COVID-19 Considering: <ul style="list-style-type: none"> • Social distancing compliance • Hygiene and cleaning • Compliance in higher risk situations • Plans for medically vulnerable/ pregnant etc. • Extended opening hours to enable social distancing 		Continue to maintain remote working for all workers/ businesses that can do	
		State to develop mechanism for supporting, advising on, assessing, regulating planning for return to onsite working by organizations.			

Public health rationale:

Public health risk is lower in workplaces where adequate arrangements are made to limit population density in order to facilitate social distancing and limit person to person contact and the time spend in contact

The re-start of the economic activity should be phased in, thus ensuring that authorities and businesses can adequately adjust to increasing activities Insafe way recognizing the interdependency between public health and wellbeing and economic activity. There are several models (jobs suitable for teleworking, economic importance, shifts of workers etc.) but not all the population should go back to the workplace at the same time, with an initial focus on less endangered groups and sectors that are essential to facilitate economic activity (e.g. transport)

The effectiveness of containment and mitigation depends on limiting the number of social contacts but also the duration of each contact

Figure A. Example of Ireland's Phased Plan for Reopening; Source:.gov.ie

<https://www.gov.ie/en/press-release/e5e599-government-publishes-roadmap-to-ease-covid-19-restrictions-and-reope/>

2. Use of rational, including considerations for the social and economic benefits
3. Evidence and data to inform decisions
4. Fair and ethical considerations for human dignity, autonomy and equality
5. Openness and transparency with decisions made
6. Whole of Society: unity and solidarity

The strategy framework developed for reopening was to introduce a phased, incremental reduction of restrictions, taking into consideration risks in a fair and proportionate way, as a whole for enabling a return of social and economic activity. The framework also gives much consideration for decision making, noting that the governments consideration of easing restrictions will be based on evidence and data provided by the Department of Health, which will include reports on disease progression, healthcare capacity and ICU occupancy, testing and tracing capabilities, care for risk groups, and the assessment of risk of mortality due to restrictions. What is certain is that public health, science and data will be driving decision making, and that restrictions may be re-imposed out of necessity. An example of their phased approach to reopening business and workplace is shown in Figure A.

Scotland⁶

The Scottish government adopted a COVID-19: A Framework for Decision Making, which defines the steps required for managing the transition out of lockdown. That framework recognizes the need to implement a “test, trace, isolate, support” approach (others use the terminology test, trace, isolate and quarantine (TTIQ)). The goal is that through this approach, the government will be effective in managing and future infection, and potentially preventing a second surge. As a part of their plan, five steps were identified for the effective implementation of “test, trace, isolate, support”:

1. Effective disease surveillance: identifying patterns of disease activity, evolution of the virus (i.e. mutations), and the progression of immunity.
2. Early identification and isolation of possible cases
3. Early and rapid testing of possible cases: ensuring that whoever needs a test can get one

6. <https://www.gov.ie/en/press-release/e5e599-government-publishes-roadmap-to-ease-covid-19-restrictions-and-reope/>

4. Early and effective tracing of close contacts of a confirmed case: through the use of appropriate technology and staff to support an efficient platform for tracing.

Identify people with symptoms consistent with COVID-19 and ask them to self-isolate	Rapid testing to identify cases	Identify and trace close contacts of cases	Support self-isolation of cases (for at least 7 days) and close contacts (14 days)
<p>People reporting symptoms consistent with COVID-19 are asked to self-isolate and a test is arranged.</p> 	<p>Testing enables those who do not have COVID-19 to be released from self-isolation, and contact tracing to continue for positive cases.</p> 	<p>All cases are asked to self-identify close contacts, and are able to access telephone support.</p> <p>For low risk cases, all close contacts are provided with advice to self-isolate.</p>  <p>For high risk and complex cases specialist risk assessment and support to identify close contacts is available.</p> 	<p>Some cases and close contacts will be able to self-isolate easily</p>  <p>Others will need support to isolate.</p> 

5. Early, effective and supported isolation of close contacts

CDC Guidelines⁷

The CDC released activities and initiatives to support the President’s plan for reopening the American economy. The document briefly described the activities and initiatives that need to be put in place, which involved ensuring that proper surveillance is in place to monitor the spread and intensity of the pandemic. The approach would be that through adequate testing, a test, trace and isolation approach would be put in place, in combination with monitoring the healthcare capacity of the country to ensure adequacy of care. The following are the main initiatives and activities were recommended by the CDC:

1. **Expanding Testing and Advising Testing Practices:** beyond expanding the testing and tracing capabilities, there is also a recommendation on prioritizing testing. The CDC is working across the US government to support diverse efforts to increase testing as a means to diagnose as well as monitor and control outbreaks. This includes:
 - i **Prioritizing patients for Testing:** recommendations were provided by the CDC, as shown in diagram below

7. Covid-19 - Test, Trace, Isolate, Support A Public Health approach to maintaining low levels of community transmission of COVID-19 in Scotland; May 2020 CDC Activities and Initiatives Supporting the COVID-19 Response and the President’s Plan for Opening America Up Again; May 14, 2020.

High Priority

- Hospitalized patients with symptoms
- Healthcare facility workers, workers in congregate living settings, and first responders with symptoms
- Residents in long-term care facilities or other congregate living settings, including prisons and shelters, with symptoms

Priority

- Persons with symptoms of potential COVID-19 infection, including fever, cough, shortness of breath, chills, muscle pain, new loss of taste or smell, vomiting or diarrhea, and/or sore throat.
- Persons without symptoms who are prioritized by health departments or clinicians, for any reason, including but not limited to: public health monitoring, sentinel surveillance, or screening of other asymptomatic individuals according to state and local plans.

ii **Focus Testing efforts:** This involves ensuring that the technical assistance needed to establish an effective a state-specific testing plan is available. Beyond the technical expertise, the materials and supplies needed for these tests will need to be supplied to public health labs and ensuring that these supplies are sufficient to achieve a rate of less than 10% positive tests among individuals tested (asymptomatic, symptomatic, and pre-symptomatic). The CDC is also establishing nationwide surveillance systems to identify new or emergent cases or clusters of infected individuals. The goals of the surveillance is to produce accurate information and data to support evidence based decision making and for adjusting diseases reduction strategies, as well as to inform the public and key stakeholders, at a national, state and local level. The approach is to use multiple systems and networks to capture data for understanding the following:

- Situational awareness: Timely and accurate monitoring of the spread and intensity of the pandemic, through the capturing of public health data, timely communications, viral characteristics, and preparation of healthcare systems.
- Understanding impact and forecasting disease spread: Providing data to understand overall impact and epidemic characteristics for the use of public health and medical resources.
- Characterizing COVID-19 infection across a spectrum of conditions, including asymptomatic and symptomatic infections, hospitalizations, deaths, etc

Gating Criteria	Threshold for entering Phase 1	Threshold for entering Phase 2	Threshold for entering Phase 3
Decrease in newly identified COVID-19 cases	Downward trajectory (or near-zero incidence) of documented cases over 14-day period	Downward trajectory (or near-zero incidence) of documented cases for at least 14 days after entering Phase 1	Downward trajectory (or near-zero incidence) of documented cases for at least 14 days after entering phase 2
Decreases in emergency department (ED) and/or outpatient visits for COVID-like illness (ILI)	Downward trajectory (or near-zero incidence) of CLI syndromic cases reported over a 14-day period	Downward trajectory (or near-zero incidence) of CLI syndromic cases reported for at least 14 days after entering phase 1	Downward trajectory (or near-zero incidence) of CLI syndromic cases reported for at least an additional 14 days after entering phase 2
Decrease in ED and/or outpatient visits for influenza-like illness (ILI)	Downward trajectory (or near zero incidence) of ILI reported over a 14-day period	Downward trajectory (or near-zero incidence) of ILI reported for at least 14 days after entering phase 1	Downward trajectory (or near-zero incidence) of ILI reported for at least an additional 14 days after entering phase 2
Decrease in percentage of SARS-CoV-2 tests positive	Downward trajectory (or near-zero percent positive) of positive tests as a percentage of total tests over a 14-day period (flat of increasing volume of tests)	Downward trajectory (or near-zero percent positive) of positive tests as a percentage of total tests for 14 days after entering phase 1 (flat of increasing volume of tests)	Downward trajectory (or near-zero [percent positive] of positive tests as a percentage of total tests for at least 14-days after entering phase 2 (flat or increasing volume of tests)
Treat all patients without crisis care	Jurisdictions inpatient & ICU beds <80% full staff shortage in last week = no PPE supplies adequate for > 4 days	Jurisdiction inpatient & ICU beds <75% full staff shortage in last week = no PPE supplies adequate for > 4 days	Jurisdiction inpatient & ICU beds <70% full staff shortage in last week = no PPE supplied adequate for > 15 days
Robust testing program	Test availability such that percentage of positive tests is < 20% for last 14 days median time from test order to results is >4 days	Test availability such that percentage of positive tests is <15% for 14 days median time for test order to results is <3 days	Test availability such that the percentage of positive tests is <10% for last 14 days median time from test order to result is <2 days

Figure C. The thresholds identified by the CDC for entering the various phases of the reopening plan.

iii **Defining Usage:** There is much effort on working with state and local partners to define where the testing of asymptomatic individuals is needed to control the pandemic, as well as the best implementation of surveillance serological testing. Efforts are being placed to identify indicators for serological testing, to either identify individuals that have been infected or as a means to survey the population. Serological testing is important in this sero-surveillance approach, for providing insights into the transmission dynamics of disease. However, more information is needed to determine how the results of serologic testing can correlate with possible immunity, including the duration of immunity as this will inform an effective vaccine strategy, when available.

iv Augmenting Existing Infrastructure and Technology to Improve Data Flow and Reporting: The CDC is supporting the improvement of the current data infrastructure, including the integration of digital and technology based solutions to be able to provide up to date information to stakeholders and decision makers. This involves working with state and local officials to develop web-based platforms that will allow for an open and transparent system for data collection, visible to all communities. Efforts are also being made to work with manufacturers, commercial laboratories, state and local health departments, testing locations (providers, hospitals, pharmacies), and public health partners to enhance data quality, integration, and electronic reporting. This also includes integrating testing to support state and local contact tracing, as well as platforms for storing and managing personal data.

2. Phased Plan and Indicators for Reopening America: A three-phased approach was developed for reopening the US economy, which could be implemented statewide or community-by-community at governors' discretion, with clear indicators how one state or community would shift from one phase to the next (Figure C). The CDC also noted that considerations should be given to infections in populations, the capabilities of the healthcare sector, and the demographics of the population (i.e. high risk groups, including minority populations). Incidence and trajectory (increasing versus decreasing) should also be a point for consideration. It is important that where there may be a possibility of recrudescence in some areas, mitigation measures and strategies may shift based on the evidence and data.

i. Technical Support for States: CDC is providing technical assistance regarding testing, surveillance data collection and reporting, contact tracing, infection control, and outbreak investigation

Category	Considerations for Assessing Capacity for Case Identification, Follow Up and Containment
SARS - coV-2 testing in jurisdiction	Testing is available as indicated for clinical, public health, and infection prevention needs
Identification of new COVID-19 cases	All new COVID-19 cases in the jurisdiction can be rapidly identified through active surveillance, including proactive monitoring for asymptomatic cases through surveillance monitoring
Interviewing new COVID-19 cases	Initial interviews can be conducted for nearly all new COVIDS-19 cases within one day of health department notification
Contact Tracing	Follow up (isolation, self-monitoring, and rapid testing of selected contacts) can be initiated for nearly all identified contacts of newly identified cases
Incidence relative to local public health resources	Public health capacity is sufficient to fully perform contact tracing and investigate outbreaks based on local incidence and resources available.

- ii. Contact Tracing: Contact tracing is a key strategy for preventing further spread of infectious diseases, supporting affected individuals and warning contacts of exposure in order to stop chains of transmission. CDC has developed multiple training tools for frontline workers and contact tracers on how to quickly locate and talk with the affected individuals, assist with isolation issues, as indicated in Figure D.

Policy Implications and Recommendations:

1. The reopening of societies from lockdown restrictions requires a national strategy and phased plan, that will include mass testing, technology to support tracing, monitoring and surveillance, and data to drive decision making. The plan should have key indicators to allow for decision makers to use as a marker for shifting from one phase to the next. These indicators need to be based on evidence, with tools in place to continuously measure the spread of the pandemic and trends associated with the evolution of the virus. The plan should also take into consideration the healthcare capacity of the country, not only in relation to staff and ICU occupancy, but also the essential materials, supplies, and equipment needed to support staff and patients, including PPE.
2. A unified Test-Isolate-Trace-quarantine (TITQ) Strategy is in the interest of the public and the economy.⁸
 - a. A widespread testing plan will include determining how, when and who to test, over time, prioritizing areas of individuals that are higher risk, and more likely to increase the infection rate based on living standards (i.e. migrant workers). The testing plan will also need to consider the capabilities of the testing laboratories and the required resources to provide efficient processing. In case of capacity constraints (number of tests, costs), priority should be given to people who have been referred to a testing facility by a medical professional; people who exposed based on tracking and tracing efforts; frontline workers (nurses etc.; vulnerable people (in terms of age and/or health status)
 - b. Contact tracing will be essential to complement testing efforts. This will not only include the adoption of a digital platform tailored to the needs of the individual country, but also include the training of personnel for classic person-based contact tracing. It is important that both approaches are implemented to prevent infection of the pandemic. In addition, guidelines and rules for those that will be considered “potential infections” will need to be developed.⁹ A plan should also be developed for the identification of individuals through tracing, as in the isolation/quarantine measures that will be taken once the individual is identified.¹⁰

8. <https://ncs-tf.ch/en/policy-briefs/contact-tracing-strategy-26-april-20-en>

9. Traditionally, an infected person would list all those individuals that they have been in contact with within a certain time frame. Digital platforms notify individuals if they have been within 2m of someone infected for more than a period of time. Source: <https://ncs-tf.ch/en/policy-briefs/contact-tracing-strategy-26-april-20-en>

10. One approach could be a period of quarantine, with regards to quarantine approaches, as well as testing and tracking measures that should be taken (i.e. testing (RT PCR) at the start and end of quarantine). Source: <https://ncs-tf.ch/en/policy-briefs/contact-tracing-strategy-26-april-20-en>

- c. With testing and tracing in place, isolation and lockdown can be restricted to individuals, families or communities, rather than a national lockdown or quarantine measure. Quarantine protocols (specifically with respect to timing and testing) need to be continually adjusted to newly emerging scientific evidence.
- d. A central database for storing and collecting information regarding individuals and their testing results, from the various facilities, should also be developed comprehensively. It is important the data privacy and protection policies are implemented to ensure good data governance and management.
 - i. The integration of platforms for surveillance and testing with national health or identification records will be critical, to ensure that there is one system with open, transparent, accurate and timely information. This will allow government officials from across the various agencies with access to the same information.
3. Social distancing measures will need to be continued and guidelines for these measures will need to be identified in the national plan for reopening of societies, for workplaces, social engagements and community based events. Considerations for vulnerable or high risk individuals should be in place, where those who choose to remain in confinement should be protected against loss of their jobs or income.
4. Public acceptance through open and transparent data and evidence will be key in ensuring strong popular support and high compliance, especially amongst native and non-native populations.
5. A collaborative, regional approach to addressing the pandemic needs to be developed, especially as travel restrictions are lifted. This includes the exchange of information on infected individuals, and a unified approach to testing, tracing and isolation.