The COVID-19 Pandemic: Changing Lives and Lessons Learned
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We have nothing to fear but fear itself.
—Franklin D. Roosevelt

The COVID-19 pandemic is evolving rapidly, and its course is altering the landscape for all citizens of the world, including plastic surgeons. Much remains unknown. However, an increasing body of evidence is guiding swift global action against the virus. The novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), responsible for COVID-19, was identified in Wuhan, Hubei Province, China, in December 2019, notably close to a wet animal market that sells poultry, snakes, and bats.1 The virus shares most of its genetic sequence with coronaviruses found in bats and is thought to arise from that animal, although an infected bat with SARS-CoV-2 has not yet been identified to confirm this theory.2 From Wuhan, the virus crossed over to the human population and spread throughout China and beyond: by March 11, 2020, the World Health Organization declared COVID-19 a pandemic, which is the worldwide spread of a new disease that crosses continents and affects a large number of people.3

Details regarding the behavior and implications of the virus are emerging daily. The virus is spread person-to-person and appears to linger in the air for up to 3 hours and upon various surfaces from 24 hours to 3 days.4 Accordingly, the Centers for Disease Control and Prevention (CDC) recommend contact and airborne precautions with personal protective equipment (PPE) and N95 respirators.5 The virus utilizes the angiotensin converting enzyme 2 receptor as its entry point, which is located predominantly in the lung alveolar epithelial cells and the enterocytes of the small intestine.4 Accordingly, COVID-19 presents both as an upper respiratory infection characterized by cough, fever, and fatigue that progresses to pneumonia and as a gastrointestinal illness characterized by diarrhea.7 The progression from mild symptoms to respiratory failure requiring ventilation can be rapid, and cardiac failure has also been implicated. Chest radiographs reveal bilateral lower lobe pneumonia, and computed tomography of the lungs reveals ground glass opacities.8 At the moment, supportive therapies are indicated as treatment. While there are no specific treatments officially, medications are being tested including hydroxychloroquine (a retrofitted anti-malaria and autoimmune drug, which has been employed in China and France) and antiretrovirals such as remdesivir.9,10 There is no approved prophylactic medication at this time. Vaccines are under development as a long-term approach aimed toward prevention (Table 1).

The seriousness of the COVID-19 pandemic echoes the Spanish Flu of 1918, which killed 50 million people worldwide, including 675,000 people in the United States. This pandemic was the source of great interest for scientists looking to understand what made it so deadly to learn from the past. The Spanish Flu—like COVID-19—caused severe pneumonia and pulmonary inflammation. Epidemiologists considered the global landscape in 1918. World War I was underway, troops were traveling the world in close contact and acting as vectors, vaccines did not exist and neither did antibiotics, and there were no viral tests. There were no local, state, or federal governing bodies that were prepared to manage an outbreak or pandemic.11 This situation is not the case today, and we have learned from the Spanish Flu. We have the CDC in the United States and the World Health Organization globally monitoring and responding to outbreaks. We have governments ready to mobilize resources and implement social distancing policy via school closures, limiting large gatherings, and shelter-in-place measures. The US Strategic National Stockpile stores facemasks, medications, and other materials to respond to a pandemic (Table 2). We are able to test for COVID-19 and to study it using evidence-based medicine. All of these measures have been deployed in recent days to reduce the impact of the novel coronavirus pandemic in the United States and abroad, as much as possible. That China has reported no new domestic coronavirus cases for the third day in a row is encouraging, albeit unusual, news.12

Beyond these lessons learned from past pandemics, the handling of the current pandemic in Hong Kong, Taiwan, and Singapore offers insight into successful efforts to “flatten the curve.” This epidemiological term refers to slowing the spread of disease so as to prevent healthcare systems from being overwhelmed. A slow, steady stream of
patients is more manageable compared to a sudden influx of sick patients requiring hospitalization (Table 3).14 This technique is employed once efforts at containment of an outbreak have failed. China has reported success with measures that would not be easily supported in a democratic society. Hong Kong, Taiwan, and Singapore, however, similarly managed to flatten the curve of new cases without such extreme measures. What can we learn from their handling of the virus? All were quick to screen and then ban entry of flights and individuals from infected regions of China. Social distancing was employed early using the same six-foot benchmark and avoidance of gathering in large numbers. Inhabitants were educated about hand hygiene and wearing masks if they felt ill. The handling and isolation of symptomatic patients and those with travel exposure have been aggressive and appropriate—separate screening locations, separate clinical teams, and separate treatment facilities were used to avoid exposing other patients and limit the possibility of healthcare personnel becoming vectors of transmission themselves. Health authorities have been aggressive in tracking down sick contacts via interviews and closed-circuit television footage and quarantining those at risk. Singapore and Hong Kong were more likely to place identified at-risk individuals in state-controlled quarantine facilities. Taiwan focused on home quarantine reinforced by hefty fines for those who did not comply. Taiwan and Hong Kong closed schools, while Singapore did not. In short, these 3 regions were swift and aggressive in their response, and they have been effective in limiting their cases despite neighboring China, the epicenter of the outbreak (Table 3). Lessons learned from the past century of pandemics should be heeded and rapidly implemented. Had efforts like these been implemented in Wuhan, perhaps the pandemic could have been avoided (Table 4).15–17

These are uncertain times. We do not know enough about this virus yet. We must learn about its pathophysiology, epidemiology, and treatment. We must focus on being effective and prepared, while avoiding the feelings of panic, which surround all pandemics. What is the path forward? The Centers of Medicare and Medicaid Services, the American College of Surgeons, the American Society of Plastic Surgeons, the Aesthetic Society, and most state medical and regulatory boards have appropriately recommended canceling all elective and nonessential cases.20 This action serves multiple purposes of opening hospital beds for incoming COVID-19 patients, preserving healthcare equipment and resources, and avoiding

| Table 1. Contrasting the Seasonal Flu (Influenza A and B) and COVID-19 |
|-----------------------------|-----------------------------|
|                            | Flu                         | COVID-19                   |
| R0 number                   | 1.3                         | 2–2.5                      |
| Incubation time, d          | 1–4                         | 1–14                       |
| Hospitalization rate, %     | 2                           | 19                         |
| Case fatality rate, %       | ≤0.1                        | 1–3.4                      |
| Pandemics/prevention        | Vaccine available; herd immunity† | No vaccine; preventative measures advised |

*R0 number indicates viral transmission rate. It estimates how many people will be infected by the average individual with the disease.
†Seasonal flu is different from a flu pandemic (Swine flu). With annual flu vaccination, we have established herd immunity that reduces both the risk of being infected or that of infecting another individual who may be at high risk.

| Table 2. COVID-19 Interventions |
|----------------------------------|
| Interventions Immediately Available                                      | Future Interventions                                      |
| Social distancing (individuals spaced 6 ft away, gatherings no greater than 10 people) | Targeted medical therapies (such as hydroxychloroquine or remdesivir under investigation) |
| Availability and effective implementation of personal protective equipment (masks, gowns, gloves) | SARS-CoV2 vaccine development |
| Rotating shifts of healthcare providers to limit exposure and allow recuperation | National lockdown or enforced lockdown |
| Identification and quarantine of sick contacts | Governmental intervention for production of medications and supplies (PPE, ventilators) |

| Table 3. How to Flatten the Curve for COVID-19 |
|-----------------------------------------------|
| Intervention                                      | Goal                                      |
| Ban flights from affected regions               | To prevent importation of disease          |
| Close borders                                   | To prevent importation of disease          |
| Social distancing                                | To slow the spread of disease              |
| Widespread and early COVID-19 testing           | To contain disease (early goal)            |
| Aggressive and monitored quarantine              | To promote epidemiological monitoring and patient care (secondary goal) |
| Aggressive tracking of sick contacts            | To contain disease (early goal)            |
| Development and identification of effective medications and treatment modalities | To slow the speed of the pandemic |
| Development of vaccines                         | To treat and cure disease                  |
| Development of vaccines                         | To prevent disease                         |
hospitalizations for patients recovering from elective surgery, which can also place them at risk in a hospital housing infected patients. Additionally, canceling elective surgery supports social distancing in the healthcare setting. Practices that are functionally shut down at this time can elect to donate resources, particularly PPE, including gowns, masks, and gloves, which are in high demand and short supply.21 Such a shortage of PPE is unprecedented in the wealthiest nation in the world, and it places our physician colleagues and fellow healthcare personnel at great risk on the front lines.

The pandemic has profoundly altered how plastic surgeons will practice. Much of what we do is elective surgery. Our practices have slowly evolved according to the national and international response to this virus. Healthcare meetings have been canceled throughout the summer and fall—with no certainty that any professional conferences will be held for the duration of 2020. In plastic surgery, patients travel domestically and internationally to undergo surgery. As countries close their borders and restrict travel, we can expect a substantial portion of patients seeking care in our offices. Telemedicine offers an alternative to communicate with these patients who seek our care and will likely become a common part of future medical practice. Simultaneously, COVID-19 has destabilized the financial markets. The lasting extent of the damage will depend on the virus’ course, whether we find a cure, and how government aid buffers the downturn. As with the economic recession in 2008, we may find that a substantial portion of patients will lack the disposable income to seek elective plastic surgery. Plastic surgeons will have to evolve and to respond creatively to this change in landscape (Table 5).

This pandemic will have broad implications for global behavior. Beyond life lost, we can expect it will alter or accelerate societal habits. In America, we are increasingly relying on services that decrease social contact—grocery delivery services replace store visits; virtual meetings supersede their real-life counterparts; virtual education blends with traditional schooling; working from home is increasingly common; religious gatherings will stream online. By the time the dust settles—months or even over a year from now—we may have acclimated to this new norm, which is functionally an acceleration of where present technology is leading us already. Moreover, we may even prefer the absence of in-person interaction, recognizing it as safer and virus-free. If the pandemic response leads to enforced quarantine and the like, individuals may turn to the safety of authoritarianism over the dangers of individualism. The stunning lack of American control on the supply chain for essential products such as PPE and common medications may cause the nation to turn inwards to domestic production and away from global interdependence.22

Table 4: Previous Pandemics

| Pandemic | Organism | Impact | Lessons Learned |
|----------|----------|--------|----------------|
| 1918 Spanish Flu | H1N1 Influenza | 50,000,000 deaths | Secondary bacterial infection was a leading cause of mortality including healthcare workers who were at risk and suffered increased mortality |
| 2003 SARS | SARS-CoV-1 Coronavirus | 744 deaths | WHO International Health Regulations for prompt coordinated global alert and action |
| 2005 Avian Flu | H5N1 Influenza | <1,000 deaths | Highlighted weakness in healthcare infrastructure |
| 2009 Swine Flu | H1N1 Influenza | 151,700–575,400 deaths | Updated WHO Pandemic Preparedness |
| 2015 Zika Virus | Zika Virus | 2,656 cases of microcephaly | WHO defined requirements for “Pandemic”29 |
| 2019 COVID-19 | SARS-CoV-2 Coronavirus | | Need for government support for long-term funding to allow companies and research institutes to develop vaccines and clinical trials |

21 Such a shortage of PPE is unprecedented in the wealthiest nation in the world, and it places our physician colleagues and fellow healthcare personnel at great risk on the front lines.

22 Need for proactive investment versus reactionary investment during outbreaks

29 New virus emerges in humans, minimal or no population immunity, causes serious illness with high mortality/morbidity, spreads easily from person to person. FDA, Food and Drug Administration.

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will rise above their own needs to tackle the challenges at hand, a chance to reset our values and priorities (Table 6). It is not too late to change the course of this pandemic, and we must lead in this crisis situation to empower, to fight resiliently, and to succeed.

We are entering a period marked by uncertainty. How long will we be isolated, quarantined, and unable to practice as usual? Will we be called upon to act as intensivists as in other countries should our healthcare system be overwhelmed? As plastic surgeons and doctors first, we will continue to take the very best care of our patients, even in difficult times. We will have to be creative and intrepid to overcome the obstacles we encounter. In the words of Sir Winston Churchill, “If you’re going through hell, keep going.”

### REFERENCES

1. Wang C, Horby PW, Hayden FG, et al. A novel coronavirus outbreak of global health concern. *Lancet*. 2020;395:470–473.

2. Lu R, Zhao X, Li J, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet*. 2020;395:565–574.

3. World Health Organization. WHO Director-General’s opening remarks at the media briefing on COVID-19—11 March 2020. https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020. Accessed March 22, 2020.

4. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. *New Engl J Med*. 2020. [Epub ahead of print].

5. Centers for Disease Control and Prevention. What healthcare personnel should know about caring for patients with confirmed or possible COVID-19 infection. https://www.cdc.gov/coronavirus/2019-ncov/hcp/caring-for-patients.html. Accessed March 22, 2020.

6. Hamming I, Timens W, Bulthuis ML, et al. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. *J Pathol*. 2004;203:631–637.
7. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395:497–506.

8. Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. J Med Virol. 2020;92:441–447.

9. Dong L, Hu S, Gao J. Discovering drugs to treat coronavirus disease 2019 (COVID-19). Drug Discov Ther. 2020;14:58–60.

10. Wang M, Cao R, Zhang L, et al. Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. Cell Res. 2020;30:269–271.

11. Colson P, Rolain JM, Lagier JC, et al. Chloroquine and hydroxychloroquine as available weapons to fight COVID-19. Int J Antimicrob Agents. 2020. [Epub ahead of print].

12. Centers for Disease Control and Prevention. The deadliest flu: the complete story of the discovery and reconstruction of the 1918 pandemic virus. https://www.cdc.gov/flu/pandemic-resources/reconstruction-1918-virus.html. Accessed March 22, 2020.

13. Regan H, Berlinger J, Hollingsworth J, et al. March 20 coronavirus news. https://www.cnn.com/world/live-news/coronavirus-outbreak-03-20-20-intl-hnk/h_09bb21fd43c82a2f7d02c02e119c2. Accessed March 22, 2020.

14. Wan W, Achenbach J, Johnson CY, et al. Follow the outbreak with coronavirus updates. https://www.washingtonpost.com/health/2020/03/19/coronavirus-projections-us/. Accessed March 22, 2020.

15. Gawande A. Keeping the coronavirus from infecting health-care workers. https://www.newyorker.com/news/news-desk/keeping-the-coronavirus-from-infecting-health-care-workers. Accessed March 22, 2020.

16. Cowling BJ, Lim WW. They’ve contained the coronavirus. Here’s how. https://www.nytimes.com/2020/03/13/opinion/coronavirus-best-response.html. Accessed March 22, 2020.

17. Barron L. What we can learn from Singapore, Taiwan and Hong Kong about handling coronavirus. https://time.com/5802295/coronavirus-covid19-singapore-hong-kong-taiwan/. Accessed March 22, 2020.

18. Kilbourne ED. Influenza pandemics of the 20th century. Emerg Infect Dis. 2006;12:9–14.

19. Madhav N, Oppenheim B, Gallivan M, et al. Pandemics: risks, impacts, and mitigation. In: Jamison DT, Gelband H, Horton S, et al, editors. Disease Control Priorities: Improving Health and Reducing Poverty. 3rd ed. Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2017. https://www.ncbi.nlm.nih.gov/books/NBK525302/ doi: 10.1596/978-1-4648-0527-1/p1.ch17. Accessed March 22, 2020.

20. American Society of Plastic Surgeons. COVID-19 Resources of plastic surgeons and their practices. https://www.plasticsurgery.org/for-medical-professionals/covid19-member-resources#statement. Accessed March 22, 2020.

21. Centers for Disease Control and Prevention. Healthcare supply of personal protective equipment. https://www.cdc.gov/coronavirus/2019-ncov/hcp/healthcare-supply-ppe.html. Accessed March 22, 2020.

22. Politico Magazine. Coronavirus will change the world permanently. Here’s how. https://www.politico.com/news/magazine/2020/03/19/coronavirus-effect-economy-life-society-analysis-covid-135579. Accessed March 22, 2020.

23. US & Canada. US students party on spring break despite coronavirus. https://www.bbc.com/news/av/world-us-canada-51955362/us-students-party-on-spring-break-despite-coronavirus. Accessed March 22, 2020.