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Editorial

COVID-19: Lost opportunities and lessons for the future

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Humanity has witnessed outbreaks since millennia, from limited epidemics to universal pandemics that wiped millions of lives and changed the course of civilizations. The advent of vaccines has eradicated some of the serious human pathogens and attenuated many others. However, pandemics are still a fact of our modern world, as we continue to have pandemics as ravaging as HIV and as alarming as severe acute respiratory syndrome, Ebola, and Middle East respiratory syndrome. The outbreak of COVID-19 with exponential curves racing to the 3 million confirmed cases should not have been a surprise. However, we seemed to ignore the past.[1,2] Unfortunately, COVID-19 is not the world's last pandemic and we have to learn what we have missed, and how to avoid the failures. In this article, we try to summarize the lost opportunities as well as the lessons learned, hoping we can do better in the future.

Lessons from the past were ignored: The emergence of COVID-19 pandemic marks almost a century since the Spanish influenza pandemic, one of the worst disasters in human history that claimed the lives of more than 50 million. We learned a lot from the 1918 outbreak. This quote published more than a decade ago addresses methods that worked:

"*From wearing surgical masks to* "*social distancing*" *measures (as we call them today) that ranged from closing schools and prohibiting public gatherings to isolating sick people in hospitals or encouraging them to stay home… closing schools, churches, and theaters, for example, appeared to be among the most effective measures…. these measures were far more effective if applied early and maintained as long as possible*."[2]

Although these measures have worked in the past, are recommended by experts, and have been shown to work in countries that were ahead of the curve, many countries were late to implement such measures, and some have not taken them seriously.

Early warnings have been ignored: There have been many signs that we were not as immune against a serious pandemic as we comfortably thought. In the past few years, we have had serious epidemics with new pathogens. Scientists, opinion leaders (e.g., Bill Gates), and World Health Organization (WHO) experts have warned that an unprepared world may face a nightmarish pandemic that no one seems to listen to, here is a quote from a report by the WHO published last year and reads like written today:

"*A rapidly spreading pandemic due to a lethal respiratory pathogen…. poses additional preparedness requirements. Donors and multilateral institutions must ensure adequate investment in development of innovative vaccines and therapeutics*, *surge manufacturing capacity, broad-spectrum antivirals, and appropriate non-pharmaceutical interventions.*" [1]

The world is more globalized and more vulnerable: Connectivity has dissolved the borders among countries transcending the barriers of distance. While the disease is thought to have started in a city in China, it has traveled to every continent, respecting no geographical borders. The situation is very different from the 1918 flu pandemic, where travel and urbanization were far less common than in our world today. While closure of borders and travel restrictions may help, this is far less effective than it has been in the past. Global pandemics require a stronger WHO with enough resources.[2] Failure in one country is a failure for the whole planet; therefore, pandemics require more solidarity and coordination so that poor countries could find the needed resources to treat, isolate, and combat serious epidemics. There are good signs that such efforts are being implemented (e.g., the European Union announced 15 billion euros to fight the current pandemic in developing countries), and hopefully, these efforts are consolidated to become systemic, proactive, and organized. In other words, global pandemics require global efforts with a strong, resourceful global health organization.

The globalized information world is equally vulnerable: The

1 https://apps.who.int/gpmb/assets/annual_report/GPMB_Annual_Report_English.pdf

vulnerability due to connectivity goes beyond the spread of the disease to the spread of misinformation, inaccurate medical advice, and conspiracy theories. Some of the misinformation was being spread by politicians and celebrities. Such problems with misinformation pose serious threats to disease control efforts. Misinformation is as old as information itself; however, it has been made worse with the massive instant connectivity, we have today.[3,4] Of course, the problem of misinformation is far from solvable in the near future; however, the problem was taken lightly, and the world has not invested enough in countering the dangerous and far-reaching enemy misinformation. A strong consistent message was badly needed as early as when the threat of the outbreak became imminent. Efforts are needed to target both disease and misinformation, they are equally destructive.[3,4]

Reluctance to communicate uncertainty and complexity to the public. Faced by the massive threat of the new pandemic and our wish to communicate a coherent message, the policy makers and scientists were largely inconsistent and perhaps contradictory. Take, for example, the face masks issue, at first, the general advice was against, even warning people against. It did not take long before the advice was reversed. The issue reflects a deeper problem with how we humans think and communicate. A complex dynamic problem needed a different approach so that the message does not erode the public trust. An approach prioritizes credibility, communicates the future consequences, and outlines the several factors that influence the danger of the pandemic, the uncertainties, and limitations of our knowledge. The public can understand uncertainty better than contradictory messages. Furthermore, complexity and uncertainty need to be embedded in our educational systems so that future generations can understand the world as it is complex, dynamic, and uncertain.[3-5]

Big data were misunderstood in many big ways. With the emergence of the pandemic, many websites have offered detailed curves of high-resolution fine-grained information; mathematicians and epidemiologists offered countless models. Furthermore, data scientists with no medical or epidemiological training have jumped on the bandwagon offering their analysis and conclusions. Unfortunately, the exponential growth of data and publications has seen an exponential decline in rigor, failure to communicate sense-making, data flaws, and uncertainty. The quality of existing data about COVID-19 is limited (e.g., due to low testing) and we still know so little about COVID-19. These limitations in data accuracy render every curve and model inaccurate, but not useless. Data should be communicated with all the uncertainty and complexity it has. Data-driven technologies could help understand the burden of the disease or the distribution of care. However, big data should not be substituted for rigorous medical trials or communicated to the public as facts while they are not.[6]

Our system of medical education lags in many considerable ways, doctors are prepared to treat patients and save lives. The current pandemic has highlighted the need to extend medical education to emphasize current world issues at larger scales beyond the scale of individual patients. We need to see doctors studying disease modeling, big data, simulation, forecasting health problems, and triage. At present, modeling and forecasting are done by physicists and mathematicians with little collaboration with health-care providers. The gap is evident between doctors who are struggling to save lives and epidemiologists who are trying to save societies. Furthermore, medical education has to prepare doctors to deliver remote assistance to patients through telemedicine and similar technologies.[4,7,8]

Reluctance to rely on existing solutions: Although we had solutions that have proven effective, for example, working from home, online education, and online meeting, they were not implemented in a timely manner. Take, for example, education, after many years of offering research and solutions for online learning that have basically been ignored in traditional universities, this changed overnight! Suddenly, as countries introduced various shutdowns and social distancing regulations, universities had to move their teaching online, entrenched with logistical, pedagogical, technological, and legal challenges due to these extraordinary measures. Many made the decision early on to cancel all face-to-face activities for the rest of the semester, enabling stability to address the challenges, and not have to wonder if the solutions that were being implemented would only be short term.[9,10]

To summarize, the world needs serious investment in research and development to understand the current epidemics as well as to prepare for the possible future ones. We need to prepare our health-care infrastructure, develop new diagnostic and therapeutic solutions, invest in vaccines and broad-spectrum antivirals, as well as fund research infrastructure and pandemic predictability. We need more research into social sciences to help understand the social aspects of the pandemic, to help foster engagement, trust in our communities, improve our education to be more adaptive, and target misinformation. We need each other more than ever with more compassion, solidarity, and collaboration. A global pandemic requires global efforts. There will be future serious pandemics.

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