Vaccines and Variants, Valiance and Variance

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In September 2020, Richard Horton, the editor of the highly prestigious medical journal, *The Lancet,* made the provocative statement "COVID-19 is not a pandemic. It is a syndemic."[1] In this statement, he was referring to the fact that COVID-19 and chronic conditions go hand-in-hand and cluster among groups that experience deep inequities due to their social and economic positions in society.[1]

The concept of a syndemic emerged from medical anthropology in the 1990s.[1] It refers to the concentration of and interaction between two or more health conditions within a population group (and/or groups) that experiences health inequities due to conditions such as poverty, stigmatization, stress, or structural violence.[2] The entangled relationship between COVID-19 and chronic disease, as discussed in this special issue, exemplifies this type of interaction. A preponderance of evidence indicates that those groups most at risk of infection, hospitalization, and death from the SARS-CoV-2 virus represent those who, prior to the epidemic, already experienced the greatest health burdens, primarily from chronic conditions like diabetes and heart disease.[3-8]

With increasing vaccination rates and new viral variants, the epidemiology of COVID-19 is rapidly changing. With more than 80% of COVID-19 deaths occurring among people above the age of 65,[9] older adults who, as a population, typically average 2 or more chronic conditions,[10] are a high-risk group.[9] However, in Hawai'i, vaccination of older adults surpasses 90%,[11] greatly reducing their risks of serious disease and death from COVID-19. Cases are now concentrated among younger age groups (only 55% of those 18-29 are vaccinated)[11] and among those who distrust vaccines. It is now a "pandemic of the unvaccinated".[12]

Youth in and of itself does not fully protect against severe COVID-19 disease and death. An "epidemic of chronic disease" was well underway before the pandemic and affected people of all ages.[13] In Hawai'i, there is strong evidence that Native Hawaiians and Other Pacific Islanders are more likely to be ill with chronic conditions, such as heart disease, at younger ages, including during childhood.[14-16] Thus, while younger age protects against COVID-19 severity and mortality, the protection is not equal for all groups and existing disparities across groups, especially those socially and economically disadvantaged, exemplifies the concept of a syndemic.

When the call for papers for this special issue came out in the late summer of 2020, there was already strong evidence that those with underlying chronic conditions were more likely to be hospitalized with and die from COVID-19.[17,18] At that time, however, it was unknown if or when a vaccine would be available. Further, for many globally, August and September of 2020 was a highly uncertain and frightening time as cases surged during a "second wave" of the pandemic. For example, in Hawai'i, case numbers reached a peak in August,[8] causing government officials to issue strict restrictions on many facets of daily life.[19] Unfortunately, they are again reaching an even higher peak in August 2021 than last year, but with few additional restrictions so far.

Since the original call for papers was issued, much has changed. Most critically, we now have several highly effective vaccines against COVID-19.[20] Additionally, treatment guidance for those with COVID-19 has evolved considerably in the 16 months since the pandemic was declared and the writing of this commentary.[21] Relatedly, we also know a lot more about the risks of severe disease and premature death for people with chronic conditions;[22,23] for example, there are now prediction tools for people with diabetes to better understand their individual risks of contracting a severe or fatal COVID-19 infection based on their personal clinical characteristics.[23] Simply put, compared to a year ago when this special issue was announced, we are in a much better place today to prevent disease from the SARS-CoV-2 virus and to save lives among those sickened with it.

Unfortunately, despite these rapid and impressive advancements, viral variants threaten the progress achieved to date.[24,25] Variants describe strains of the virus that differ in terms of their nucleic acid sequence from the original Wuhan strain. Terms often used to describe these novel strains are "variants of interest" and "variants of concern".[25] Variants of interest refer to those with mutations in the spike protein of the virus. These mutations are "of interest" because the spike protein is the part of the virus that binds to cells in the respiratory tract, and hence may affect transmissibility.[25] Variants of interest can become variants of concern, such as when they become increasingly prevalent among total cases and therefore suggestive of a heightened ability to transmit. One example of a variant of concern is Delta,[24] which is so highly transmittable that it has reversed national[26] and international trends of declining case numbers.[27,28] Variants of concern can also describe viral strains that affect the immune response such that more antibodies are needed to neutralize an infection. These strains may curtail existing immunity from previous infection or make vaccination less effective.[24,25] The Gamma variant is one such example[25] and appears to be responsible for the large COVID-19 outbreak in

December and January 2020 in the Brazilian Amazon. Many of those infected during that outbreak had had previous COVID-19 disease and thus should have been immune to new infection.[29]

With the emergence and wide circulation of novel variants, local and global vaccination are more urgent a priority than ever, as vaccination is the most important strategy for putting an end to the pandemic.[20] Viruses mutate. The more a virus replicates, the more opportunities there are for mutations that result in new variants, including those of interest and concern. The best way to reduce the opportunities for mutations that affect viral transmission and/or severity is to reduce the opportunity for replication, hence the vital importance of mass vaccinations which allow us to stay one step ahead of the viral mutation process.

The state of Hawai‘i has excelled nationally in terms of vaccination coverage. As of July 19, 2021, 59.3% of the total population had been fully vaccinated, with rates varying from 61% in Honolulu to 53% in Maui county.[11] Comparatively, at the time, only a handful of other states and territories had vaccination rates as high or higher than Hawai‘i: Connecticut, District of Columbia, Maine, Massachusetts, Palau, Puerto Rico, and Vermont.[30] For a small state, Hawai‘i has also excelled in terms of disease surveillance, including the molecular sequencing of COVID-19 variants. Hawai‘i ranks second in the nation in the percent of positive cases which are sequenced and reported.[31]

These successes reflect the hard work of public health officials and their community partners. Unfortunately, despite relatively high vaccination rates, as of August 2021, Hawai‘i faced its worst outbreak of COVID-19, with hospitalizations threatening to overwhelm health systems across the state. Given the amplitude of the most recent outbreak, its control will require a massive mobilization of public health and medical resources, which is only possible with strong leadership from the most senior levels down to grass-roots community organizations.

Dating to early in the pandemic, there have been ongoing efforts by state public health officials to understand what was occurring “on the ground” in communities across the state in order to predict and adapt to how people would respond to COVID-19 public health measures. The 3R group described by Kamaka and colleagues in this special issue is one example of such a collaborative process. Crucially, ongoing efforts to engage with community leaders and stakeholders stem from a recognition that not everyone in the state has equal access of opportunity to vaccination. Some barriers to accessing vaccination are well-documented locally.[32] For residents of rural communities, barriers cited in the media include fewer vaccine administration sites and appointment and walk-in hours that can conflict with work schedules.[32]

Other barriers to accessing the vaccine are less apparent. As of writing, patients unaware of their access to free vaccinations were still being reported by physicians and other medical professionals to Hawai‘i Department of Health leadership. As described in the article by Sentell et al, this example reflects a continuing need to increase health literacy among certain groups, especially among those for whom English is a second language or who do not speak English. Finally, there are barriers with regard to trust. For certain individuals and communities, historical legacies of trauma associated with public health actions, such as those criminalizing and exiling people with Hansen’s disease,[33]have resulted in a deep distrust of government-supported medical actions. For these individuals and communities, additional efforts, including taking time to build trust, are needed to increase vaccination rates.

Throughout most of the pandemic, Hawai‘i has led the nation in terms of low case counts and hospitalizations[34] as well as high vaccination rates.[30] A critical component of Hawai‘i’s success has been a deeply dedicated but relatively small public health workforce. The accomplishments of this workforce are exceptional given the critical human resources and financial shortages facing most state and county public health departments across the US. Public health has been deeply underfunded for decades, especially at local levels.[35-37] Hawai‘i is no exception. In fact, many entry- and even mid-level Hawai‘i Department of Health professionals do not earn a livable wage, especially given the high cost of living in the state.[38,39] Retention across the state bureaucracy is challenging and made worse by administrative rules that hinder efficient hiring and procurement processes. No matter how dedicated or professional the existing workforce, these challenges severely impede efficient and nimble public health responses, especially during times of crisis when maximum agility is needed. Hawai‘i’s successes in managing COVID-19 are thus all the more exceptional in the given context, but there remains an urgent need to address human resource shortages and bureaucratic hurdles.

The lack of resources for public health is not trivial. Public health, unlike medicine, is a field funded almost entirely by public dollars, yet its 2019 share of total health spending was estimated at less than 3%,[37]about half that of Canada or the United Kingdom.[40] Neoliberal policies that accelerated during President Trump’s tenure amplified a pattern of decades of public health neglect.[40] For example, budget shortfalls from his signature legislation—a trillion-dollar tax cut to the wealthy—justified cuts to essential wrap-around services for vulnerable populations, such as food and housing subsidies.[40] Further, in the past decade, shrinking government spending and an aging public health workforce have resulted in state and local public health agencies losing 50,000 positions, or 20% of the workforce.[41] These positions represent the frontline public health professionals needed to effectively respond to crises.[40] At the national level, the CDC has experienced a 10% budget decrease since 2003. This was made worse by a 2017 hiring freeze that left hundreds of CDC positions for researchers and officials unfilled.[40] Ultimately, the dismantling of critical in-

frastructure for and chronic underfunding of public health has hamstrung an effective and efficient response to the pandemic, both locally and nationally. Worse, the crisis was predicted and its root causes explained nearly three decades ago.[42]

Without significant and sustained investment in public health, the challenges described above will only grow. Already, many other critical public health issues are experiencing neglect due to the diversion of resources and personnel to address COVID-19. Despite the remarkable scientific success of developing new, highly efficacious vaccines for COVID-19 and their rapid roll-out in the US and other highly industrialized countries, routine childhood vaccination efforts have stalled or reversed.[43,44] Currently, the world is facing a global vaccination crisis that extends far past COVID-19. It is estimated that 23 million children globally did not receive basic vaccinations in 2020, with many of these children affected by conflict, residing in remote locations, living in slums or informal settlements, or otherwise experiencing situations of limited access to basic health and social services.[43] The World Health Organization's Region of the Americas has experienced one of the most concerning drops in vaccine coverage due to funding shortfalls, vaccine misinformation, and instability.[43]

In the US, vaccine administration data indicates substantially lower administration of routine childhood and adolescent vaccines, raising significant concerns for outbreaks of preventable diseases such as measles and potentially thwarting nationwide efforts to return children to the classroom.[44] These concerns are as compelling in Hawai'i as nationally. Prior to the COVID-19 pandemic, Hawai'i had already had a major mumps outbreak in 2017-18 and felt the impact of a measles epidemic in Samoa in 2019. While travel restrictions during the pandemic minimized the risk of importation on non-endemic illnesses, the return of tourism to the islands reignites this risk and the potential for other outbreaks. Further, children staying at home has negatively affected vaccination rates in the state. School entry vaccine requirements were not enforced for distance learners, and during case surges, many families avoided or were discouraged from attending in-person healthcare visits where routine vaccines would typically be administered. On top of it all, even the ability to accurately assess routine vaccine uptake during the pandemic has been limited because of disruption in routine data collection and reporting processes related to the redistribution of an already limited public health workforce to COVID-19 related duties.

Returning to the concept of a syndemic, in the absence of sustained and meaningful investment in public health, Hawai'i and the nation are poised to experience many other syndemics that will contribute to ongoing trends in reductions in US life-expectancy.[45] For example, if routine vaccination rates do not increase rapidly, there is a significant risk that both COVID-19 (as of writing, vaccines were not available to children under 12 years) and other preventable childhood diseases could explode among children living in communities with low vaccination rates. Further, despite the increased risks of severe COVID-19 symptoms and death associated with smoking and underlying chronic conditions, policies and systems created to support at-risk populations face post-pandemic funding cuts. The situation is worsened by the fact that proposed prevention policies, such as those designed to limit youth vaping and consumption of sugar-sweetened beverages, faced set-backs during the pandemic.

Improving health outcomes and life-expectancy will require concerted policies, systems, and environmental changes to address the social determinants of health and advance health equity. To compound the challenge, social and digital media platforms amplified misinformation and disinformation on the vaccine and distrust in public health guidance, requiring sustained, intensive public health education and presence in communities for relationship-building. As is the case with nearly all health conditions, these challenges are not borne by communities equally and instead concentrate among those socially and economically deprived and marginalized. Now more than ever, it is essential to build trust and invest in public health.

Conflict of Interest

None of the authors identify any conflict of interest.

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