Maxims for a Pandemic: Time, Distance, and Data

In their article, Alagoz and colleagues explored the effect of coronavirus disease 2019 (COVID-19)-related public health mandates in 3 U.S. locations—Dane County, Wisconsin; the Milwaukee metropolitan area; and New York City—using agent-based simulation models (1). They modeled variations in adherence to social distancing mandates, time of intervention, and population density. Mask mandates are notably absent from the model because the authors focused on early periods of the pandemic before recommendations that the general population wear masks. The findings corroborate the growing scientific consensus that social distancing mandates (for example, limiting the size of group gatherings and closing schools and nonessential businesses) limit community spread of respiratory viruses, such as severe acute respiratory syndrome coronavirus 2. Moreover, we learn that the challenge of controlling COVID-19 is magnified in urban locations where factors like higher population densities and greater reliance on public transportation increase transmission rates. Alagoz and colleagues' study provides an opportunity to pause and assess how modeling can and should inform COVID-19 decision making.

Although Alagoz and colleagues' methods are sound, some of the assumptions about public health interventions are questionable. Authorities imposed social distancing mandates to decrease population mobility and reduce in-person contacts, but the effects of these mandates varied. Cellular mobility data show that many people began to stay home before the mandates, and steeper decreases in mobility were seen when the orders went into effect. In Wisconsin, mobility decreased to –7% below baseline averages 5 days before social distancing mandates were issued. When the orders went into effect on 18 March, mobility rates plummeted to –28% below average, reaching a nadir of –66% on 11 April before increasing again (2). Similar patterns were seen in New York City. Many states saw upticks in mobility in early April as officials signaled the relaxation of mandates (2). The researchers did not account for these fluctuations and based assumptions about contacts per person on pre-COVID-19 data rather than capturing pandemic-era behavioral changes.

One of the hard truths revealed by the pandemic is that demography is destiny and population density is a contributor. Black Americans are about twice as likely as White Americans to die of COVID-19 (3–5). Not only are many “essential workers” low income and persons of color, but the very nature of work in many essential fields makes quarantine infeasible because of financial precarity, in-person work requirements, reliance on public transport, and dense living arrangements. At the same time, many white-collar professionals transitioned to at-home work rather seamlessly. There is no one-size-fits-all community solution. To control the spread of the virus, we must localize our responses. However, while tending to local contexts, there must be some

consistency. A commitment to transparency and scientific integrity should guide all policies and practices.

Alagoz and colleagues' analysis shows the variability of the pandemic across geographic locations. A pandemic model must carefully consider local conditions and account for a range of variables. Rigorous modeling requires an analytic structure with clear and defensible assumptions, varying scenarios, appreciation of a myriad of contributory factors, and attention to sensitivity analysis. Modeling and forecasting are increasingly common features of epidemiologic studies and have become especially prominent in academic, policy, and media circles during the current pandemic (6).

Forecasting models are a dynamic science based on moving variables and are indispensable tools when faced with a virus that we are only starting to understand. It is imperative that the scientific community improve our forecasting capacity because this will not be the last crisis. There will be other global pandemics, and we must prepare for future health scenarios. This burgeoning area of research and policy should be a focus for researchers and funders. Having the capacity for rigorous modeling analyses will improve decision making during future public health crises. We need massive investment to build a national disease surveillance system similar to our advanced weather-tracking infrastructure.

Three salient lessons related to the current model have been learned. First, early interventions save lives. Second, social distancing mandates are an effective policy intervention. Third, tracking cases and deaths deepens our knowledge of the virus and can inform decision making. Timing, distance, and data are critical during a pandemic. Unfortunately, the federal response to COVID-19 fell short on all 3 of these issues. The absence of an adequate national plan undermined our ability to curb the pandemic at its beginning, and this continues to impede progress. From a scientific standpoint, when the highest levels of government ignored nearly 2 decades of pandemic planning (7–9) and evidence-based messaging from the nation's top disease experts, it served to sow confusion and foment discord. Even while many Americans were battling COVID-19, some influential voices perpetuated a misleading narrative about the virus and quite literally infected the body politic. Downplaying the severity of COVID-19 as nothing more serious than the common flu is an insult to the 210 000 grieving families of persons who died so far and the many more who have had the illness. The American public has paid dearly for this recklessness. The United States is home to 4% of the world's population, yet it accounts for more than 20% of both cases and deaths (10). By year's end, COVID-19 will be the second-leading cause of death in the United States. Other high-income and Asian countries have fared far better.

Alagoz and colleagues' study makes a strong case for recognizing the threat of a disease outbreak as early as possible and taking decisive action. With mass vaccination months, if not years, away and few effective therapies, the timely use of nonpharmaceutical public health interventions will reduce morbidity and mortality from COVID-19. Future pandemics may tie our hands in different knots. Commonly accepted truths about the nature of a viral disease or expectations about human behavior may prove elusive for any model to capture, no matter how technically impressive. As a result, our ability to forecast must be nimble and quick to be recalibrated, modified, or even reversed. Alagoz and colleagues' analysis contributes to an emergent body of science on pandemic modeling that is certain to prove useful.

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