Building a pandemic supply chain — equity over equality

To the Editor — During the initial phases of the pandemic, politicians, celebrities and public-health leaders alike peddled a narrative of COVID-19 as the 'great equalizer'. Although disparities in COVID-19 vaccination rates, hospitalizations and mortality have emphasized this fallacy, an equality-first approach has largely guided the response to COVID-19 in the United States, from allocation of critical-care resources to vaccination. Most recently, the Biden administration began distributing half a billion free at-home COVID-19 tests, and this rollout has garnered widespread praise, given its simplicity and efficiency. Although expanding testing access is critical to mitigating the spread of COVID-19, this administration's initiative seems to have once again prioritized ease and equality to the detriment of health equity.

First, the dissemination through the website CovidTests.gov may disproportionately exclude communities with limited health literacy and poor access to digital infrastructure. Indeed, 15–24% of Americans lack any broadband connection, and this digital divide complicates access to free testing, especially among low-income and rural communities[1]. Even when technology is accessible, health literacy can determine whether people can effectively utilize the digital resources necessary to request free tests, or not. In parallel with social inequities, widespread health-literacy disparities contribute to a lower uptake of healthcare services and resources among older adults, non-English speakers and racial or ethnic minorities. Thus, these communities may be more unaware of the administration's testing initiative and may be less able to secure a dwindling supply of tests for themselves. The administration certainly recognizes these potential inequities, offering a secondary phone-in option and prioritizing orders to communities facing the greatest social vulnerability. These strategies, however, do not proactively address health-literacy disparities or meet these communities where they are. An opt-in webpage approach may be easily accessible to a majority of Americans, but equity requires centering the needs of the most disadvantaged. With limited consideration to digital infrastructure and health literacy, already vulnerable communities may be the least able to benefit from the administration's free testing program.

Limitations on order size and a requirement for a residential address also make free COVID-19 tests more inaccessible to multi-generational households and those living in multi-unit buildings or experiencing homelessness. Although those who own multiple properties can capitalize on the administration's testing program with ease, many people who live in apartment complexes or mobile homes have been unable to obtain free COVID-19 tests because of orders placed to the shared address. Similarly, the four-kit restriction impedes access to testing among multi-generational households, which are most common among Asian Americans (29%) and Hispanic Americans (27%)[2]. For people experiencing homelessness, the issue is more fundamental: a lack of a residential address. The testing initiative biases access to privileged single-family households rather than the low-income, immigrant and minority families that have long experienced housing disparities and disproportionately bore the pandemic's burden of disease. Although the administration has made encouraging efforts to provide free tests through community health centers, homeless shelters and rural health clinics, these steps come as an afterthought to the comprehensive distribution via CovidTests.gov. Both systems boast accessibility and equality, but neither does enough to ensure equity. The false notion of equality created by these relief programs obfuscates efforts to achieve true equity in COVID-19 mitigation and outcomes.

Unfortunately, this hyper-focus on equality is nothing new. Early in the pandemic, prominent bioethical frameworks were published in *The New England Journal of Medicine* and the *Journal of the American Medical Association* to outline the allocation of critical-care resources under scarcity, with both emphasizing 'maximizing benefits' to save the most lives and life-years possible. But this utilitarian approach is deceptive; as Sayeed and Taylor describe in a critique of these frameworks, their "sterilized notion of fairness" neglects social determinants of health and ignores how the world is shaped by racism, sexism, ageism and ableism[3]. The sequential-organ-failure assessment metric, for instance, was found to have exacerbated racial disparities if applied to COVID-19. Black patients obtained the highest scores on this metric relative to every other group, which assumed they would experience the worst clinical outcomes and thus would waste life-saving resources[4].

Similarly, many states' vaccination plans touted speed and accessibility at the expense of equity, switching from a textured approach involving individual and structural risk factors to a strictly age-based criteria[5]. Although seductively 'objective', this distribution system ignores the fact that poor digital connection, ability to travel to vaccine sites and trust in vaccination lead marginalized groups to be vaccinated at much lower rates than the general public. It was an equal solution with inequitable outcomes. Massachusetts, as one opposing example, implemented an equity-focused vaccine distribution strategy, prioritizing the vaccination of communities most impacted by COVID-19 cases. The state's vaccination rate was initially sluggish, but its emphasis on equity enabled Massachusetts to immediately protect its most vulnerable communities and ultimately record one of the highest vaccination rates in the country.

These observations demonstrate that a justice-first framework is necessary to overcome health disparities and successfully curb the spread of COVID-19. To ensure that marginalized populations receive free testing kits, the administration should expand its efforts to establish community-based distribution in places of worship, cultural centers, gas stations, dollar stores and other accessible local fixtures, as certain cities and counties have already started doing. Not only will these alternative methods increase vulnerable communities' access to COVID-19 tests, but the community-based distribution centers can also be leveraged as outreach centers to increase health literacy for other relief efforts and public-health interventions. We would simultaneously advocate for an opt-out program for the dissemination of testing, because an opt-in program may be considerably underutilized by disadvantaged communities. Although perhaps initially unfeasible, given testing shortages, this system would allow all residential addresses to receive necessary pandemic resources regardless of broadband access, housing disparities and other social disadvantages. Shifting the focus of the pandemic supply chain from equality to equity can more

effectively mitigate COVID-19 transmission for all Americans.

From critical-care resources and vaccination to (more recently) testing, equality has mainly been at the forefront of COVID-19 relief policy in the United States. And undoubtedly, equality is a laudable goal — in an equal world. Underlying health disparities, and the widening of these disparities during the pandemic, reveal that equality is necessary but insufficient. A justice-first approach is required. We understand that many of these decisions by this administration are driven by scarcity, but that is hardly an excuse to neglect equity. While politicians and public-health leaders combat shortages and build a more vigorous pandemic supply chain, priority must be given to marginalized and disadvantaged communities that have been most harmed by the pandemic and are most at risk going forward. Scarcity need not be accepted as a given; supply, demand, cost and even values are all malleable. ❐

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Dynamical malaria modeling as a tool for bold policy-making

To the Editor—The malaria community have been called upon to be bold[1]. Pedro Alonso's recent Comment in *Nature Medicine* asked us to adapt established interventions to new areas, to tailor preventive strategies to local contexts and to strive to reach the hard-to-reach[1]. We would like to highlight the pivotal role that dynamical modeling can and does play in making these necessary policy shifts.

Malaria is complex. Describing its dynamics requires an understanding of the parasite, the various mosquito vectors, the human hosts' level of immunity, human behavior and the policy landscape and environment in which all these factors interact. Dynamical modeling suites for malaria, such as the Swiss Tropical and Public Health Institute's OpenMalaria, provide platforms where all these factors can be taken into account simultaneously[2,3]. After adequately capturing the current state of malaria in a given setting, we use the calibrated model as a tool to explore the potential impact of deploying additional interventions. Dynamical modeling has many limitations, is inherently replete with uncertainty and can only ever be as trustworthy as the data upon which it rests. But even given these caveats, with its evidence-based, explicit and interrogable assumptions, modeling provides a crucial framework for comparing possible approaches.

Modeling has a formalized place within the World Health Organization's (WHO's) High Burden to High Impact process, which aims to accelerate the reduction of malaria risk in the 11 highest-burden countries[4]. The watchwords of High Burden to High Impact are "political engagement" and "using data for action," with dynamical modeling having a key role in the latter. In this process, policy-makers in each country create national malaria control plans, tailoring the interventions to the epidemiological context in each geographical area. The potential impact of each of these sub-nationally tailored plans are then modeled, and the results used to help finalize strategies and prioritize resources during funding requests to national and international donors.

Expanding seasonal malaria chemoprevention (SMC) into untested areas offers another example of the role of modeling in policy change. SMC is a highly effective malaria intervention suitable for areas with seasonal malaria transmission: preventive treatment of children monthly for the duration of the malarial season. In the past eight or so years, SMC has been widely deployed across the Sahel, where it likely averts several million cases annually[5]. But, mainly because it was assumed that drug resistance would render the intervention ineffective, it has never been implemented outside the Sahel, even though other areas of Africa also see malaria cases concentrated during well-defined rainy seasons. The Karamoja region of Uganda is such a place, with most rain falling within a five-month period starting in May. Malaria prevalence in Karamoja has long been substantially higher than that in other regions of Uganda, and its population is largely nomadic, hampering bed net usage. In short, it seems like a region ripe for SMC.

Ugandan policy-makers envisioned deploying SMC in Karamoja as a way to finally make a dent in the region's persistently high malaria burden. As a first step, they reached out to dynamical modelers. Together, we modeled the deployment plan of monthly rounds of SMC from May to September, as well as a series of scenarios in which we varied each of our model assumptions in turn. Baseline levels of malaria incidence shape the impact of any malaria intervention, and incidence can vary widely within even a small area. For these reasons, we projected our SMC deployment scenarios across a range of incidence levels, rather than using the regional-level estimate.

From a modeler's perspective, there were several key findings from the exercise. Firstly, effect size (measured as percentage reduction in incidence compared to the scenario with no SMC deployment) is highest when baseline incidence is lowest; secondly, any intended or unintended deviations in the deployment plan likely cause less perturbance to the effect size when baseline incidence is higher; and thirdly, the two scenarios that would do the most to drag down the expected effect size at