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How to build more equitable vaccine distribution technology

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Lillie McCray (R) receives a COVID-19 vaccine from Walgreens healthcare professional Ghassan Ayyad (L) at the Victor Walchirk Apartments in Evanston, Illinois, U.S. February 22, 2021. REUTERS/Kamil Krzaczynski

The COVID-19 pandemic and the distribution of vaccines that promise to bring it to an end have spotlighted inequities in our nation's healthcare system. But the vaccine distribution problem illustrates a peculiar fact of our digital era: just how hard it is to ensure equitable delivery of services via the internet. This is especially the case when distributing a scarce critical resource as quickly as possible on a massive scale.

The digital infrastructure used to set up vaccine appointments has created significant obstacles for individuals without certain technical resources, as *The Verge* and *Recode* have reported in recent weeks. The online registration processes rolled out state by state are tragically too difficult for most people to handle on their own. Major news outlets have created guides to help readers navigate registration processes, and good Samaritans—a group of teachers in Maryland, a 13-year-old in Chicago, and retired educators in Tacoma, to name

a few—have devoted their time to helping frustrated seniors find appointments. Despite these efforts, vaccine rates are alarmingly low among those that need the vaccine the most, including in communities of color and low-income communities that have suffered disproportionately during the pandemic.

As vaccine distribution accelerates, we should pause to think through what problems are already apparent, and what changes we might make to mitigate those problems.

Digital infrastructure is a determinant of health

The growing recognition that digital infrastructure is linked to health outcomes reflects a broader theme in public health policy: Many important factors affecting health are socioeconomic and environmental, not medical. Indeed, "social determinants of health," conditions in people's lives that affect their health risks and outcomes, are now widely recognized to account for as much as 80 to 90% of our health. Consider the effect of access to safe, affordable housing on health. Decades of research show that individuals who are evicted or who live in substandard housing have worse health than those with stable, safe housing. For example, mold or rodents in a family's home can significantly exacerbate a child's asthma. Similar research documents the health effects of food insecurity, unequal access to quality education, income insecurity, and unemployment.

Access to technical resources and technical literacy also affect health, particularly during a crisis. In a socially-distanced economy, people need internet access to keep jobs that have transitioned to remote work, or to help their kids attend school online. Individuals without internet access also miss out on services that could improve their health—including health-care providers' online portals and online grocery delivery systems. "Internet access is emerging as a new and troublesome determinant of health," a group of public-health researchers argued earlier this month. "This appears to be particularly true for under-resourced racial and ethnic minority communities and aging populations."

The digital divide compounds health inequities in disadvantaged communities

Uneven access to computers, computer skills, and the internet—the digital divide—is making it particularly difficult to deliver the vaccine to those who need it most. Internet access lags among the elderly, as well as in Black, Latinx, Native American, and rural communities, all among those hit hardest by the pandemic. And early numbers indicate that communities of color facing disproportionate rates of COVID infection, hospitalization, ICU admission, and death are also being vaccinated at lower rates. There are many reasons for these lower vaccination rates, but the role that technology plays in creating and exacerbating vaccination disparities must be addressed to stop them from compounding.

The stories of people who lack the technical resources to access vaccine appointments are heartbreaking. An 83-year-old woman with lymphoma said trying to get a vaccine was like "hitting a brick wall." A 78-year-old patient spent so much time trying to figure out how to navigate the online registration portal that by the time she finally got through, all the appointments were gone. A 70-year-old woman who spent three-and-a-half weeks trying to make an appointment said she "wanted to throw [her] computer out the window." An elderly Queens resident got so stressed trying and failing to get an appointment that she told a reporter, "All I did was cry." She went on, "When you're older, that could give you a heart attack because fear and continuously being on the computer just getting negativity."

One of us encountered this frustration firsthand when making appointments in Maryland for her high-risk older parents and a handful of others, most with additional health complications. To secure appointments, she had to register for text message alerts from multiple sources, watch her messages like a hawk, and check six different websites (of different hospitals and pharmacies that offer vaccines in the state) repeatedly, at all hours of the day and night. When appointments became available, she had to move fast, because the open slots typically were snatched up within minutes. On each of the three platforms, she had no idea what information would be needed to complete the booking until she was already halfway through the process, and once had to scramble to collect the relevant details before she lost the slot.

The problem won't go away on its own

As vaccine distribution accelerates and more people become eligible to make an

appointment, inequities in online registration are likely to persist. According to the Pew Research Center, among U.S. adults with an annual income of $30,000 or less, 18% don't use the internet and 29% don't have smartphones (as compared to 2% and 5%, respectively, among those who make $75,000 or more). 41% of those over the age of 65 lack home broadband. Even among people who have smartphones, computers, and internet access, there are likely to be huge disparities. Many lower-income individuals, including essential workers, lack the time and flexible schedules required to continuously check for appointments or jump online at a moment's notice. Parents with children at home engaged in remote learning may have limited devices to share among the family, as well as limited bandwidth that is stretched to the breaking point among family members. Further, those with mobile data caps might not have the necessary data to look for appointments, while those with unlimited data or high-speed home internet connections won't have such concerns.

Disparities in vaccine registration are particularly problematic for essential workers and those who work multiple jobs, many of whom are people of color. These individuals' jobs put them at risk of illness, and they are likely to live in high-risk areas. They might be unable to find appointments because their work schedules will not allow them the time needed to navigate appointment websites, or because they lack stable internet access. They face compounded risk of virus contraction and serious illness, and they have many barriers to vaccination.

Recommendations

What can be done about these problems? For those designing or administering the appointment-distribution platforms, we—two law professors who research and advocate for equity in technology and health policy—offer five suggestions:

> 1. **Consult with health equity experts and affected communities on how to offer vaccine appointments equitably.** The social determinants of health most responsible for negative health outcomes in low-income communities of color are also likely to present serious obstacles to vaccine registration. Officials should seek a deeper understanding of the barriers faced by low-income people and people of color through dialogue with health

equity experts and members of highly impacted communities to develop an equitable and accommodating appointments process. Health equity experts must also be involved in design conversations with the engineers building and maintaining appointment registration systems. Those engineers are likely to have deep experience building web interfaces but may not have experience anticipating and designing around equity challenges.

2. **Provide multilingual, offline options for vaccine registration.** States and localities must ensure that appointments can be booked by phone, text, or in person. Vaccine clinics should reserve a certain number of appointments for offline booking to give people without an internet connection a fighting chance. Managing incoming phone and text inquiries may be challenging but could be done by third-party call centers equipped to field incoming communications or by volunteers trained to take calls and text messages. It is also critical that these programs be properly staffed with a backup plan to field excess calls. Some jurisdictions, including Maryland, have launched appointment hotlines only to become overwhelmed by the volume of calls.

Vaccination clinics operated by private companies, such as pharmacies, may not want to shoulder the expense of offering phone and text options, but grants could be made available to cover the cost. Private clinics could also be required to set aside appointments for booking on a separate platform accessible only to state health departments or the call centers or volunteers working with them.

Health departments also should consider working with trusted community partners to get people signed up at in-person events. For example, Washington, D.C. recently launched a new partnership with faith leaders to stage vaccine clinics on church grounds. Some community organizations—including the Dallas, Texas Democratic Party—have conducted direct-outreach campaigns to register seniors for vaccine appointments, going door-to-door with mobile devices and organizing phone banks.

3. **Give advance notice of scheduled appointment releases, designate appointments specifically for high-risk communities, and release appointments at multiple times of the day and night.** The most frustrating—and time-consuming—appointment platforms to navigate are those on which available slots appear unpredictably, at seemingly random

times. This creates an unfair advantage for people who can check websites continuously or respond immediately to surprise alerts. To even the playing field, administrators should queue up available appointments for release at predetermined times that are public and consistent. Available appointments should be divided into batches offered at two or more different times of day, to maximize the likelihood that any given individual will be off work and available to call or get online at one of the key times. Washington, D.C. recently announced multiple changes in that vein. The city now releases appointments and notifies people in waves, giving individuals 24 hours to sign up after being notified. Every other week appointment release times are in the evening to accommodate those who work or care for children during the day. The city also reserves appointments each week for high-risk neighborhoods where vaccinations have lagged, releasing them on a different day and only to residents of those areas.

4. **Make the booking process quick and simple.** The people most in need of a COVID vaccine often are those with the least time to book an appointment. The booking process should be streamlined, without extraneous pages or lengthy questionnaires. Many people are very concerned with mobile data usage on their smartphones, so booking platforms should forego complex visual elements or other items that use a chunk of data. They should be easily navigable on a phone, since many people don't have access to a tablet or laptop. Vaccine registration sites should allow for pre-registration, so that people only need to enter their information once. When appointments become available, sites should notify people with "inventory alerts," similar to those used by retail sites. The City of Chicago recently launched a revamped vaccine sign-up page that allows pre-registration and provides inventory alerts, to significant success. West Virginia also has a pre-registration option, and the Massachusetts House of Representatives is considering one.

5. **Minimize the amount of information needed to book the appointment and tell people what is needed in advance.** Different platforms ask for different information during the booking process, and it often seems that some of the requested details are unnecessary at the time of booking. In addition, some platforms ask for an email address and/or mobile phone number—which some people just don't have. The required details should be kept to a bare minimum. In addition, administrators should publish information in advance about what will be needed during the booking process, so that people trying to

make appointments don't find themselves rummaging through purses or drawers or making an urgent phone call to a loved one to try to collect the necessary information in the moment.

Even if vaccine registration platforms are made more equitable, there will still be serious equity challenges associated with COVID vaccine distribution. For one thing, there's still the problem of transportation—many people have no way to get to a vaccine clinic, even if they have an appointment. Community trust is also an issue—people in historically disadvantaged communities are less likely to trust the healthcare system and be enthusiastic about getting the vaccine. Overcoming these challenges, many of which are driven by structural racism, will require focused and sustained attention and dedication on the part of health officials.

As health officials tackle these challenges, improving the vaccine appointment distribution system has to be an immediate next step. The technological status quo is plainly inequitable, and it disadvantages those who need the COVID vaccine most urgently. During this pandemic, activists and researchers have called for "health justice"—the leveraging of law and policy to ensure health equity. "Tech justice" is an essential component of health justice in this pandemic, as vaccine access necessitates an equitable vaccine appointment distribution system. Without swift action, this problem will persist and may even intensify as vaccine distribution ramps up. We can do better.

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