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Commentary

On the rise of the new B.1.1.529 variant: Five dimensions of access to a COVID-19 vaccine

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ABSTRACT

Mass COVID-19 vaccination, as the last resort to bring society to a new normal, has been rapidly rolled out in the US. However, because of the lifting of international travel restrictions, amid the many uncertainties induced by the emerging B.1.1.529 variant, it remains unclear about the timeline of reaching herd immunity and when our daily life will return to normalcy. Since access to a vaccine is an important predicate to the achievement of herd immunity, we articulate the vaccine access issue as the degree of fit between patients and the healthcare system in five dimensions: availability, accessibility, accommodation, affordability, and acceptability. These five dimensions can be adopted in existing health practice and policy to elucidate effective strategies for raising COVID-19 vaccination rates and improving vaccine equity in the fight against the new variant.

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1. Introduction

The rapid rise and diffusion of the coronavirus disease 2019 (COVID-19) have prompted unprecedented global health adversities, economic downturns, and massive societal impacts. In the US, with infection cases nearing 50 million and deaths surpassing 770 thousand as of November 2021 [1], simply containing the virus spread through social distancing is of little avail in ending the pandemic. Vaccination, as the last resort to bring society to a new normal, has been rapidly implemented in the US over the past year. Guided by the Centers for Disease Control and Prevention (CDC)'s Advisory Committee on Immunization Practices (ACIP), vaccinations were implemented in multiple phases, with the initial phases prioritizing healthcare personnel, long-term care facility residents, and elderly with medical conditions [2]. Subsequent phases saw vaccines offered to other age groups in reverse chronological order. As of late November 2021, more than 196 million or 59.1% of people received full vaccination, including Johnson & Johnson's single-dose vaccine or Pfizer-BioNTech and Moderna's two-dose series [1].

The vaccination effort has been approved to be effective as new cases started to dwindle. However, the emerging B.1.1.529 variant,

firstly reported from South Africa on November 24, 2021 [3], posed new challenges to ending the pandemic. The B.1.1.529 variant manifests heavy mutations found in existing variants and can even evade the immunity gained from vaccines [3]. Because of the new variant, amid the lifting of travel restrictions for fully vaccinated foreign travelers in early November 2021 [4], there is a likelihood of seeing a new wave in the months to come [5]. While the pathway to herd immunity rests on effective vaccines, the actual disease landscape that vaccination shapes is predicated on how readily accessible and culturally acceptable vaccines are to those yet to be vaccinated. This issue can be further articulated by examining the different dimensions of access to a vaccine.

While "access" is an important concern in evaluating the effectiveness of health policy and services, it is often loosely defined and used interchangeably with other terms, such as accessibility and availability. Penchansky and Thomas [6], by defining access as the degree of fit between patients and the healthcare system, further specify it in five dimensions: availability, accessibility, accommodation, affordability, and acceptability. These five dimensions can be adopted in existing health practice and research agenda to elucidate effective strategies for vaccine distribution and promotion in fighting the emerging variant.

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2. Five dimensions of vaccine access

Availability is defined as the volume and type of healthcare services in meeting patients' demands. At the early vaccination phase, because of the relative shortage of vaccine production, amid the hurdles of fulfilling Pfizer-BioNTech and Moderna's two-dose requirements, there has been a debate about the vaccination schedule in the US. Although ACIP has proposed the general guidelines, every state has its own plan in terms of priority groups and timelines. The lack of consistency and sudden change of criteria over different phases could obfuscate the public's perception of eligibility [7]. Also, vaccination priorities based on age, occupation, and health conditions overlooked racial inequities. Specifically, racial minorities, especially African Americans and Latinos, were comparatively victimized in the pandemic in terms of the highest case rates [8]. However, these two populations had considerably lower vaccination rates [9,10]. With increased vaccine production and continuing vaccination efforts, vaccine availability has become a minor issue. However, in future vaccination efforts, such as the implementation of the booster shot and a new vaccine against the variant, it is advisable to refer to a comprehensive social metric, such as the Social Vulnerability Index [11], to aid communities at the highest risk of spreading the disease.

Accessibility, defined as the physical access to healthcare services, depends on the geographical distribution of healthcare facilities, patients' residential locations, and their transportation resources (e.g., car ownership, access to public transit). Healthcare accessibility has been long evaluated using various spatial measures, including the density of services, proximity to healthcare centers, and more complex spatial interaction models [12]. While vaccination practice is underway, a promising research agenda is to explore the spatial complementarity between vaccine supply and demand from a geographical perspective, such as evaluating if the distribution of vaccination clinics and allocations of doses can accommodate the unequal disease landscape and if vaccination gaps exist in certain high-risk communities (e.g., neighborhoods of color). This identification can rely on classical accessibility models, such as the two-step floating catchment area (2SFCA) method [12]. Understanding this spatial complementarity helps to identify regional pockets where vaccination coverage is devoid. Beyond the measure of physical access, another area of equal importance is to elucidate the perceived accessibility of unvaccinated individuals, as the difficulty in reaching a clinic may not be a result of spatial separation but could be a lack of transport resources and knowledge to schedule or fulfill an appointment. Supporting evidence can be found in a recent study, which showed that the vaccination rates in the elderly were significantly correlated with education attainment [9]. Thus, improving vaccine accessibility for socioeconomically disadvantaged populations in terms of onsite scheduling and at-home vaccination services will be a promising approach to improving vaccine accessibility [13].

Accommodation can be defined as the organization of healthcare services in fulfilling patients' needs. A drastic shift in healthcare accommodation during the pandemic manifests in the rise of telehealth services (through videoconferences, emails, text messages, and wearable devices). Due to the compliance with social distancing, telehealth services have been rapidly approved and adopted for screening, triaging, and consultation. Evidence-based research shows that telehealth services help to decrease the chance of virus transmission for both clinicians and patients and play an indispensable role in psychiatric treatment and providing social support [14]. The digital transformation comes with the concern of possibly violating patients' privacy in virtual care, an area currently uncovered by either the Health Insurance Portability and Accounting Act (HIPAA) or the Food and Drug Administration

(FDA) [15]. Another issue arising from the new care form is the existence of the digital divide, referred to as the inequity of access to technology between different social groups. The digital divide has further catalyzed health inequity, as those most vulnerable to the epidemic exposure (e.g., the elderly, immigrants, and populations of color) experience considerable challenges in utilizing technology. Similar to COVID-19 testing, telehealth has been ubiquitously adopted for vaccination registration and relevant medical intervention. How to leverage telehealth to improve vaccination accommodation while bridging the digital divide, such as retaining field support for physically or technologically disadvantaged patients, needs urgent assessments and practices.

Affordability is the pricing of healthcare services in relation to patients' ability to pay. In the US, the financing mechanism of a vaccine can be divided into two pathways—conventional vaccines (e.g., influenza, and hepatitis) are supported by federal and state healthcare programs (e.g., Medicare, the Affordable Care Act (ACA), and the Section 317 Immunization Program), while non-conventional vaccines for countering abrupt public health crises are purchased by the federal government and provided to care providers at no cost [16]. The payment model for COVID-19 vaccines undoubtedly follows the second financial pathway with the federal government fully reimbursing providers, even for uninsured patients (which will be covered by the Health Resources and Services Administration's Provider Relief Fund) [17]. Because of the pervasive support, it is unlikely that affordability will become an issue for COVID-19 vaccinees.

Acceptability refers to patients' attitudes towards healthcare services and providers. Research on individuals' perception of COVID-19 vaccines shows that vaccine acceptability is largely dictated by the trust in vaccine efficacy and safety and is moderated by the severity of outbreaks in individuals' residential neighborhoods [18]. As the pandemic continued to evolve, there have been many transitions in vaccine acceptance—a biweekly longitudinal survey on over 8000 adults in the US showed that the percentage of respondents willing to get a COVID-19 vaccine significantly declined in early December 2020 (56%) compared to the early outbreak (74%) [19]. Another study in early January 2021 reported that 20% of adults in the US had a strong reluctance to receive a vaccine [20]. There was also a significantly lower acceptance within certain groups, including African Americans and individuals with low education attainment [18,19,21], and these populations were found to have higher infection and mortality rates [8]. This lack of vaccine confidence was palpably a trust issue, and was historically rooted in marginalized populations experiencing medical exploitation and education deprivation. To this end, Volpp et al. [21] propose behaviorally informed strategies where such trust can be rebuilt, including increasing the physical access to and the visibility of vaccination, making vaccination conditional and less compulsory in non-essential settings, increasing vaccine publicity with the voice of trusted opinion leaders, prioritizing vaccine access to people with early sign-up, promoting vaccination as a public act. At the forefront of these strategies is the assurance of integrity in the vaccine efficacy and the approval process. While the COVID-19 booster shot is quickly rolling out, a concurrent need exists in building a national promotion program to induce behavioral changes among populations with vaccine resistance.

3. Conclusions

These five dimensions of vaccine access are subject to various degrees of uncertainty. Specifically, it is not difficult to estimate *availability*, as current vaccine development and production have projected timelines. *Accessibility*, *accommodation*, and *affordability*, as relatively objective measures, could be illuminated by health

policy legislation and targeted medical funding. However, *acceptability*, as a subjective, perceptual dimension, is dictated by individuals' risk perceptions and health education, and could be moderated by political ideology [22]. Increasing the vaccination acceptability in high-risk regions and among those showing strong resistance is worthy of policy intervention.

It should be noted that although the five dimensions of access are articulated in a US context, they can be substantiated in a different country given the local disease progression, vaccination policy, and available medical resources. While there are still many uncertainties about the vaccine effectiveness towards the new B.1.1.529 variant, the five dimensions of vaccine access must be evaluated and substantiated in synchrony with new vaccine development. These combined efforts can help to elucidate potential obstacles in vaccine distribution, reduce health inequity, and pave the pathway to a new normal.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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