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Commentary

Vaccines are not yet a silver bullet: The imperative of continued communication about the importance of COVID-19 safety measures

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ABSTRACT

COVID-19 vaccines are by no means a silver bullet. With more COVID-19 vaccines expecting approval in the coming months, it is necessary to note that vaccine availability does not equate to vaccine accessibility, nor vaccine efficacy. Some research suggests that approximately 9 out of 10 individuals living in lower-income countries will not have access to COVID-19 vaccines until 2023 or later. For higher-income countries, such as the United States, the prevalence of vaccine hesitancy may further compound the situation. These insights combined, in turn, emphasize the fact that even though COVID-19 vaccines are becoming more available, safety measures (e.g., face masks, personal hygiene, and social distancing) are still of pivotal importance in protecting personal and public health against COVID-19. Furthermore, this paper argues for the continued imperative for health experts and government officials to communicate and emphasize the importance of COVID-19 safety measures with the public, to make sure people are protected against COVID-19 till the pandemic ceases to pose a threat to personal or public health.

The coronavirus 2019 (COVID-19) vaccines are becoming more available, starting from the first approval and the distribution of Pfizer-BioNTech vaccines in the United Kingdom's (U.K.) on December 8th, 2020 (World Health Organization, 2020). As of January 28th, 2021, in addition to Pfizer-BioNTech, vaccines developed by nine other companies, ranging from Oxford-AstraZeneca, Sinopharm, to Gamaleya, have all been utilized for mass inoculation across the world, while 20 vaccines are currently at the final stage of the clinical trial (World Health Organization, 2020). Over the coming months, more countries will begin approving vaccines. No doubt that amid an avalanche of negative news about the pandemic, reports on COVID-19 vaccines serve as rays of hope. It is important to note, however, that these vaccines are not yet a silver

bullet; for starters, vaccine availability does not equate to vaccine accessibility (e.g., vaccine equity issues) (Paltiel et al., 2020). Furthermore, COVID vaccines' real-world efficacy should also consider factors ranging from vaccine delivery challenges, distribution hurdles, to potential side effects. Not to mention vaccine hesitancy, a prevalent and persistent issue many countries face, could further compound the situation (Su et al., 2020a,b).

Even though scientists have been working on COVID-19 vaccines at an unprecedented speed, data are still scarce when it comes to questions such as "Can one spreads COVID-19 after vaccination?", "How long will the vaccine protect vaccinated people from the virus?", and "Will COVID-19 be eradicated, or develop a transmission pattern that is similar to

seasonal influenza?" (Centers for Disease Control and Prevention, 2021a; Kissler et al., 2020). These insights combined suggest that even though COVID-19 vaccines are becoming more available, the continued communication and implementation of COVID-19 safety measures (e.g., face masks, personal hygiene, and social distancing) are still instrumental to effective pandemic control and containment. Despite the positive news about COVID-19 vaccines, health experts and government officials must continue communicating the unwavering imperative for the public to adhere to COVID-19 safety measures till the pandemic ceases to pose a flagrant threat to personal or public health.

1. COVID-19 vaccine availability vs. vaccine accessibility

Though more COVID-19 vaccines will become available in the coming months, it is important to understand that, due to limitations in vaccine production, not all people will have the same level of access. The U.K., for instance, prioritized people who are most vulnerable to COVID-19 infections, such as older adults and frontline workers (e.g., healthcare professionals), over the rest of the population (Department of Health and Social Care, 2021). Vaccine distribution policy in the United States (U.S.), on the other hand, will be heavily influenced by how each of its 50 states determines to roll out the vaccines and it could be difficult to predict how the trajectory of mass inoculation of different states (Centers for Disease Control and Prevention, 2020b). In New Jersey, for instance, where smoking is classified as a medical condition, nearly two million smokers will be eligible to get a vaccine in the state, regardless of whether they are older adults (Arco, 2021). In contrast, Florida's decision to include both residents and nonresidents has effectively fueled a "vaccine tourism," where foreigners who are 65 years older and are sharing available vaccine doses with residents (Campo-Flores and Córdoba, 2021). While writing this paper, Florida has changed its policy—people who receive COVID-19 vaccines need to provide a proof of residence (Sarasota County Government, 2021). In other words, now "vaccine tourism" in Florida will only apply to those who could afford to maintain a permanent or seasonal residensy status—vaccine inequality is still present, but only for the super rich.

Accessing COVID-19 vaccines will be substantially more difficult for people living in lower-income countries. Even with the help of COVAX, a vaccine alliance organized by the World Health Organization that hopes to bridge COVID-19 vaccine equity, approximately 9 out of 10 people living in 70 poor income countries will not be able to have access to COVID-19 vaccines till 2023 or later (Duke Global Health Innovation Center, 2021). One key contributor to this inequality centers on vaccine nationalism— rich countries have been disproportionately hoarding doses to exacerbate the COVID-19 vaccine shortage further. In early December 2020, Canada, for instance, has already ordered a stockpile of COVID-19 vaccines that are enough to inoculate each Canadian five times (601%, by share of the population able to vaccinated with), followed by the U.S. (442%), the U.K. (419%), Australia (267%), and the European Union (246%) (Doucleff, 2020).

2. COVID-19 vaccine availability vs. vaccine efficacy

The efficacy of COVID-19 vaccines in protecting the public from potential infections and deaths is also highly dependent on key contextual factors, ranging from vaccine potency, implementation, and vaccine hesitancy (Centers for Disease Control and Prevention, 2020b; Su et al., 2020a,b). Vaccine approval is followed by mass production, the process of which, in light of the competition for critical resources and logistical challenges, is highly dependent on an array of factors, ranging from the accessibility of glass vials, syringes, and needles, to advanced cold chain systems (United Nations International Children's Emergency Fund, 2020). Vaccines are delicate health products that need special attention in their delivery and distribution; any hiccups in COVID-19 vaccines' supply chain have the potential to harm COVID-19 vaccine efficacy (Paris, 2020). Some vaccines, such as the first clinically-authorized and fully-tested coronavirus vaccine, Pfizer-BioNTech vaccine, need to be stored in extremely cold environments (i.e., $-70\,^\circ C \pm 10\,^\circ C$) throughout its delivery to end-users (Pfizer, 2020). In other words, the efficacy of some COVID-19 vaccines could become vitally compromised if the temperature is not maintained throughout the delivery process (Pfizer, 2020).

There is also a last-mile issue. Individuals will receive their COVID-19 vaccine in health facilities that may have varying degrees of competency in terms of staff training, equipment maintenance, and safety vigilance, and in turn, success in vaccine administration (Centers for Disease Control and Prevention, 2020b; National Health Service, 2020). The fact that many health systems, especially their healthcare professionals, have been overstretched and overstressed, may further compound the situation (Weber, 2020). In addition to mental health issues faced by the general public (Su et al., 2020a,b), emerging evidence shows that frontline workers also have to cope with substantial trauma or stress-related disorders, ranging from anxiety, depression, to fear of stigma and isolation (Cabarkapa et al., 2020). This could lead to substantial human and economic consequences. In the U.S., for instance, healthcare workers in the state of West Virginia have accidentally "inoculated" 42 people with an experimental monoclonal antibody treatment, as opposed to COVID-19 vaccines (Wolfe, 2020). Compared to issues such as unknown short-term and long-term side effects, perhaps the least worrisome fact in this incident is that the antibody treatment is only approved to be given in an intravenous infusion, rather than a shot in the arm. Fortunately, to date, no substantial side effects have been reported in these 42 people.

Compared with their more affluent counterparts, poorer countries might have to shoulder additional challenges in vaccine administration, as these countries face added pressures such as the lack of necessary infrastructure needed for a successful COVID-19 vaccine distribution (Nkengasong et al., 2020). What also needs consideration is how vaccine updates are communicated to the public; because there are currently multiple vaccines, each with different costs, efficacy rates, and clinical trial reports and, as such, there will likely be variations in the process of implementation. Additionally, challenges in access to vaccines, lower socioeconomic areas, or countries with less advanced medical and health infrastructure, for example, means that a direct comparison of methodological processes and evaluations will also differ. Even assuming that vaccine dissemination goes as planned, the society at large has still yet to figure out fundamental questions such as: (1) Whether people can spread COVID-19 after vaccination, (2) How long will COVID-19 vaccines protect vaccinated people from the virus, (3) What will be the impact of virus mutations, such as the B.1.1.7 variant, on COVID-19 vaccine efficacy, and (4) Will COVID-19 be eradicated, or progress into a transmission pattern that is similar to seasonal influenza (Centers for Disease Control and Prevention, 2021a; Kissler et al., 2020)?—Questions that are crucial to gain an in-depth, comprehensive, and evidence-based understanding of COVID-19 vaccines' abilities to control and contain the pandemic.

It is also important to note that COVID-19 vaccine efficacy will be substantially impacted by the scale of the virus' infection in a society (Paltiel et al., 2020). In the U.S., research suggests that for countries with a high level of COVID-19 infection, even with a vaccine distribution of 95% efficacy and without substantial complications, after six months of vaccination, roughly 10 million infections and 160,000 deaths could still be added to the U.S.'s overall COVID-19 patient pool (Paltiel et al., 2020). Data on COVID-19 vaccines' potential drug interactions are even more scarce, partially because mass inoculation of COVID-19 is either just started or still pending official approval. What is clear, though, is that side effects of COVID-19 are inevitable—available evidence shows that at least four volunteers developed Bell's Palsy or partial facial paralysis during the Pfizer-BioNTech's vaccine trial period alone (Centers for Disease Control and Prevention, 2020b). As of early January 2021, rates of anaphylaxis or allergic reactions associated with Pfizer-BioNTech vaccines are 11.1 per one million, substantially higher than those of seasonal influenza vaccines, which is 1 per one million (CDC COVID-19 Response Team & U.S. Food and Drug Administration, 2021). In the

same month, a Florida doctor has developed a rare severe blood disorder and died shortly after receiving the Pfizer-BioNTech vaccine (Grady and Mazzei, 2021).

Vaccine hesitancy may further compound the situation. A recent nationally representative poll jointly conducted by the Associated Press and the University of Chicago indicates that only 47% of Americans have the intention to update COVID-19 vaccines (AP-NORC, 2020). Among 19 respiratory therapists who intubate severely ill COVID-19 patients at Long Island Jewish Hospital in New York City, only 3 of them agreed to be vaccinated (Robbins et al., 2021), even though they are at pronounced risk of contracting the virus. As reports on COVID-19's side effects begin to merge, fact-based conversations, as well as infodemics, may further cause vaccine hesitancy to rise (Su et al., 2020a,b). These factors, taken together (see Fig. 1), underscore the fact that COVID-19 vaccines are not yet a silver bullet in controlling the pandemic, and more importantly, the imperative for the public's continued adherence to COVID-19 safety measures, such as masking, maintaining personal hygiene, and social distancing, even though uplifting news on COVID-19 vaccines is mushrooming. In other words, in addition to sharing positive news on COVID-19 vaccines with the public, health experts and government officials also need to continually remind people of the importance of holding fast to effective COVID-19 prevention strategies till the pandemic ceases to be a threat to personal or public health.

3. The need for continued communication about COVID-19 safety measures

The need for COVID-19 safety measures is particularly pronounced during the distribution planning months when news on COVID-19 vaccine approval could be mediated by biased perceptions of data and inaccurate reports (Bastian, 2020). As inaccurate or misleading communication about the vaccines could lead to oversized, or even irrational exuberance, that could cause the public to miscalculate their susceptibility to COVID-19. These months, between December 2020 to March 2021, are also when most of the northern hemisphere experiences the first COVID-19 winter—a time when efforts of treating COVID-19 can be hindered by a higher prevalence of seasonal influenza, longer time spent indoors, and more holiday-season gatherings, compared to warmer seasons (Gorman and Trotta, 2020).

Vaccines are not the panacea for the COVID-19 pandemic control and containment. To continue to protect personal and public health, health experts and government officials have a responsibility to help people understand and remember the imperative to continue their preventive health measures: wearing a mask, washing hands properly and frequently, and social distancing, especially when the public's heightened exposure to positive news on COVID-19 vaccines might lower their guard against COVID-19. In light of phenomena such as the "COVID-19 fatigue" or "mask fatigue", along with the tsunami of fact-based
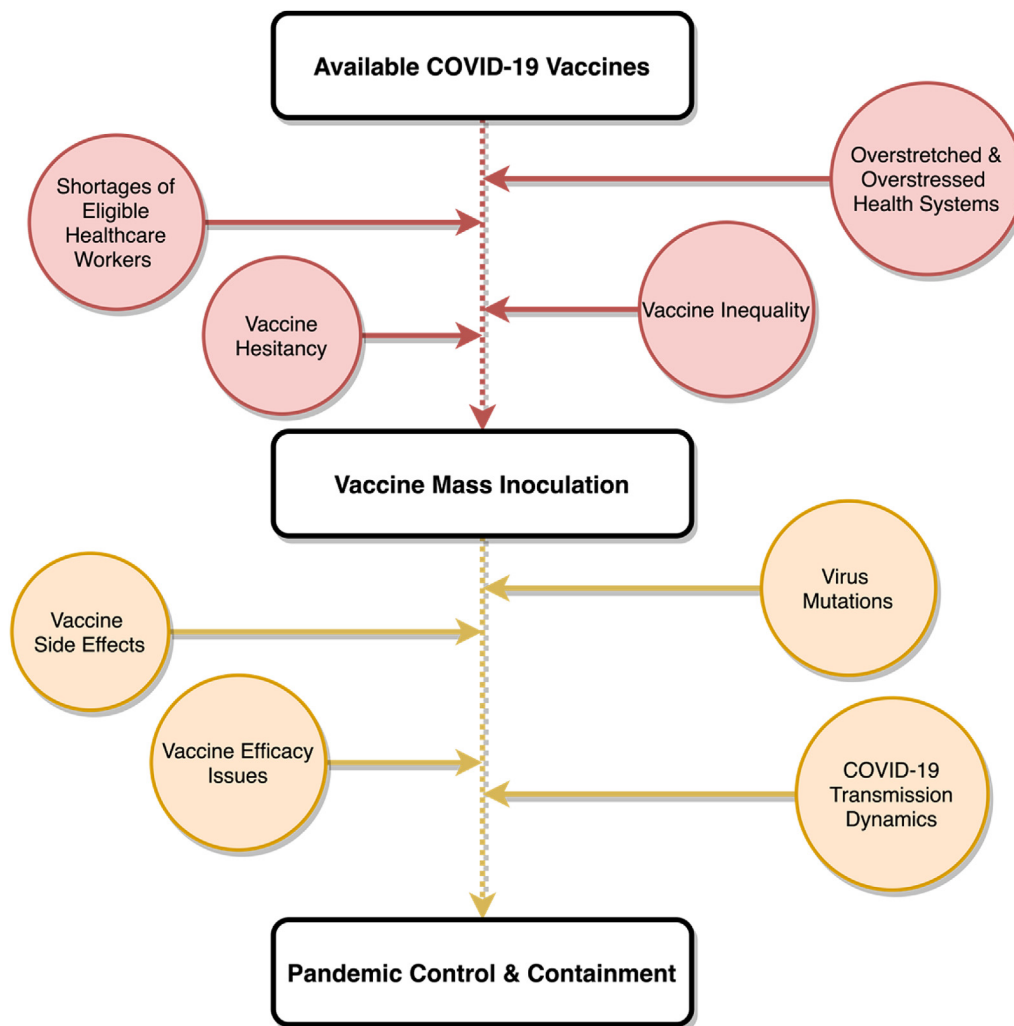

Fig. 1. Issues that could compromise COVID-19 vaccines' capabilities to help control and contain the pandemic.

information and fake news amid the pandemic, to persuade people to adhere to safety measures amid positive news about COVID-19 vaccines, healthcare and government officials should not only inform the public about the need to stick to safety rules or regulations, but also *persuade* them to conform to these COVID-19 measures (Su et al., 2020a). Principles of persuasive communication rooted in behavioral sciences indicate that the efficacy of a health message is not only determined by "what to say," but also "how to say it" (Kahneman and Tversky, 1979). In other words, though the content is the same, whether a message is framed as "a staggering of 25.6million Americans have been infected with COVID-19 as of January 28th, 2021" or "a reassuring majority of 302.6 million Americans have steered clear of COVID-19 as of January 28th, 2021" will affect how the public evaluate the pandemic and react to COVID-19 safety measures.

Many health communication and behavioral psychology approaches can be applied to the COVID-19 context. Reinforcing compliance behaviors whilst simultaneously informing communities regarding the dangers of complacency could be a practical campaign concept. For instance, a recent study finds that when campaign messages are tailored to trigger thoughts of infecting a large number of people or vulnerable individuals, people will more likely adhere to social distancing rules (Lunn et al., 2020). Compared to other types of health care service messages, when social media posts are framed in a disease prevention narrative, messages are more likely to foster social engagement (e.g., comments and information exchange) (Ngai et al., 2020).

In light of COVID-19 infodemics, health expert promotions of COVID-19 safety measures have seen varying levels of implementation. Considering the potential cases of COVID-19 infection and death, narratives surrounding the need to "wear face masks when you take public transportation" or "not take public transportation when you are unwell", could further drive the much-needed community-driven health response. In other words, to help societies avoid transmission vectors and start imagining the "new normal", continued communication about the need for face masks, personal hygiene, and social distancing is of instrumental importance. While it is expected for some compliance to become a concern throughout this time of year, reigniting past campaigns and encouraging communities to continue doing their part is a must. In China, for instance, the Lunar New Year, a holiday that starts on February 12th in 2021 and traditionally celebrated in the unit of the family, can incentivize the largest human migration on earth— in a normal year, around three billion trips occur during the Spring Festival (Tan, 2021). For some Chinese people, especially migrant workers, the Spring Festival is often the only time they get to see their family members and pay proper respects to the dead (Tan, 2021). How to effectively and equitably persuade people to refrain from traveling amid the Chinese New Year are two Herculean tasks health experts and government officials in China must conquer in order to: (1) protect personal and public health from avoidable COVID-19 infections and deaths, (2) safeguard Chinese people's need for love and belonging amid the most important holiday season of the year, and (3) make sure people can travel safely and freely to celebrate the Chinese New Year in 2021 and beyond.

4. Special communication efforts for international travel

Unlike other social contexts, international travel is unique in that individuals may be subjected to multiple, and possibly contradicting as well as capricious, COVID-19 safety mandates. These issues are seen in chaotic international responses towards the news about COVID-19 mutations, such as B.1.1.7 first identified in the U.K., range from travel bans of incoming U.K. travelers to widespread cancellation of all international flights, most of which issued within hours of the U.K. announcement (Booth and Noack, 2021). Inconsistencies in international travel policies amid COVID-19 can also be found elsewhere. Different from the rest of the countries across the world, several nations have begun to require international travelers to produce a negative COVID-19 test certificate before crossing their borders (Pitrelli, 2020). People who travel by air

into the U.S., for instance, would be mandated to present proof of a negative COVID-19 test starting from January 26th, 2020 (Centers for Disease Control and Prevention, 2021b). This suggests that, as infection rates fluctuate, it is even possible for the same country to be reflexive and issue differing guidelines and safety mandates across time. These conflicting COVID-19 health and communication policies and directives have the potential to compromise travelers' understanding of the specific rules and regulations they need to follow, which in turn, could result in severe personal and public health consequences.

As the struggling tourism and hospitality industries slowly recover, travelers may have pinned their hopes on returning to the pre-pandemic normality with a COVID-19 vaccine. Airlines have been responsive to vaccine updates, especially when the idea of using an immunity passport to track a traveler's COVID-19 status has been theorized for some time (Centers for Disease Control and Prevention, 2020a). Companies, such as Qantas, recently announced plans to make it compulsory for all future air passengers to be vaccinated before being allowed to board a flight (Pitrelli, 2020). Technologies can also help. Companies such as Microsoft, Oracle, Salesforce, and Mayo Clinic are working together to develop technology-based mechanisms that would enable people to electronically share their immunization records via a COVID-19 health passport app (Singer, 2020). In theory, such measures can prevent COVID-19 from spreading. Still, even with the most effective vaccines currently available, the ideal rates are only 95% effective in protecting people from contracting COVID-19 (Wen and Su, 2020), without factoring in other compounding variables such as numbers needed to treat. In other words, infection and transmission are still possible. Inadvertently, international fights may expose a substantial number of people, living in the destination or fly-over countries, to the harms of COVID-19 (Wen and Su, 2020).

COVID-19 vaccines are no silver bullet to safeguard international travel, at least not yet. This is especially true as COVID-19 vaccines, as highlighted above, will not be available for all travelers simultaneously for pragmatic and logistical reasons (BBC, 2020). In reality, it is almost impossible for COVID-19 vaccines to be 100% effective for all demographics (Centers for Disease Control and Prevention, 2020b). What is possible is that international travelers, whether they received a vaccine or not, will be required to comply with different countries' COVID-19 safety measures (e.g., quarantine) that are subject to change across time. It is difficult to predict how the "travel bubble" experiments progress, a mechanism that allows international travelers arriving from low-risk countries (e.g., New Zealand and Australia) to be exempt from quarantine regardless of vaccination status (Taylor and Remeikis, 2020). What is clear is that even if these "travel bubbles" are effective, considering the scale of COVID-19 infections in most countries across the globe (Johns Hopkins University, 2020), the majority of travelers must still be vigilant of COVID-19 safety measures while crossing borders.

Taken together, in addition to having a disaster readiness mindset (Su et al., 2021), these insights further underscore the importance of international cooperation and collaboration among health experts and government officials across the globe regarding communicating the necessity of and implementing safety measures, such as masking, personal hygiene, and social distancing, until COVID-19 ceases to be an active pandemic. Citizens and international travelers are two markedly different audiences, partially since they may have different levels of familiarity with the destination or fly-over nations' COVID-19 safety rules and regulations. Effective communication of COVID-19 safety measures with citizens and international travelers requires health experts and government officials worldwide to develop tailored communication strategies for a broad and diverse audience—a daunting, yet necessary task to achieve, especially in light of the limitations with COVID-19 vaccines accessibility and efficacy.

The most cost-effective approach might require international health experts and public officials to collaborate in developing evidence-based and practical COVID-19 safety and communication plans that factor in the broader needs and preferences (e.g., preferred communication style or languages) of all stakeholders. While COVID-19 vaccines are not yet a

silver bullet, international cooperation and collaboration in communicating the necessary health information the public needs to know for controlling and containing the pandemic might be. Until the pandemic is curbed, the world must work in unity to deliver a clear, concise, and coherent message to the public—masks are a must, personal hygiene can help clean out the pandemic, and momentary social distancing can bring the world closer in due time.

List of acronyms

COVID-19: The coronavirus disease 2019.

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ZS conceived the work, reviewed the literature, drafted, and edited the manuscript. JW, DMD, EG, XL, SS, JA, AC, and YTX reviewed the literature and edited the manuscript. All authors approved the manuscript for submission.

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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