

Perspective Piece

Transmission-Blocking Preventive Measures for Infectious Diseases: Altruism, Solidarity, and the Common Good

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Abstract. Aiming to prevent the spread of contagious diseases has long been a central tenet of public health. In the present time, divisive political responses to mask wearing to prevent SARS-CoV-2 transmission have competed with sound public health advice for public attention. Here, we draw parallels in terms of individualism versus societal solidarity between the slow and ponderous development of transmission-blocking vaccines for malaria and advocacy for mask wearing to prevent COVID-19.

In 2020, combined political and public health leadership (the U.S. CDC; US federal, state, and local governments) delayed recommending that the general public wear face masks to reduce the spread of the novel coronavirus, SARS-CoV-2, that causes COVID-19. Resistance to wearing masks continues to be based on political divisions as evidenced by recent rescission of mask-wearing mandates and recommendations by various states and jurisdictions. However, experimental evidence provides robust scientific rationale to support public health recommendations for the use of facial coverings to prevent SARS-CoV-2 transmission.^{1,2} The CDC currently recommends wearing face masks in all public areas, and as of July 9, 2020, 41 U.S. states imposed some requirement regarding wearing masks.³ Still, the general public has not committed to upholding public health recommendations to wear masks. Underlying political ideologies, including those based on individualism versus collectivism, seem to be the basis of this controversy. Importantly, some consider the use of face masks as primarily benefiting others, that is, as altruistic, and therefore not high priority. The larger principle of measures to prevent public spread of infection, as opposed to reducing an individual's risk of contracting infection, seems to be the basis of such arguments regarding altruism, and is the basis for vaccine rollout campaigns, whether for COVID-19 or other infectious diseases. Such considerations are similar to criticisms of malaria transmission-blocking vaccines, which have also been dismissed as “altruistic,” which contrast the beliefs held by people in at least one malaria-endemic region.⁴

Both American government officials and citizens have been reluctant to comply to these public health recommendations. Certain governors have opposed mask mandates, for example, South Carolina Governor Henry McMaster who said that they are “unenforceable and possibly unconstitutional.”⁵ American citizens demonstrated a similar attitude when residents of Palm Beach County vocally opposed a mask mandate, arguing that masks “kill(ed)” citizens, denied “God’s way of breathing,” and “brainwashed” citizens.⁶ Although this reluctance is likely a culmination of false information and political influence, this does not negate the importance of Americans accepting altruistic health interventions.

Transmission-blocking preventive measures, along with vaccines that are intended to build “herd-immunity,” are not new to infectious disease control. Two notable examples are the pursuit of a transmission-blocking vaccine to prevent malaria within endemic populations, and the rubella vaccine, which aims to prevent the devastating effects of rubella on the fetus (rubella is generally a mild disease otherwise).⁴ These measures have a similar goal to wearing masks to combat COVID-19: prevent spread and protect the vulnerable. A main difference, however, is that wearing a mask demonstrates solidarity with fellow citizens, whereas, generally speaking, recipients of any vaccine do not display that they have done so (unless they snap a selfie, as has been commonly done with the COVID-19 vaccine rollout). An important common theme is that individuals undergo an intervention with the intent of contributing to the well-being of everyone in society at no physical risk to the individual.

Although there are differences between the interventions for COVID-19 and rubella and malaria, all diseases share one important variable: infectious asymptomatic individuals. For preventive measures such as vaccines to be effective, a large enough proportion of a population must receive them to lead to herd immunity; this is as true of COVID-19 vaccination as it would be for an effective malaria transmission-blocking vaccine. Although the continued reluctance toward mask wearing in the United States to prevent SARS-CoV-2 infection makes effective and comprehensive protection to the public difficult, other societies seem more willing to adopt altruistic measures. This theme was explored in a questionnaire-based study conducted in a malaria-hypoendemic region in the Peruvian Amazon, which showed that residents would readily take on necessary measures to protect their population; of 143 participants, only one indicated unwillingness to receive a theoretical transmission-blocking vaccine (a transmission-blocking vaccine blocks the transmission of malaria from the human host to a mosquito vector but would not confer direct protection to the recipient).⁴ Amazonian community members’ value on “family, community, and selflessness” motivated them to agree to receive a theoretical transmission-blocking vaccine.⁴

Creating response to infectious public health threats depends on understanding pathogens and how they spread, combined with having tools to intervene to prevent transmission. With regard to COVID-19, to date, a critical prevention tool—predicated on understanding the aerosol and

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droplet modes of SARS-CoV-2 transmission—is mask wearing, which reduces general community spread from (unknown) infected individuals, with an important effect on reducing the risk of infection of the elderly and those with underlying health conditions. Similarly, rubella vaccine primarily protects fetuses against the teratogenic effects of German measles without clinically relevant protection against severe diseases in vaccine recipients. This concept parallels that of rubella, where pregnant women are the vulnerable population because of the teratogenic effect.⁷ To prevent rubella in pregnant populations, 94% of a population must be vaccinated based on the reproductive capacity of the virus.⁸ Although the United States has seen an effective elimination of vaccine-preventable diseases, those who do not believe in vaccination remain as potential transmission reservoirs, maintaining enough susceptibles in the population to enable viral spread under stochastic circumstances.⁸ Not unlike COVID-19, mistrust in public health policy and individualism seem to be responsible for continued insurgence and endemicity of many infectious diseases. The prominence of people refusing vaccinations suggests that when it comes to health, Americans prioritize individual decision-making over collective well-being, marked by a refusal to sacrifice perceived individual rights.

Therefore, although the United States has not asked its citizens to universally adopt wearing masks before, this measure shares many principles with other public health interventions. Asking citizens to wear a mask in public may seem like a small sacrifice to protect vulnerable populations from a possibly fatal illness; however, American citizens continuously show resistance in public health measures as seen in the past and present. Although reluctance to use masks is not just a reflection of the core values of the country but also of a mistrust in public health professionals who have frequently modified their opinions throughout the pandemic, it still prompts reflection on whether when shaping the future of this country, there must be a greater emphasis on making sure all citizens are safe.

The individualistic nature of certain American citizens is a cultural challenge to adopting altruistic health measures. It would be difficult in the United States to achieve a large-scale cultural shift toward public health altruism that was observed in the Peruvian Amazonian where there was a clear community acceptance of a favorable attitude toward a theoretical malaria transmission-blocking vaccine. To build a community-oriented mentality in the United States, it is important to establish stronger relationships between members of the same community so that people will choose to protect each other. Establishing these connections locally allows for more

personal connections, influencing compassionate behavior, and eventually leading toward acceptance of altruistic measures throughout the country. As Americans slowly begin to care for those around them, public health officials must also work to regain citizen's trust, so they will be more readily open to health suggestions moving forward.

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REFERENCES

1. Stadnytskyi V, Bax CE, Bax A, Anfinrud P, 2020. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proc Natl Acad Sci U S A* 117: 11875–11877.
2. Anfinrud P, Stadnytskyi V, Bax CE, Bax A, 2020. Visualizing speech-generated oral fluid droplets with laser light scattering. *N Engl J Med* 382: 2061–2063.
3. Mendelson L, 2020. *Facing Your Face Mask Duties— A List of Statewide Orders, as of July 18, 2020*. Available at: <https://www.littler.com/publication-press/publication/facing-your-face-mask-duties-list-statewide-orders>. Accessed July 18, 2020.
4. White SE, Harvey SA, Meza G, Llanos A, Guzman M, Gamboa D, Vinetz JM, 2018. Acceptability of a herd immunity-focused, transmission-blocking malaria vaccine in malaria-endemic communities in the Peruvian Amazon: an exploratory study. *Malar J* 17: 179.
5. Weiner R, 2020. Republican governors who opposed mask mandates start to soften. *The Wash Post*. Available at: https://www.washingtonpost.com/health/republican-governors-who-opposed-mask-mandates-start-to-soften/2020/07/10/465baf14-c070-11ea-b4f6-cb39cd8940fb_story.html. Accessed March 9, 2021.
6. CNN, 2020. *Angry Residents Erupt at Meeting over New Mask Rule: CNN Politics*, Available at: <https://www.cnn.com/videos/politics/2020/06/24/mask-mandate-florida-anger-erupts-coronavirus-vpx.cnn>. Accessed March 9, 2021.
7. Centers for Disease Control and Prevention, 2017. *Rubella (German Measles, Three-Day Measles)*. Available at: <https://www.cdc.gov/rubella/about/symptoms.html>. Accessed March 9, 2021.
8. Orenstein W, Seib K, 2014. Mounting a good offense against measles. *N Engl J Med* 371: 1661–1663.