VIEWPOINT

Preventing the Spread of SARS-CoV-2 With Masks and Other "Low-tech" Interventions

Andrea M. Lerner, MD, MS
National Institute of Allergy and Infectious Diseases, Bethesda, Maryland.

Gregory K. Folkers, MS, MPH
National Institute of Allergy and Infectious Diseases, Bethesda, Maryland.

Anthony S. Fauci, MD
National Institute of Allergy and Infectious Diseases, Bethesda, Maryland.

Audio and Video

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the cause of coronavirus disease 2019 (COVID-19), has caused a global pandemic of historic proportions in the 10 months since cases were first reported in Wuhan, China, in December 2019, with worldwide morbidity, mortality, and disruptions to society.

Ultimately, a safe and effective vaccine will be essential to control the pandemic and allow resumption of the many activities of normal life. While results of phase 3 trials for multiple candidate vaccines are on the near horizon, "low-tech" tools to prevent the spread of SARS-CoV-2 are essential, and it must be emphasized that these interventions will still be needed after a vaccine is initially available. Even if one or more vaccines have high efficacy and uptake in the population, it will take at least several months for enough people to be vaccinated to confer herd immunity on a population basis.

Modalities in the combination prevention "toolbox" against the spread of SARS-CoV-2 include wearing masks, physical distancing, hand hygiene, prompt testing (along with isolation and contact tracing), and limits on crowds and gatherings. If a vaccine has only moderate efficacy, or if vaccine uptake is low, these other modalities will be even more critical.

> Return to normalcy will require the widespread acceptance and adoption of mask wearing and other inexpensive and effective interventions as part of the COVID-19 prevention toolbox.

Wearing face coverings—masks—in the community setting to prevent the spread of SARS-CoV-2 is a key component of this combination approach. Multiple lines of evidence support the effectiveness of masks for the prevention of SARS-CoV-2 transmission. Mandates for the wearing of masks in public have been associated with a decline in the daily growth rate of COVID-19 cases in the US. The implementation of such mandates averted more than 200 000 cases of COVID-19 by May 22, 2020, according to modeling estimates.[1]

Randomized clinical trials of community mask use are challenging to conduct because of ethical and practical considerations. Observational studies have substantial limitations but can be instructive. For example, a study of secondary SARS-CoV-2 transmission in 124 Chinese households found that mask wearing at home by 1 or more family members before the onset of symptoms in the primary case was associated with a lower odds of secondary transmission (adjusted odds ratio, 0.21 [95% CI, 0.06-0.79]).[2] In a study at a US academic medical center, after the implementation of universal mask use for all health care workers and patients, the SARS-CoV-2 positivity rate among health care workers declined from 14.65% to 11.46%, with a decline of 0.49% per day.[3]

To understand the rationale for mask wearing to prevent SARS-CoV-2 transmission, it is helpful to understand how the virus spreads from person to person. SARS-CoV-2 is primarily transmitted by respiratory droplets exhaled by infected individuals; these droplets span a spectrum of sizes. Larger droplets fall out of the air relatively quickly while close to the source, usually within a 6-foot distance. Smaller droplets, often referred to as aerosols, are also present at close range but may remain in the air over time and greater distances, decreasing in concentration as they move outward from their source.[4]

The epidemiology of SARS-CoV-2 indicates that most infections are likely spread through exposure to an infected individual at close range, within about 6 feet. However, recent reports indicate that aerosols remaining in the air over longer distances or times also have been involved in SARS-CoV-2 transmission in certain circumstances, often in poorly ventilated enclosed spaces and associated with behaviors such as singing, shouting, or breathing heavily during exercise. The Centers for Disease Control and Prevention (CDC) recently updated its guidance to acknowledge this potential for airborne spread of SARS-CoV-2.[4]

Blocking the dispersion of respiratory droplets from an individual infected with SARS-CoV-2 via use of a mask that functions as a physical barrier is a logical strategy to curb transmission. Surgical masks can reduce respiratory virus shedding in exhaled breath,[5] and the filtering efficacy of some materials used in cloth masks may approach that of surgical masks.[6]

Respiratory droplets are produced not only by coughing and sneezing, but also when speaking and simply breathing.[4] Light-scattering experiments indicate that 1 minute of loud speaking potentially can generate more than 1000 virion-containing aerosols that may linger in the air in a closed, stagnant environment.[7] These particles may accumulate in enclosed spaces with poor ventilation, especially when individuals are singing, shouting, or breathing heavily (eg, with physical exercise). Therefore, the commonly observed practice of individuals removing their mask when speaking is not advisable. With the onset of colder weather in the northern hemisphere, activities will increasingly occur inside, resulting in often-unavoidable congregating. Therefore, it is particularly important to continually

Corresponding Author: Andrea M. Lerner, MD, MS, National Institutes of Health, 31 Center Dr, Room 7A10A, Bethesda, MD 20892 (andrea.lerner@nih.gov).

emphasize the necessity of consistent wearing of masks, particularly in the indoor setting.

Recent evidence suggests that up to 40% to 45% of people infected with SARS-CoV-2 may never be symptomatic but still can transmit the virus.[4] Viral spread from people without symptoms may account for more than 50% of transmission events in COVID-19 outbreaks.[8] Since it has now become evident that individuals capable of transmitting SARS-CoV-2 cannot be identified solely by the presence of symptoms, universal mask wearing in the community for source control is recommended.[4]

Masks should be used in combination with other modalities to prevent the spread of SARS-CoV-2, including physical distancing, hand hygiene, adequate ventilation, and avoiding crowded spaces. Widespread testing for SARS-CoV-2 infection is also important but insufficient on its own for pandemic control. No test is perfect; all have a lower limit of detection for viral material and the potential for false negatives. In addition, the result of a test represents just one point in time and does not indicate an individual's status outside of the moment the specimen was collected. Testing, along with contact tracing and the isolation of individuals who are infected, is a key tool for curbing the spread of SARS-CoV-2. However, reliance on testing alone to prevent transmission will be ineffective without the use of additional strategies such as mask wearing and physical distancing.

As countries around the world seek to safely reopen businesses, schools, and other facets of society, mask use in the community to prevent the spread of SARS-CoV-2, in conjunction with other low-cost, low-tech, commonsense public health practices, is and will remain critical. Return to normalcy will require the widespread acceptance and adoption of mask wearing and other inexpensive and effective interventions as part of the COVID-19 prevention toolbox.

ARTICLE INFORMATION

Published Online: October 26, 2020. doi:10.1001/jama.2020.21946

Conflict of Interest Disclosures: None reported.

REFERENCES

1. Lyu W, Wehby GL. Community use of face masks and COVID-19: evidence from a natural experiment of state mandates in the US. *Health Aff (Millwood)*. 2020;39(8):1419-1425. doi:10.1377/hlthaff.2020.00818

2. Wang Y, Tian H, Zhang L, et al. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Glob Health*. 2020;5(5):e002794. doi:10.1136/bmjgh-2020-002794

3. Wang X, Ferro EG, Zhou G, Hashimoto D, Bhatt DL. Association between universal masking in a health care system and SARS-CoV-2 positivity among health care workers. *JAMA*. 2020;324(7):703-704. doi:10.1001/jama.2020.12897

4. Centers for Disease Control and Prevention, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases. Scientific Brief: SARS-CoV-2 and potential airborne transmission. Updated October 5, 2020. Accessed October 8, 2020. https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html

5. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nat Med*. 2020;26(5):676-680. doi:10.1038/s41591-020-0843-2

6. Konda A, Prakash A, Moss GA, Schmoldt M, Grant GD, Guha S. Aerosol filtration efficiency of common fabrics used in respiratory cloth masks. *ACS Nano*. 2020;14(5):6339-6347. doi:10.1021/acsnano.0c03252

7. Stadnytskyi V, Bax CE, Bax A, Anfinrud P. The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission. *Proc Natl Acad Sci U S A*. 2020;117(22):11875-11877. doi:10.1073/pnas.2006874117

8. Moghadas SM, Fitzpatrick MC, Sah P, et al. The implications of silent transmission for the control of COVID-19 outbreaks. *Proc Natl Acad Sci U S A*. 2020;117(30):17513-17515. doi:10.1073/pnas.2008373117