COVID-19 MITIGATION:
SCIENCE TO POLICY TO PRACTICE

by

Athalia Christie

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Abstract

The United States is currently experiencing a sixth wave of SARS-CoV-2 transmission with the highest daily number of new COVID-19 cases reported since the pandemic began. The steep epidemic trajectory will require immediate public health action to prevent severe impacts on the health of individuals and the healthcare system. This study describes evidence-based prevention strategies and guidance to reduce SARS-CoV-2 transmission in the United States before and after vaccine introduction. The first section provides a brief overview of the current epidemiology of COVID-19. The second section provides recommendations and sustainable strategies to reduce community transmission of SARS-CoV-2 and related deaths prior to vaccine distribution. The third section provides the initial guidance for fully vaccinated people including recommendations for visiting in private settings, travel, isolation, testing and quarantine. It also describes the science and rationale behind the guidance. The fourth section assesses the impact of the U.S. national vaccination program on the age distribution of COVID-19. The fifth section determines the key factors that inform the need for layered prevention strategies in the context of varying vaccination coverage. The findings suggest that layered prevention strategies, including vaccination, can reduce the overall burden of illness and the strain on the healthcare system, and provide guidance for decision-making and implementation. The central challenge to SARS-CoV-2 control is no longer a limited understanding of a new virus, but public and political support to implement what we know works. Increasing acceptance of these interventions and reducing disparities in access and uptake remain critical to reducing preventable morbidity and mortality and controlling the pandemic.

Thesis Readers

Carlos Castillo-Salgado, MD, DrPH, JD, MPH (Advisor)

Professor, Department of Epidemiology

David Celentano, SCD, MHS

Professor and Charles Armstrong Chair of the Department of Epidemiology

Jennifer Nuzzo, DrPH

Associate Professor, Environmental Health and Engineering

Ms. Lauren Sauer, MHS

Assistant Professor, School of Medicine

Margaret Honein, PhD, MPH (Practitioner)

Acting Director, Division of Preparedness and Emerging Infections

National Center for Emerging and Zoonotic Infectious Diseases

U.S. Centers for Disease Control and Prevention

Alternate Reader

David Dowdy, MD, PhD, ScM

Associate Professor, Department of Epidemiology

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Dedication

To Coleman and Wyatt, who gave the most for each deployment.

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Chapter 1: Introduction

Overview of the Current Epidemiology of COVID-19 in the United States

Coronavirus disease (COVID-19) is an infectious disease first described in December 2019 in Wuhan City, Hubei Province China. SARS-CoV-2, the virus that causes COVID-19, spreads from person to person mainly through respiratory fluids carrying infectious virus. The infectious period is believed to begin a few days before symptom onset and continue for up to ten days in mild or moderate cases. Persons with asymptomatic or presymptomatic infection contribute an estimated 50% of SARS-CoV-2 transmission. Symptoms range from mild disease to severe illness and typically appear 2-14 days after exposure to the virus. Older adults, people from certain racial and ethnic minorities, and people who have underlying medical conditions (e.g., heart or lung disease) are at higher risk for developing more serious complications from COVID-19. Given the novelty of the virus and the rise of new variants, the impact on approved or authorized medical countermeasures, non-pharmaceutical interventions (NPIs), transmissibility, and disease severity must be continually re-evaluated.

The United States (U.S.) is currently experiencing a sixth wave of high SARS-CoV-2 transmission. During the first week of January 2022, the highest daily number of new U.S. COVID-19 cases (956,893) were reported since the pandemic began (https://covid.cdc.gov/covid-data-tracker/#datatracker-home). On January 4, 2022 the seven-day daily average of cases (554,323) was up 96.7% from the prior seven-day period, hospital admissions (15,642) rose 63.6%, and deaths (1,238) increased by 15.5% (https://covid.cdc.gov/covid-data-tracker/#datatracker-home). Lineage B.1.1.529 (Omicron), a new, more efficiently transmitted variant of SARS-CoV-2 with the ability to evade immunity conferred by past infection or vaccination is now the predominant U.S. variant (https://covid.cdc.gov/covid-data-tracker/#variant-proportions). The steep epidemic trajectories caused by the spread of Omicron will require immediate public health action to prevent severe impacts on the health of individuals and the healthcare system.

COVID-19 vaccines remain effective in preventing severe disease, however recent data (https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-11-19/06-COVID-Oliver-508.pdf) suggest their effectiveness at preventing infection or severe illness wanes over time. A booster shot increases the immune response improving protection against Omicron and other variants. Although 206.8 million people, or 62.3% of the total U.S. population, have been fully vaccinated, only 72.3 million (34.9%) of them have received booster doses (https://covid.cdc.gov/covid-data-tracker/#datatracker-home). Vaccine administration peaked on April 12, 2021 with a seven-day average of 3,943,976 doses (https://covid.cdc.gov/covid-data-tracker/#vaccination-trends). As of January 4, 2022, the 7-day average number of administered vaccine doses reported was 1,075,148. Increasing vaccine uptake, both of a primary series and booster doses, remains critical to pandemic control.

Overview of this Study

This study describes evidence-based prevention strategies and guidance to reduce SARS-CoV-2 transmission in the United States before and after vaccine introduction.

Chapter 2 provides evidence-based recommendations and sustainable strategies to reduce community transmission of SARS-CoV-2 and related deaths in December 2020. Multi-layered application of universal face mask use, physical distancing, avoiding nonessential indoor spaces, increasing testing, prompt quarantine of exposed persons, safeguarding those at increased risk for severe illness or death, protecting essential workers, postponing travel, enhancing ventilation and hand hygiene, and achieving widespread COVID-19 vaccination coverage are recommended. These combined strategies are proposed to protect health care, essential businesses, and schools, until high community coverage of effective vaccines and a safe return to everyday activities is achieved.

Chapter 3 provides the initial guidance for fully vaccinated people including recommendations for visiting in private settings, travel, isolation, testing and quarantine. It also describes the science and decision-making that led to the guidance decisions.

Chapter 4 assesses the impact of the U.S. national vaccination program on the age distribution of COVID-19. The study analyzes data from the Centers for Disease Control and Prevention's (CDC) case-based surveillance system, the National Syndromic Surveillance Program, Health and Human Services Unified Hospital dataset, and CDC's National Vital Statistics System. COVID-19 cases and outcomes are compared between 2 time periods: approximately 2 weeks before vaccination began (November 29-December 5, 2020) and the end of the study period (April 25-May 1, 2021).

Chapter 5 determines the key factors that inform the need for layered prevention strategies in the context of varying vaccination coverage in the United States. The following factors should be considered in local decision-making: level of SARS-CoV-2 community transmission; health system capacity; COVID-19 vaccination coverage; capacity for early detection of increases in COVID-19 cases; and populations at increased risk for severe outcomes from COVID-19. Although increasing COVID-19 vaccination coverage remains the most effective means to achieve control of the pandemic, additional layered prevention strategies will be needed in the short-term to minimize preventable morbidity and mortality.

The final chapter describes the future of the U.S. public health response to COVID-19. The current goal is to reduce medically significant illness, particularly hospitalizations and deaths, while appropriately balancing other social goods such as in-person student learning and mental health. To achieve this goal, the public health response should adapt to the current phase of the pandemic and, as suggested by the findings of the previous chapters, focus on the proven tools of vaccination, NPIs, and testing.

Chapter 2: Summary of Guidance for Public Health Strategies to Address High Levels of Community Transmission of SARS-CoV-2 and Related Deaths, December 2020

Margaret A. Honein, PhD[1]; Athalia Christie, MIA[1]; Dale A. Rose, PhD[1]; John T. Brooks, MD[1]; Dana Meaney-Delman, MD[1]; Amanda Cohn, MD[1]; Erin K. Sauber-Schatz, PhD[1]; Allison Walker, PhD[1]; L. Clifford McDonald, MD[1]; Leandris C. Liburd, PhD[1]; Jeffrey E. Hall, PhD[1]; Alicia M. Fry, MD[1]; Aron J. Hall, DVM[1]; Neil Gupta, MD[1]; Wendi L. Kuhnert, PhD[1]; Paula W. Yoon, ScD[1]; Adi V. Gundlapalli, MD, PhD[1]; Michael J. Beach, PhD[1]; Henry T. Walke, MD[1]; CDC COVID-19 Response Team.

[1]CDC COVID-19 Emergency Response.

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Summary

What is already known about this topic?

The United States is experiencing high levels of SARS-CoV-2 transmission.

What is added by this report?

COVID-19 pandemic control requires a multipronged application of evidence-based strategies while improving health equity: universal face mask use, physical distancing, avoiding nonessential indoor spaces, increasing testing, prompt quarantine of exposed persons, safeguarding those at increased risk for severe illness or death, protecting essential workers, postponing travel, enhancing ventilation and hand hygiene, and achieving widespread COVID-19 vaccination coverage.

What are the implications for public health practice?

These combined strategies will protect health care, essential businesses, and schools, bridging to a future with high community coverage of effective vaccines and safe return to more activities in a range of settings.

Introduction

In the 10 months since the first confirmed case of coronavirus disease 2019 (COVID-19) was reported in the United States on January 20, 2020 (1), approximately 13.8 million cases and 272,525 deaths have been reported in the United States. On October 30, the number of new cases reported in the United States in a single day exceeded 100,000 for the first time, and by December 2 had reached a daily high of 196,227.* With colder weather, more time spent indoors, the ongoing U.S. holiday season, and silent spread of disease, with approximately 50% of transmission from asymptomatic persons (2), the United States has entered a phase of high-level transmission where a multipronged approach to implementing all evidence-based public health strategies at both the individual and community levels is essential. This summary guidance highlights critical evidence-based CDC recommendations and sustainable strategies to reduce COVID-19 transmission. These strategies include 1) universal face mask use, 2) maintaining physical distance from other persons and limiting in-person contacts, 3) avoiding nonessential indoor spaces and crowded outdoor spaces, 4) increasing testing to rapidly identify and isolate infected persons, 5) promptly identifying, quarantining, and testing close contacts of persons with known COVID-19, 6) safeguarding persons most at risk for severe illness or death from infection with SARS-CoV-2, the virus that causes COVID-19, 7) protecting essential workers with provision of adequate personal protective equipment and safe work practices, 8) postponing travel, 9) increasing room air ventilation and enhancing hand hygiene and environmental disinfection, and 10) achieving widespread availability and high community coverage with effective COVID-19 vaccines. In combination, these strategies can reduce SARS-CoV-2 transmission, long-term sequelae or disability, and death, and mitigate the pandemic's economic impact. Consistent implementation of these strategies improves health equity, preserves health care capacity, maintains the function of essential businesses, and supports the availability of in-person instruction for kindergarten through grade 12 schools and preschool. Individual persons, households, and communities should take these actions now to reduce SARS-CoV-2 transmission from its current high level. These actions will provide a bridge to a future with wide availability and high community coverage of effective vaccines, when safe return to more everyday activities in a range of settings will be possible.

Recommended Public Health Strategies

Universal use of face masks

Consistent and correct use of face masks is a public health strategy critical to reducing respiratory transmission of SARS-CoV-2, particularly in light of estimates that approximately one half of new infections are transmitted by persons who have no symptoms (2,3). Compelling evidence now supports the benefits of cloth face masks for both source control (to protect others) and, to a lesser extent, protection of the wearer.† To preserve the supply of N95 respirators for health care workers and other medical first responders, CDC recommends nonvalved, multilayer cloth masks or nonmedical disposable masks for community use.§ Face mask use is most important in indoor spaces and outdoors when physical distance of ≥6 feet cannot be maintained. Within households, face masks should be used when a member of the household is infected or has had recent potential COVID-19 exposure (e.g., known close contact or potential exposure related to occupation, crowded public settings, travel, or nonhousehold members in your house). A community-level plan for distribution of face masks to specific populations, such as those who might experience barriers to access, should be developed (Table 2.1).

Physical distancing and limiting contacts

Maintaining physical distance (≥6 feet) lowers the risk for SARS-CoV-2 infection through exposure to infectious respiratory droplets and aerosols and is important, even if no symptoms are apparent, because transmission can occur from asymptomatic infected persons¶ (2,3). Outside the household setting, close physical contact, shared meals, and being in enclosed spaces have all been associated with an increased infection risk (4–7). Although the impact of physical distancing is difficult to disaggregate from other interventions, one study estimated that physical distancing decreased the average number of daily contacts by as much as 74% and reduced the reproductive number (R0, a measure of transmission, which describes the average number of persons infected by one infectious person) to <1 (8). Because the highest risk for transmission has been documented among household contacts of COVID-19 patients (9), keeping the household safe requires physical distancing, using the other public health strategies summarized here, and, in particular, consistent and correct use of face masks (outside the household and in some circumstances within the household) to prevent introduction and transmission of SARS-CoV-2. At the community level, physical barriers and visual reminders might promote adherence to maintaining physical distance.

Avoiding nonessential indoor spaces and crowded outdoor settings

Exposures at nonessential indoor settings and crowded outdoor settings pose a preventable risk to all participants.**,†† Indoor venues, where distancing is not maintained and consistent use of face masks is not possible (e.g., restaurant dining), have been identified as particularly high-risk scenarios (7,10). Crowded events in outdoor settings have also been linked to spread of SARS-CoV-2, although it can be difficult to isolate the impact of crowded outdoor events from related indoor social interactions (11). To reduce risk, some restaurants are providing take-away service and well-ventilated open-air dining, and in many cases, exercise or physical activity (individual or group) can be moved to outdoor settings where physical distance is maintained and face masks are worn. Community-level policies can further reduce transmission by promoting flexible worksites (e.g., telework) and hours, as well as by applying limits to occupancy of indoor spaces and to the size of social gatherings.

Increased testing, diagnosis, and isolation

Isolation is used to separate persons infected with SARS-CoV-2 from those who are not infected; persons who are identified by testing to be infected should be rapidly isolated.§§ Estimates vary, however, >40% of persons infected with SARS-CoV-2 might be asymptomatic, and transmission from presymptomatic persons (those who are not symptomatic at the time they transmit infection, but who later experience symptoms) and asymptomatic persons (infected persons who never experience symptoms) is estimated to account for >50% of all transmission (2,3). Therefore, reliance on symptom screening to identify infected persons is inadequate (12). Increased testing is an important strategy to interrupt silent transmission of

SARS-CoV-2 from asymptomatic and presymptomatic persons. However, because the sensitivity of available tests and the time since exposure varies, a negative test might provide false reassurance; thus, all prevention strategies should continue to be followed including use of face masks and maintaining physical distance. A comparative analysis of data from six large countries demonstrated that high levels of testing, combined with robust contact tracing, can substantially reduce the transmission of SARS-CoV-2 (13). Frequent testing and contact tracing, combined with other mitigation measures, effectively limited SARS-CoV-2 transmission on a college campus (14). In addition to testing symptomatic persons and those with known exposure, a strategy of routinely testing certain population groups with high numbers of interactions with other persons, based on their occupational or residential setting, can more rapidly identify asymptomatic and presymptomatic infectious persons and their close contacts for isolation and quarantine.¶¶ Communities with high or increasing SARS-CoV-2 transmission should increase screening testing, focusing on persons at increased risk for exposure (e.g., workers in high-density worksites) or persons who might have the potential to transmit infection to large numbers of other persons (e.g., persons working in congregate settings) or to transmit to persons at risk for severe COVID-19–associated illness or death (e.g., staff members in nursing homes). Expanded screening testing should be implemented in a manner that promotes health equity for persons with limited resources or other barriers to accessing health care. In addition, prompt reporting of test results to the person tested and to public health authorities can facilitate rapid isolation, case investigation and contact tracing, and accurate monitoring of COVID-19 in the community.

Prompt case investigation and contact tracing to identify, quarantine, and test close contacts

Case investigation is the process of obtaining comprehensive information about persons with a diagnosis of COVID-19 and is followed by contact tracing, which includes identifying and communicating with persons exposed to SARS-CoV-2 (i.e., close contacts***) to inform them of their exposure, educate them about risks for and symptoms of COVID-19, and encourage them to quarantine, seek testing, and monitor themselves for signs or symptoms of illness.††† Quarantine is used to keep a person who was exposed to SARS-CoV-2 away from others.§§§ Contact tracing is most feasible when the incidence of COVID-19 in the community or workplace is low or declining, when testing and reporting of results can occur quickly (15), and when most contacts can be reached and quarantined (16). When one or more of these conditions is not met or when local capacity is overwhelmed, health departments should narrow the scope of contact tracing activities and emphasize community mitigation measures. Investigations should prioritize persons who most recently received positive SARS-CoV-2 test results, as well as identify and quarantine household contacts and persons exposed in a congregate living facility, high-density workplace, or other setting (or event) with potential extensive transmission.¶¶¶ Because the risk for household transmission is high and occurs rapidly in the absence of face masks or other protective behaviors, household members of persons with diagnosed COVID-19 should be quarantined, and, in the event that they experience symptoms or receive a positive test result, they should be isolated (9,17). Eliciting and reaching contacts in a timely manner is challenging (18,19), and quarantine can impose economic and financial burdens (20); adherence to quarantine might require provision of appropriate support services.**** Persons who receive positive SARS-COV-2 test results should also be encouraged to serve as their own contact tracers by informing close contacts that they have been exposed and encouraging those persons to quarantine, monitor for symptoms, and seek testing.

Safeguarding persons most at risk for severe illness or death

To protect those who are at highest risk for severe COVID-19–associated outcomes, universal mitigation efforts are needed. SARS-CoV-2 infection can be completely asymptomatic or can manifest as a life-threatening illness; disease can result in postacute and long-term sequelae or disability among survivors. Risk for severe illness increases with age and is highest for those aged ≥85 years.†††† In the United States, approximately 80% of reported COVID-19 deaths have occurred in patients aged ≥65 years.

Certain underlying medical conditions also increase risk for severe illness or death for persons of any age with COVID-19.§§§§ Long-term care facilities serve older adults and persons with complex medical conditions; COVID-19 can spread rapidly in these congregate settings, resulting in high rates of morbidity and mortality. To prevent introduction and transmission of SARS-CoV-2, these facilities should implement strict infection prevention and control measures and expanded screening testing of both staff members and residents to rapidly identify and isolate infected persons.¶¶¶¶

COVID-19 has also disproportionately affected racial and ethnic minority groups.***** An age-standardized analysis of COVID-19–associated deaths reported to the National Vital Statistics

System through November 25, 2020, found that Black persons accounted for 26.9% of COVID-19–related deaths, despite representing 12.7% of the U.S. population.††††† Persons who belong to racial or ethnic minority groups are likewise disproportionately affected by the underlying medical conditions that increase risk for severe COVID-19 illness and death, likely because of long-standing inequities in social determinants of health. Members of racial or ethnic minority groups are more likely to experience lower socioeconomic status, to live in crowded housing, and possibly to be employed in occupations that require in-person work.§§§§§ In addition, access to health care might be limited, including obtaining testing and care for COVID-19.

Persons who are at highest risk for severe COVID-19–associated illness or death or who share a household with someone at high risk should minimize their individual and household risk by avoiding nonessential interactions with persons outside their household whenever possible and implementing all recommended public health prevention strategies. Some approaches to safeguarding those with underlying medical conditions include promoting access to and use of telehealth when feasible and appropriate, use of no-contact pickup for groceries or other essential items, and use of online (versus in-person) educational instruction.

Protecting essential workers

Essential (critical infrastructure) workers include health care personnel and employees in other essential workplaces (e.g., first responders and grocery store workers).¶¶¶¶¶ Protecting essential workers requires full implementation of all evidence-based strategies outlined in this guidance. When a COVID-19 vaccine is authorized for use by the Food and Drug Administration (FDA) and recommended by the Advisory Committee on Immunization Practices (ACIP), essential workers, including health care personnel, are among the populations being considered for initial phased allocation of limited vaccine doses (21). Implementation of infection prevention and control with adequate supplies and extensive use of telehealth options and nurse-directed triage of patients, as well as screening of all persons entering health care facilities for signs and symptoms of COVID-19, can protect health care personnel and reduce risk for SARS-CoV-2 transmission in health care facilities.****** U.S. food manufacturing and agriculture is another sector that has been substantially affected by COVID-19, especially among workers in meat and poultry processing facilities, with disproportionate effects among persons who belong to racial or ethnic minority groups (22). CDC and the Occupational Safety and Health Administration released guidance on administrative and engineering controls that should be part of COVID-19 assessment and control plans for these workplaces.†††††† When cessation of operation of a facility might cause serious harm or danger to public health or safety, essential workers who are known close contacts of persons with confirmed COVID-19 might need to return to work as a last resort; however, if they return to work, they should use face masks and maintain physical distancing, and the workplace should be appropriately disinfected.§§§§§§ These persons should only return to work if they are and remain asymptomatic and undergo at least daily active symptom monitoring with immediate removal from the workplace if any signs or symptoms of possible COVID-19 occur; viral testing of all close contacts is recommended, and those with positive test results should not return to work.

Postponing travel

Travel increases the likelihood of SARS-CoV-2 exposure and infection and could translocate infection between communities. Postponing travel is the best way to reduce this risk.¶¶¶¶¶¶ Any traveler who is symptomatic, has had close contact with a person with COVID-19 and has not met criteria for release from quarantine, or has a positive or pending SARS-CoV-2 test result should not travel.******* For those contemplating international travel, CDC recommends getting tested with a viral test for SARS-CoV-2 1–3 days before departure and getting retested 3–5 days after arrival.††††††† Domestic travelers should also consider testing. Testing does not eliminate all risk and should be combined with other recommended public health strategies. Both domestic and international travelers should stay home or reduce nonessential activities before travel, and for 7 days after travel if tested, even if test results are negative. If not tested, this period should be extended to 10 days. Travelers should be diligent about mask wearing, physical distancing, hand hygiene, and symptom monitoring. For 14 days after arrival, travelers should avoid close contact with persons at higher risk for severe COVID-19–associated outcomes and wear masks in household spaces shared with those who did not travel.

Increased room air ventilation, enhanced hand hygiene, and cleaning and disinfection

Increasing room air ventilation, enhancing hand hygiene, and cleaning and disinfecting frequently touched surfaces might help decrease transmission of SARS-CoV-2 (23).§§§§§§ Although the epidemiology of SARS-CoV-2 suggests that most transmission is close person-to-person, there have been some documented cases of presumed airborne transmission.¶¶¶¶¶¶¶ Avoiding nonessential indoor spaces can help reduce this risk. For indoor settings, increased room air ventilation can decrease the concentration of small droplets and particles carrying infectious virus suspended in the air and, thereby, presumably decrease the risk for transmission.******** Hand hygiene includes handwashing with soap and water or using alcohol-based hand sanitizer.†††††††† Handwashing mechanically removes pathogens, and laboratory data demonstrate that hand sanitizers that contain at least 60% alcohol inactivate SARS-CoV-2 (24). These strategies, combined with appropriate cleaning and disinfection of surfaces, might prevent indirect transmission through touching surfaces contaminated with virus from an infected person, followed by touching the mouth, nose, or eyes.

Widespread availability and use of effective vaccines

Widespread availability and high community coverage with safe and effective COVID-19 vaccines represent the most important public health strategy to control the pandemic. Many COVID-19 vaccine candidates are currently in clinical trials. Promising products are being manufactured in anticipation of Emergency Use Authorization from the FDA. The federal government has established a centralized system to order, distribute, and track COVID-19 vaccines through states, tribal nations, and territories; these jurisdictions are preparing for vaccination with extensive planning for vaccine distribution and administration.§§§§§§§§ After FDA authorization of the use of one or more COVID-19 vaccines in the United States, the ACIP will review safety and efficacy data for each of the authorized vaccines and will issue recommendations for use to ensure equitable access (21,25). Ensuring transparency in these efforts, monitoring for adverse events, and working with communities to address concerns will be critical to obtaining the confidence and trust of the public and health care providers. CDC and FDA will monitor the effectiveness and safety of all COVID-19 vaccines and update and communicate this information regularly. Vaccinated persons should continue to adhere to all mitigation measures (e.g., mask use, physical distancing, and hand hygiene) until both doses in the series have been received and the duration of immunity provided by vaccines has been sufficiently established.

Discussion

No single strategy can control the pandemic; rather, a multipronged approach using all available evidence-based strategies at the individual and community levels can break transmission chains and address high levels of community transmission; reduce related illnesses, long-term sequelae, and deaths; and mitigate the pandemic's economic impact. Because COVID-19 has disproportionately affected persons with certain risk factors (e.g., age and some underlying medical conditions) and racial/ethnic minorities, implementing public health prevention strategies in a manner that assures health equity is imperative to safeguard those who have borne the worst of the pandemic's impact. The U.S. health care system is being stressed by COVID-19, with multiple jurisdictions establishing expanded or alternative treatment settings. Continuing mitigation efforts will be essential to preserve capacity for adequate treatment of persons with COVID-19 and other urgent health conditions, and to protect essential and preventive services that are not amenable to telehealth. Schools provide numerous benefits beyond education, including school meal programs and social, physical, behavioral, and mental health services. Because of their critical role for all children and the disproportionate impact that school closures can have on those with the least economic means, kindergarten through grade 12 schools should be the last settings to close after all other mitigation measures have been employed and the first to reopen when they can do so safely.¶¶¶¶¶¶¶¶ Similarly, full implementation of public health prevention strategies can help preserve the functioning of essential businesses that supply food to the population, contribute to the health protection of communities and individual persons, and fuel economic recovery. Full implementation of and adherence to these strategies will save lives. As communities respond to high levels of SARS-CoV-2 transmission, these strategies will also provide the necessary bridge to a future with wide availability and high levels of coverage with effective vaccines, and thereby a safe return to more everyday activities in a range of settings.

Footnotes

* https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases.

† https://www.cdc.gov/coronavirus/2019-ncov/more/masking-science-sars-cov2.html.

§ https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html.

¶ https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html.

** https://www.cdc.gov/coronavirus/2019-ncov/community/large-events/considerations-for-events-gatherings.html.

†† https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/going-out.html.

§§ https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/isolation.html.

¶¶ https://www.cdc.gov/coronavirus/2019-ncov/php/open-america/expanded-screening-testing.html.

*** https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/appendix.html#contact.

††† https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/contact-tracing.html.

§§§ https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html.

¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/prioritization.html.

**** https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/support-services.html.

†††† https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html.

§§§§ https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/hcp/nursing-home-long-term-care.html.

***** https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html.

††††† https://www.cdc.gov/nchs/nvss/vsrr/covid19/health_disparities.htm.

§§§§§ https://www.census.gov/content/dam/Census/programs-surveys/ahs/publications/Measuring_Overcrowding_in_Hsg.pdfpdf iconexternal icon.

¶¶¶¶¶ https://www.cisa.gov/publication/guidance-essential-critical-infrastructure-workforceexternal icon.

****** https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html.

†††††† https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/meat-poultry-processing-workers-employers.html.

§§§§§§ https://www.cdc.gov/coronavirus/2019-ncov/community/critical-infrastructure-sectors.html?CDC_AA_refVal.

¶¶¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/travelers/travel-during-covid19.html.

******* https://www.cdc.gov/coronavirus/2019-ncov/travelers/when-to-delay-travel.html.

††††††† https://www.cdc.gov/coronavirus/2019-ncov/travelers/testing-air-travel.html.

§§§§§§§ https://www.cdc.gov/coronavirus/2019-ncov/community/clean-disinfect/index.html.

¶¶¶¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html.

******** https://www.cdc.gov/niosh/conferences/events/heatventair.html.

†††††††† https://www.cdc.gov/coronavirus/2019-ncov/global-covid-19/handwashing.html.

§§§§§§§§ https://www.cdc.gov/vaccines/covid-19/planning/index.html.

¶¶¶¶¶¶¶¶ https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/indicators.html.

Table 2.1 Individual- and community-level public health strategies to reduce SARS-CoV-2 transmission*

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Universal use of face masks	Consistent and correct use of face masks, including within the household if there is a COVID-19 case or a person with a known or possible exposure in the household	Issue policies or directives mandating universal use of face masks in indoor (non-household) settings	Considerations for wearing masks: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html
		Plan for provision of face masks for specific populations if needed	Caring for someone sick at home, when to wear a mask or gloves: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/care-for-someone.html#face-covering
			Protect your home: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/protect-your-home.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Physical distancing and limiting contacts	Maintain physical distance (≥6 feet) from other persons when possible, and limit number of contacts with persons outside the immediate household	Physical barriers and visual reminders might promote adherence to maintaining physical distance	Social distancing: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html
			Personal and social activities: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/personal-social-activities.html
Avoid nonessential indoor spaces and crowded outdoor settings	Avoid nonessential indoor spaces and crowded outdoor settings	Issue policies or directives restricting some nonessential indoor spaces that pose the highest risk for transmission	Daily activities and going out: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/going-out.html
		Promoting flexible worksites (e.g., telework); apply limits to occupancy of indoor spaces and to the size of social gatherings	Considerations for events and gatherings: https://www.cdc.gov/coronavirus/2019-ncov/community/large-events/considerations-for-events-gatherings.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Increased testing, diagnosis, and isolation	Persons with a known exposure to someone with COVID-19, with possible exposure, or who experience symptoms should promptly seek testing; symptomatic or infected persons should isolate promptly; exposed persons should quarantine	Increase access to testing, including expanded screening testing of prioritized persons/groups, prioritizing those with many interactions (or interactions with persons at high risk) based on their occupational or residential setting	Testing: https://www.cdc.gov/coronavirus/2019-ncov/testing/index.html
			Expanded screening testing: https://www.cdc.gov/coronavirus/2019-ncov/php/open-america/expanded-screening-testing.html
		Promptly report test results to the person tested and to public health authorities	Isolate if you are sick: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/isolation.html
			Guidance for health departments about COVID-19 testing in the community: https://www.cdc.gov/coronavirus/2019-ncov/php/open-america/testing.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Prompt case investigation and contact tracing to identify, quarantine, and test close contacts	Persons with diagnosed COVID-19 should provide names of known contacts; close contacts should anticipate a call from the health department, answer the call, adhere to quarantine, seek testing, and encourage their household members to quarantine	When incidence is high and overwhelms capacity, prioritize case investigation and contact tracing to promptly quarantine and test close contacts, based on time since sample collection and risk for spread to others (e.g., those working in high-density settings)	When to quarantine: https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/quarantine.html
			Contact tracing (your health): https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/contact-tracing.html
			Contact tracing (health departments): https://www.cdc.gov/coronavirus/2019-ncov/php/open-america/contact-tracing/index.html
			Prioritizing case investigation and contact tracing: https://www.cdc.gov/coronavirus/2019-ncov/php/contact-tracing/contact-tracing-plan/prioritization.html
			Quarantine: https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-options-to-reduce-quarantine.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Safeguarding persons most at risk for severe illness or death	Persons with underlying medical conditions or risk factors that place them at increased risk for severe illness or death should minimize contact with nonhousehold members and nonessential indoor spaces	Protect persons most at risk for severe illness or death through 1) identifying populations at high risk in the community and 2) expanding access to testing, provision of support services, and messaging	People at increased risk: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html
Protecting essential workers	Essential workers should employ all available public health strategies to reduce their risk (e.g., wear face masks and keep physical distance)	Protect essential workers through policies directing administrative and structural prevention as well as expanded testing	Essential services and critical infrastructure: https://www.cdc.gov/coronavirus/2019-ncov/community/workplaces-businesses/essential-services.html
			COVID-19 critical infrastructure sector response planning: https://www.cdc.gov/coronavirus/2019-ncov/community/critical-infrastructure-sectors.html
			CISA guidance on the essential critical infrastructure workforce: https://www.cisa.gov/publication/guidance-essential-critical-infrastructure-workforceexternal icon

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Postponing travel	Travel should be postponed. Those who choose to travel internationally should be tested with a viral test 1–3 days before departure and retested 3–5 days after arrival; domestic travelers should also consider getting tested	Issue policies or directives mandating universal use of face masks on all modes of public transportation	Travel: https://www.cdc.gov/coronavirus/2019-ncov/travelers/index.html
	Travelers should stay home or reduce nonessential activities before and after travel and be diligent about mask wearing, physical distancing, hand hygiene, and symptom monitoring		When not to travel: https://www.cdc.gov/coronavirus/2019-ncov/travelers/when-to-delay-travel.html
			Wear face masks on public transportation conveyances and at transportation hubs: https://www.cdc.gov/coronavirus/2019-ncov/travelers/face-masks-public-transportation.html
			Mask and travel guidance: https://www.cdc.gov/quarantine/masks/mask-travel-guidance.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Postponing travel (continued)			Domestic travel: https://www.cdc.gov/coronavirus/2019-ncov/travelers/travel-during-covid19.html
			Testing and international air travel: https://www.cdc.gov/coronavirus/2019-ncov/travelers/testing-air-travel.html
Increased room air ventilation, enhanced hand hygiene, and cleaning and disinfection	Increase room air ventilation	Enhance ventilation and cleaning and disinfection, particularly of essential indoor spaces	SARS-CoV-2 and potential airborne transmission: https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html
	Frequent handwashing	Ensure provision of adequate hand sanitation supplies	Ventilation: https://www.cdc.gov/coronavirus/2019-ncov/community/general-business-faq.html#Ventilation
			When and how to wash your hands: https://www.cdc.gov/handwashing/when-how-handwashing.html
			Cleaning and disinfecting: https://www.cdc.gov/coronavirus/2019-ncov/community/clean-disinfect/index.html

Recommended public health strategies	Individual- and household-level strategies	Community-level strategies (at state or local level)	Links to guidance
Widespread availability and coverage with effective vaccines	Seek vaccine when appropriate following ACIP recommendations	Plan for distribution and administration of vaccines to achieve high community coverage	Vaccines: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/index.html
	Continue to follow all mitigation measures until community vaccination coverage is adequate	Communicate that mitigation measures still need to be followed until community vaccination coverage is determined to be adequate	Vaccination planning: https://www.cdc.gov/vaccines/covid-19/planning/index.html

Abbreviations: ACIP = Advisory Committee on Immunization Practices; COVID-19 = coronavirus disease 2019.

* https://www.cdc.gov/coronavirus/2019-ncov/communication/guidance-list.html.

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Chapter 3. Interim Public Health Recommendations for Fully Vaccinated People

Posted on: *https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html*. March 8, 2021

Key Points

This is the first set of public health recommendations for fully vaccinated people. This guidance will be updated and expanded based on the level of community spread of SARS-CoV-2, the proportion of the population that is fully vaccinated, and the rapidly evolving science on COVID-19 vaccines.

For the purposes of this guidance, people are considered fully vaccinated for COVID-19 ≥2 weeks after they have received the second dose in a 2-dose series (Pfizer-BioNTech or Moderna), or ≥2 weeks after they have received a single-dose vaccine (Johnson and Johnson (J&J)/Janssen).†

The following recommendations apply to non-healthcare settings.

Fully vaccinated people can:

- Visit with other fully vaccinated people indoors without wearing masks or physical distancing
- Visit with unvaccinated people from a single household who are at low risk for severe COVID-19 disease indoors without wearing masks or physical distancing
- Refrain from quarantine and testing following a known exposure if asymptomatic

For now, fully vaccinated people should continue to:

- Take precautions in public like wearing a well-fitted mask and physical distancing

- Wear masks, practice physical distancing, and adhere to other prevention measures when visiting with unvaccinated people who are at increased risk for severe COVID-19 disease or who have an unvaccinated household member who is at increased risk for severe COVID-19 disease
- Wear masks, maintain physical distance, and practice other prevention measures when visiting with unvaccinated people from multiple households
- Avoid medium- and large-sized in-person gatherings
- Get tested if experiencing COVID-19 symptoms
- Follow guidance issued by individual employers
- Follow CDC and health department travel requirements and recommendations

Overview

Currently authorized vaccines in the United States are highly effective at protecting vaccinated people against symptomatic and severe COVID-19. Additionally, a growing body of evidence suggests that fully vaccinated people are less likely to have asymptomatic infection and potentially less likely to transmit SARS-CoV-2 to others. How long vaccine protection lasts and how much vaccines protect against emerging SARS-CoV-2 variants are still under investigation. Until more is known and vaccination coverage increases, some prevention measures will continue to be necessary for all people, regardless of vaccination status. However, the benefits of reducing social isolation and relaxing some measures such as quarantine requirements may outweigh the residual risk of fully vaccinated people becoming ill with COVID-19 or transmitting SARS-CoV-2 to others. Additionally, taking steps towards relaxing certain measures for vaccinated persons may help improve COVID-19 vaccine acceptance and uptake. Therefore, there are several activities that fully vaccinated people can resume now, at low risk to themselves, while being mindful of the potential risk of transmitting the virus to others.

For the purposes of this guidance, people are considered fully vaccinated for COVID-19 ≥2 weeks after they have received the second dose in a 2-dose series (Pfizer-BioNTech or Moderna), or ≥2 weeks after they have received a single-dose vaccine (Johnson and Johnson (J&J)/Janssen).† This guidance applies to all fully vaccinated people. However, people should discuss with their provider if they have any questions about their individual situation, such as immunocompromising conditions or other concerns.

This guidance provides recommendations for fully vaccinated people, including:

- How fully vaccinated people can safely visit with each other or with unvaccinated people in private settings
- How fully vaccinated people should approach isolation, quarantine, and testing

In public spaces, fully vaccinated people should continue to follow guidance to protect themselves and others, including wearing a well-fitted mask, physical distancing (at least 6 feet), avoiding crowds, avoiding poorly ventilated spaces, covering coughs and sneezes, washing hands often, and following any applicable workplace or school guidance. Fully vaccinated people should still watch for symptoms of COVID-19, especially following an exposure to someone with suspected or confirmed COVID-19. If symptoms develop, all people

– regardless of vaccination status – should isolate and be clinically evaluated for COVID-19, including SARS-CoV-2 testing, if indicated.

CDC will continue to evaluate and update public health recommendations for vaccinated people as more information, including on new variants, becomes available. Further information on evidence and considerations related to these recommendations is available in the new Science Brief.

Recommendations for Visiting with Others in Private Settings

Visits or small gatherings likely represent minimal risk to fully vaccinated people. Medium or large-sized gatherings and those including unvaccinated people from multiple households increase the risk of SARS-CoV-2 transmission. Though the risk of disease may be minimal to the fully vaccinated person themselves, they should be mindful of their potential risk of transmitting the virus to others if they become infected, especially if they are visiting with unvaccinated people at increased risk for severe illness from COVID-19 or who have unvaccinated people at increased risk for severe disease in their own households. Fully vaccinated people should not visit or attend a gathering if they have tested positive for COVID-19 in the prior 10 days or are experiencing COVID-19 symptoms, regardless of vaccination status of the other people at the gathering.

Visits between fully vaccinated people

Indoor visits between fully vaccinated people who do not wear masks or physically distance from one another are likely low risk. For example, if you are fully vaccinated, it is likely a low risk for you to invite other fully vaccinated friends to dinner inside your private residence.

Visits between fully vaccinated people and unvaccinated people

Indoor visits between fully vaccinated people and unvaccinated people who do not wear masks or physically distance from one another are likely low risk for the vaccinated people.

Therefore, the level of precautions taken should be determined by the characteristics of the unvaccinated people, who remain unprotected against COVID-19.

Vaccinated people visiting with unvaccinated people from a single household that does not have individuals at risk of severe COVID-19

If the unvaccinated people are from a single household that does not have individuals at risk of severe COVID-19, they can visit with fully vaccinated people indoors, without anyone wearing masks, with a low risk of SARS-CoV-2 transmission.

For example, fully vaccinated grandparents can visit indoors with their unvaccinated healthy daughter and her healthy children without wearing masks or physical distancing, provided none of the unvaccinated family members are at risk of severe COVID-19.

Vaccinated people visiting with unvaccinated people from a single household that has individuals at risk of severe COVID-19

If any of the unvaccinated people or their household members are at increased risk of severe COVID-19, all attendees should take precautions including wearing a well-fitted mask, staying at least 6 feet away from others, and visiting outdoors or in a well-ventilated space.

For example, if a fully vaccinated individual visits with an unvaccinated friend who is seventy years old and therefore at risk of severe disease, the visit should take place outdoors, wearing well-fitted masks, and maintaining physical distance (at least 6 feet).

Vaccinated people visiting with unvaccinated people from multiple households at the same time

If the unvaccinated people come from multiple households, there is a higher risk of SARS-CoV-2 transmission among them. Therefore, all people involved should take precautions including wearing a well-fitted mask, staying at least 6 feet away from others, and visiting outdoors or in a well-ventilated space.

Continuing the example from above, if fully vaccinated grandparents are visiting with their unvaccinated daughter and her children and the daughter's unvaccinated neighbors also come over, the visit should then take place outdoors, wearing well-fitted masks, and maintaining physical distance (at least 6 feet). This is due to the risk the two unvaccinated households pose to one another.

Figure 3.1 Recommendations for Visiting with Others in Private Settings

Medium- or large-sized gatherings

All people, regardless of vaccination status, should adhere to current guidance to avoid medium- or large-sized in-person gatherings and to follow any applicable local guidance restricting the size of gatherings. If they choose to participate, fully vaccinated people should continue to adhere to prevention measures that reduce spread, including wearing a well-fitted mask, maintaining physical distance from others, and washing hands frequently.

Other personal or social activities outside the home

Risk of SARS-CoV-2 infection during public social activities such as dining indoors at a restaurant or going to the gym is lower for fully vaccinated people. However, precautions should still be taken as transmission risk in these settings is higher and likely increases with the number of unvaccinated people present. Thus, fully vaccinated people engaging in social activities in public settings should continue to follow all guidance for these settings including wearing a well-fitted mask, maintaining physical distance (at least 6 feet), avoiding crowds, avoiding poorly ventilated spaces, covering coughs and sneezes, and washing hands frequently.

Travel

At this time, CDC is not updating our travel recommendations and requirements.

Recommendations for Isolation, Quarantine and Testing

The following recommendations apply to non-healthcare settings.

Fully vaccinated people with COVID-19 symptoms

Although the risk that fully vaccinated people could become infected with COVID-19 is low, any fully vaccinated person who experiences symptoms consistent with COVID-19 should isolate themselves from others, be clinically evaluated for COVID-19, and tested for SARS-CoV-2 if indicated. The symptomatic fully vaccinated person should inform their healthcare provider of their vaccination status at the time of presentation to care.

Fully vaccinated people with no COVID-like symptoms following an exposure

Fully vaccinated people with no COVID-like symptoms do not need to quarantine or be tested following an exposure to someone with suspected or confirmed COVID-19, as their risk of infection is low.

Fully vaccinated people who do not quarantine should still monitor for symptoms of COVID-19 for 14 days following an exposure. If they experience symptoms, they should isolate themselves from others, be clinically evaluated for COVID-19, including SARS-CoV-2 testing, if indicated, and inform their health care provider of their vaccination status at the time of presentation to care.

Fully vaccinated residents of non-healthcare congregate settings

Fully vaccinated residents of non-healthcare congregate settings (e.g., correctional and detention facilities, group homes) should continue to quarantine for 14 days and be tested for SARS-CoV-2 following an exposure to someone with suspected or confirmed COVID-19. This is because residential congregate settings may face high turnover of residents, a higher risk of transmission, and challenges in maintaining recommended physical distancing.

Fully vaccinated employees of non-healthcare congregate settings and other high-density workplaces

Fully vaccinated employees of non-healthcare congregate settings and other high-density workplaces (e.g., meat and poultry processing and manufacturing plants) with no COVID-like symptoms do not need to quarantine following an exposure; however testing following an exposure and through routine workplace screening programs (if present) is still recommended.

Footnotes

† This guidance applies to COVID-19 vaccines currently authorized for emergency use by the Food and Drug Administration: Pfizer-BioNTech, Moderna, and Johnson and Johnson (J&J)/Janssen COVID-19 vaccines. Considerations for applying this guidance to vaccines that are not FDA-authorized include whether the vaccine product has received emergency approval from the World Health Organization or authorization from a national regulatory agency.

CDC Interim Recommendations for Fully Vaccinated People: An Important First Step

Athalia Christie, MIA[1]; Sarah A. Mbaeyi, MD[1]; Rochelle P. Walensky, MD[1]

[1]Centers for Disease Control and Prevention, Atlanta, Georgia

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On December 11, 2020, the US reached an extraordinary milestone in the efforts to end the COVID-19 pandemic: the Food and Drug Administration authorized emergency use of the first COVID-19 vaccine, manufactured by Pfizer-BioNTech. Since then, 2 additional COVID-19 vaccines, Moderna and Janssen (Johnson & Johnson), have received Emergency Use Authorization in the US and, as of March 8, 2021, more than 31 million people, or 9.4% of the total population, have completed a vaccination series (1).

With the number of people vaccinated each week continuing to increase, the Centers for Disease Control and Prevention (CDC) has released its initial public health recommendations for fully vaccinated people (individuals who are at least 2 weeks out from having received their second Pfizer-BioNTech or Moderna vaccine dose, or from their Janssen single-dose vaccine) (2). These recommendations represent the first step for individuals in resuming their prepandemic lives.

When creating this guidance, the risks to both vaccinated and unvaccinated people were considered. Current data demonstrate that the authorized COVID-19 vaccines are efficacious among adults of different ages, races, and ethnicities, and among those with underlying medical conditions (3). Even if fully vaccinated people do become infected, they are much less likely to develop severe disease, be hospitalized, or die (3).

In addition, preliminary but rapidly increasing evidence suggests that fully vaccinated people likely pose little risk of transmission to unvaccinated people. Studies from the US, UK, and Israel found that 2 doses of Pfizer-BioNTech or Moderna vaccines were 86% to 92% effective against asymptomatic and symptomatic SARS-CoV-2 infection (3). More specifically, studies from Israel demonstrated that the Pfizer-BioNTech COVID-19 vaccine was 90% effective against asymptomatic infection, and vaccinated people who developed COVID-19 had a substantially lower viral load than unvaccinated people (3). Viral load has been identified as a key driver of transmission and this observation may indicate reduced transmissibility. Collectively, these findings demonstrate that vaccination has the potential to substantially reduce the COVID-19 disease burden in the US.

Although scientists have already learned a great deal about SARS-CoV-2 and how well the authorized COVID-19 vaccines perform, some questions remain. Researchers are still investigating how long protection from natural infection or vaccination lasts and how well the vaccines protect against emerging SARS-CoV-2 variants. A recent analysis that assessed the 4 major types of immune memory found substantial durability 6 months after natural infection (4). Although they remain rare, cases of reinfection have been reported (5). Because of these data, vaccination is recommended for individuals who have recovered from COVID-19 (6). Data from the phase 3 vaccine trials and vaccine effectiveness studies will help to understand how well COVID-19 vaccines provide long-term protection. If and when the level of neutralizing antibody that correlates with protection against SARS-CoV-2 is identified, more will be learned about how natural and vaccine-derived immunity may compare.

Additionally, the authorized COVID-19 vaccines may provide protection against many well-described SARS-CoV-2 variants (3). However, reduced vaccine efficacy and antibody neutralization have been observed for the B.1.351 variant (3), originally identified in South Africa, and currently reported from 20 US jurisdictions (7). CDC and state, local, and academic partners are rapidly scaling up genomic surveillance to understand how widely these variants have dispersed across the US and to identify new variants as they emerge. The CDC and others are also monitoring the effects of specific mutations on the authorized COVID-19 vaccines, therapeutics, and diagnostic tests.

Despite these unknowns, fully vaccinated people can resume several activities now, at low risk to themselves, while being mindful of the potential risk of becoming infected and transmitting the virus to other people. With the new CDC recommendations (Figure 3.2), fully vaccinated people can share a meal or movie night in their private residence, without masks or physical distancing. Fully vaccinated people can also do these things with unvaccinated family and friends; however, prevention measures (such as wearing masks and physical distancing) should be maintained if any unvaccinated people are at risk of severe COVID-19 or if multiple households of unvaccinated people are mixing together.

In addition, most fully vaccinated people will no longer have to be tested for SARS-CoV-2 infection or quarantine if they are exposed to someone with COVID-19, allowing them to go to work, take care of their families, and continue their daily lives (exceptions to this recommendation include patients and residents of congregate settings).

CDC guidance will evolve as vaccination coverage increases, disease dynamics in the country change, and new data emerge. Until then, the CDC will rely on other proven prevention strategies during this critical juncture. With high levels of community transmission and the threat of SARS-CoV-2 variants of concern, CDC still recommends a number of prevention measures for all people, regardless of vaccination status. These include continuing to wear a well-fitted mask when in public or with people at risk of severe COVID-19, avoiding large gatherings, and postponing travel. In addition, community-level prevention strategies must be maintained. To reduce transmission, layered prevention strategies such as universal face mask mandates, and restrictions on occupancy of indoor spaces and the size of social gatherings, are essential. Once vaccinated people make up a greater proportion of the general US population, these community-level restrictions will be readdressed, but not yet.

The promising early data of the COVID-19 vaccines offer a path toward ending this pandemic that has affected everyone's daily lives in so many ways. Yet some reports suggest that approximately a third of US adults still do not want to get vaccinated (3). As highlighted at the recent National Forum on COVID-19 Vaccine, barriers to vaccine access must be removed and evidence-based approaches to improving vaccine confidence and acceptance are essential.

Day by day, arm by arm, millions of vaccines are being administered across the US in the largest vaccination effort in this country's history. As vaccine supply increases, and distribution and administration systems expand and improve, more and more people will become fully vaccinated and eager to resume their prepandemic lives. Giving vaccinated people the ability to safely visit their family and friends is an important step toward improved well-being and a significant benefit of vaccination.

Figure 3.2 Background Rationale and Data for Public Health Recommendations for Fully Vaccinated People

- COVID-19 vaccines currently authorized in the US are effective against COVID-19, including severe disease.
- Preliminary evidence suggests that the currently authorized COVID-19 vaccines may provide some protection against a variety of strains, including B.1.1.7 (originally identified in the UK). However, reduced antibody neutralization and efficacy have been observed for the B.1.351 strain (originally identified in South Africa).
- A growing body of evidence suggests that fully vaccinated people are less likely to have asymptomatic infection and potentially less likely to transmit SARS-CoV-2 to others. However, further investigation is ongoing.
- Modeling studies suggest that preventive measures such as mask use and social distancing will continue to be important during vaccine implementation. However, there are ways to take a balanced approached by allowing vaccinated people to resume some lower-risk activities.
- Taking steps toward relaxing certain measures for vaccinated persons may help improve COVID-19 vaccine acceptance and uptake.

- The risks of SARS-CoV-2 infection in fully vaccinated people cannot be completely eliminated as long as there is continued community transmission of the virus. Vaccinated people could potentially still get COVID-19 and spread it to others. However, the benefits of relaxing some measures, such as quarantine requirements, and reducing social isolation may outweigh the residual risk of fully vaccinated people becoming ill with COVID-19 or transmitting the virus to others.
- Guidance for fully vaccinated people is available and will continue to be updated as more information becomes available.

From the CDC science brief and recommendations (2,3).

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Chapter 4: Decreases in COVID-19 Cases, Emergency Department Visits, Hospital Admissions, and Deaths Among Older Adults Following the Introduction of COVID-19 Vaccine — United States, September 6, 2020–May 1, 2021

Athalia Christie, MIA[1]; S. Jane Henley, MSPH[1]; Linda Mattocks, MPH[1]; Robyn Fernando, MPH[1]; Amy Lansky, PhD[1]; Farida B. Ahmad, MPH[1]; Jennifer Adjemian, PhD[1]; Robert N. Anderson, PhD[1]; Alison M. Binder, MS[1]; Kelly Carey, MPH[1]; Deborah L. Dee, PhD[1]; Taylor Dias, MPH[1]; William M. Duck, MPH[1]; Denise M. Gaughan, ScD[1]; Brianna Casey Lyons, MPH[1]; A.D. McNaghten, PhD[1]; Meeyoung M. Park, MPH[1]; Hannah Reses, MPH[1]; Loren Rodgers, PhD[1]; Katharina Van Santen, MSPH[1]; David Walker, MPH[1]; Michael J. Beach, PhD[1]

[1]CDC COVID-19 Response Team.

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Summary

What is already known about this topic?

COVID-19 vaccination began in the United States in December 2020, and adults aged ≥65 years were prioritized in early phases.

What is added by this report?

By May 1, 2021, 82%, 63%, and 42% of adults aged ≥65, 50–64, and 18–49 years, respectively, had received ≥1 vaccine dose. From November 29–December 12, 2020 to April 18–May 1, 2021, the rate ratios of COVID-19 incidence, emergency department visits, hospital admissions, and deaths among adults aged ≥65 years (≥70 years for hospitalizations) to adults aged 18–49 years declined 40%, 59%, 65%, and 66%, respectively.

What are the implications for public health practice?

The greater decline in COVID-19 morbidity and mortality in older adults, the age group with the highest vaccination rates, demonstrates the potential impact of increasing population-level vaccination coverage.

Introduction

Throughout the COVID-19 pandemic, older U.S. adults have been at increased risk for severe COVID-19–associated illness and death (1). On December 14, 2020, the United States began a nationwide vaccination campaign after the Food and Drug Administration's Emergency Use Authorization of Pfizer-BioNTech COVID-19 vaccine. The Advisory Committee on Immunization Practices (ACIP) recommended prioritizing health care personnel and residents of long-term care facilities, followed by essential workers and persons at risk for severe illness, including adults aged ≥65 years, in the early phases of the vaccination program (2). By May 1, 2021, 82%, 63%, and 42% of persons aged ≥65, 50–64, and 18–49 years, respectively, had received ≥1 COVID-19 vaccine dose. CDC calculated the rates of COVID-19 cases, emergency department (ED) visits, hospital admissions, and deaths by age group during November 29–December 12, 2020 (prevaccine) and April 18–May 1, 2021. The rate ratios comparing the oldest age groups (≥70 years for hospital admissions; ≥65 years for other measures) with adults aged 18–49 years were 40%, 59%, 65%, and 66% lower, respectively, in the latter period. These differential declines are likely due, in part, to higher COVID-19 vaccination coverage among older adults, highlighting the potential benefits of rapidly increasing vaccination coverage.

CDC analyzed the age distribution of COVID-19 vaccination during December 14, 2020–May 1, 2021. To visualize trends before and after vaccine introduction, rates of reported COVID-19 cases, ED visits, hospitalizations, and deaths by age group are presented for September 6, 2020–May 1, 2021. Daily data about COVID-19 vaccine doses administered in the United States, including partial and full vaccination, were collected by vaccination providers and reported to

CDC through multiple sources.* Daily COVID-19 case data were obtained from CDC's case-based surveillance system† as reported by jurisdictional health departments. Daily ED visits for patients with a diagnosis of COVID-19§ (COVID-19 ED visit) were obtained from the National Syndromic Surveillance Program. Daily admissions data on persons newly admitted to a hospital with a laboratory-confirmed COVID-19 diagnosis at the time of admission (COVID-19 hospital admission) were obtained from the U.S. Department of Health and Human Services (HHS) Unified Hospital dataset.¶ Weekly COVID-19 death data were collected from CDC's National Vital Statistics System.** U.S. Census Bureau midyear 2019 population estimates (as of July 1, 2020)†† were used to calculate vaccination, case, hospital admission, and death rates per 100,000 population. ED visits were shown as visits with a COVID-19 diagnosis per 100,000 ED visits reported.

To assess differences by age, CDC calculated the weekly proportion, rate, and rate ratio by age group for COVID-19 outcomes, including cases, ED visits, hospital admissions, and deaths.§§ Trends were examined by plotting weekly rates by age group and rate ratios comparing persons aged ≥65 years (≥70 years for hospital admissions¶¶) with those aged 18–49 years during September 6, 2020–May 1, 2021. Differences in age group–specific average weekly proportions, rates, and rate ratios for COVID-19 outcomes were compared during two periods: November 29–December 12, 2020 (prevaccine) and April 18–May 1, 2021 (most recent data available, accounting for reporting lag); 95% confidence intervals (CIs) and p values for these differences and for rate ratios were constructed by applying the parametric bootstrap method to 10,001 replicate pseudosamples (3). Analyses were conducted using R software (version 4.0.0; R

Foundation). These activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.***

COVID-19 vaccine administration increased from introduction on December 14, 2020, to a peak 7-day moving average of 3.3 million doses per day in mid-April before decreasing to 2.2 million doses per day by May 1, 2021 (Figure 4.1). Among persons aged ≥65 years, 25% had received ≥1 vaccine dose by February 6, 2021, 50% by March 3, 2021, and 82% by the end of the analysis period, May 1, 2021 (Figure 4.1). Among persons aged 18–49 years, 7%, 10%, and 42% had received ≥1 vaccine dose by the same dates, respectively. By May 1, 2021, 69% of persons aged ≥65 years and 26% of persons 18–49 years were fully vaccinated.

COVID-19 incidence increased in all age groups during September 6, 2020–January 2, 2021, and then decreased (Figure 4.2). The weekly rate ratio of COVID-19 incidence among older adults to younger adults was highest in late December and then declined. Compared with the prevaccination period of November 29–December 12, 2020, COVID-19 incidence during April 18–May 1, 2021, was 69% lower among all adults, and 79%, 71%, and 66% lower among persons aged ≥65, 50–64, and 18–49 years respectively (Table 4.1). The proportion of COVID-19 cases diagnosed in persons aged ≥65 years decreased from 16.0% to 10.7% ($p<0.001$). The rate ratio of COVID-19 incidence among persons aged ≥65 years to that among persons aged 18–49 years decreased 40% ($p<0.001$) from 0.68 (95% CI = 0.67–0.68) to 0.40 (95% CI = 0.40–0.41) ($p<0.001$).

During September 6, 2020–May 1, 2021, COVID-19 ED visits per 100,000 ED visits peaked among all age groups during the week of January 3–January 9, 2021, approximately 1 week after the peak in incidence (Figure 4.2). The weekly rate ratio of COVID-19 ED visits among older adults to younger adults was highest in mid-January and then declined. Compared with the prevaccination period of November 29–December 12, 2020, COVID-19 ED visits per 100,000 ED visits during April 18–May 1, 2021, were 59% lower among all adults, with a larger change for persons aged ≥65 years (77%) than for other age groups (Table 4.1). During November 29–December 12, 2020, and April 18–May 1, 2021, persons aged ≥65 years accounted for 37.9% and 20.7%, respectively, of adult COVID-19 ED visits. The rate ratio of COVID-19 ED visits per 100,000 ED visits among persons aged ≥65 years to those among persons aged 18–49 years decreased 59% ($p<0.001$) from 1.99 (95% CI = 1.96–2.01) to 0.82 (95% CI = 0.80–0.84).

Rates of COVID-19 hospital admissions peaked during the week of January 3–January 9, 2021, approximately 1 week after case incidence peaked (Figure 4.2). The trend in the weekly rate ratio of COVID-19 hospital admissions among older adults to younger adults followed a similar pattern as ED visits. Compared with hospital admissions during the prevaccination period of November 29–December 12, 2020, adult COVID-19 hospital admissions rates were 63% lower among all adults, with the largest change (78%) among adults aged ≥65 years, during April 18–May 1, 2021. Although COVID-19 admissions remained highest among persons aged ≥70 years, the proportion of adult COVID-19 hospital admissions among this age group decreased from 45.6% during November 29–December 12, 2020, to 27.6% during April 18–May 1, 2021 ($p<0.001$) (Table 4.1). The rate ratio of COVID-19 hospital admission rates among persons aged

≥70 years to those among persons aged 18–49 years decreased 65% ($p<0.001$) from 9.60 (95% CI = 9.45–9.76) to 3.33 (95% CI = 3.26–3.41) ($p<0.001$).

During September 6, 2020–May 1, 2021, weekly COVID-19 death rates peaked between January 3–January 16, 2021, among all age groups and then decreased through May 1, 2021 (Figure 4.2). The weekly rate ratio of COVID-19 deaths among older adults to those among younger adults was highest in mid-December and then declined. Mortality remained highest for persons aged ≥65 years; however, the proportion of COVID-19 deaths that occurred among this age group decreased from 84.2% during the prevaccination period of November 29–December 12, 2020, to 68.0% during April 18–May 1, 2021 ($p<0.001$) (Table 4.1). The rate ratio of COVID-19 death rates among persons aged ≥65 years to those among persons aged 18–49 years decreased 66% ($p<0.001$) from 66.93 (95% CI = 62.11–72.29) to 22.43 (95% CI = 20.17–25.18).

Discussion

Weekly COVID-19 incidence among adults increased during September 6, 2020–January 2, 2021. After this peak, incidence, followed by rates of ED visits, hospital admissions, and deaths declined among all adult age groups. During September 6–December 14, 2020, before the commencement of vaccine administration, the rate ratios of COVID-19 outcomes among older adults to younger adults were either stable or increasing. The ratio for COVID-19 deaths began to decline in mid-December while rate ratios for COVID-19 incidence, ED visits, and hospital admissions began to decline in late December to mid-January. Comparing the 2-week prevaccination period with 2 weeks in late April, declines were significantly greater among older adults, who had higher vaccination coverage, than among younger adults, who had lower coverage. These age-stratified results provide ecologic evidence of the likely contribution of vaccination coverage to reducing COVID-19 outcomes.

These data are consistent with other preliminary reports showing a reduction in COVID-19 cases and severe illness in populations with high vaccination coverage. An ecologic study from Israel found the ratio of COVID-19 patients aged ≥70 years requiring mechanical ventilation to those aged <50 years declined 67% within 3 months of a nationwide vaccination campaign prioritizing persons aged >60 years (4). In separate studies analyzing Israeli surveillance data, COVID-19 incidence, hospitalizations, and deaths markedly declined across all age groups as cumulative vaccination coverage increased (5), and vaccine effectiveness of 46% for COVID-19 infection, 74% for hospitalization, and 72% for death, was observed during 14–20 days after the first dose (6). A CDC evaluation at 24 hospitals found that receipt of COVID-19 vaccine was 64% effective against COVID-19 hospitalization among partially vaccinated adults aged ≥65 years and 94% effective among fully vaccinated adults aged ≥65 years (7).

The findings in this report are subject to at least five limitations. First, this was an ecologic analysis based on aggregated data that does not account for variability in reporting or vaccination coverage among jurisdictions, between rural and urban areas, or by race and ethnicity. Second, states and territories adapted ACIP recommendations (8); therefore, the populations eligible and timing of each vaccination phase varied across jurisdictions. Third, the case, ED, and hospital data are subsets of total outcomes, and all data are subject to reporting inconsistencies and delays. Fourth, the analysis does not account for concomitant effects, including the spread of more transmissible SARS-CoV-2 variants, the general surge and subsequent decline in COVID-19 cases, the use of recommended therapeutics (9), and the implementation and relaxation of community-level prevention policies in individual jurisdictions. However, by analyzing the relative changes in ratios comparing rates between older and younger age groups, these results were less likely to be influenced by population effects that might have affected all age groups similarly. Finally, no attempt was made to quantify the percentage of these differential rate ratio changes that were potentially attributable to vaccination. The decline in the rate ratio for deaths between older and younger adults, for example, began just after vaccine introduction; therefore, vaccine coverage can account for only part of the decline. Time trend analyses, and other analytic approaches, might enhance understanding of the impact of vaccination on population-level dynamics.

From November 29, 2020, to May 1, 2021, COVID-19 incidence, ED visits, hospital admissions, and deaths declined more in older adults, who had higher vaccination coverage, than in younger adults, who had lower coverage. Despite sufficient vaccine supply and expanding eligibility, administration of COVID-19 vaccines has steadily declined in adults since mid-April 2021. These results suggest that tailored efforts by state and local jurisdictions to rapidly increase vaccine coverage among all eligible age groups could contribute to further reductions in COVID-19 cases and severe outcomes. Such efforts include effectively communicating the benefits of vaccination, ensuring equitable access and convenience, empowering trusted messengers, including primary health care providers, and engaging communities.

Footnotes

* COVID-19 vaccine administration data are reported to CDC by multiple entities using immunization information systems, the Vaccine Administration Management System, pharmacy systems, or direct submission of electronic health records. (https://www.cdc.gov/coronavirus/2019-ncov/vaccines/distributing/about-vaccine-data.html). Persons were considered fully vaccinated if they received the second dose in a 2-dose COVID-19 vaccine series (Pfizer-BioNTech or Moderna) or 1 dose of the single-dose Janssen (Johnson and Johnson) COVID-19 vaccine.

† CDC official counts of COVID-19 cases and deaths, released daily at https://covid.cdc.gov/covid-data-tracker, are aggregate counts from reporting jurisdictions. Some jurisdictions electronically submit standardized information for individual cases of COVID-19 to CDC via a case report form developed for the CDC COVID-19 response (https://www.cdc.gov/coronavirus/2019-ncov/php/reporting-pui.html) or via the CDC National Notifiable Diseases Surveillance System (https://www.cdc.gov/nndss/action/covid-19-response.html). Individual-level case report data were available for approximately 80% of the aggregate number of confirmed cases.

§ The National Syndromic Surveillance Program collects electronic health data, including ED visits with confirmed COVID-19 diagnoses, from a subset of hospitals in 49 states (all but Hawaii) and the District of Columbia (71% of nonfederal EDs in the United States). ED visits for COVID-19 are defined as ED visits with any of the following: International Classification of Diseases, Tenth Revision codes U07.1 or J12.82 or Systematized Nomenclature of Medicine codes 840539006, 840544004, or 840533007. https://www.cdc.gov/nssp/overview.html

¶ The HHS Unified Hospital dataset includes data reported by hospitals registered with the Centers for Medicare & Medicaid Services. Data, including counts of new hospital admissions of patients with confirmed COVID-19 by age group, are reported to HHS either directly from facilities or via a state submission; on May 1, 2021, 98.5% of hospitals reported data. This analysis includes Veterans Administration, Defense Health Agency, and Indian Health Services hospitals and excludes psychiatric, rehabilitation, and religious nonmedical hospitals. https://www.hhs.gov/sites/default/files/covid-19-faqs-hospitals-hospital-laboratory-acute-care-facility-data-reporting.pdfpdf iconexternal icon

** COVID-19 deaths include deaths for which COVID-19 was listed on the death certificate as a confirmed or presumed underlying cause of death or contributing cause of death (ICD-10 code U07.1). https://www.cdc.gov/nchs/nvss/vsrr/covid19/tech_notes.htm

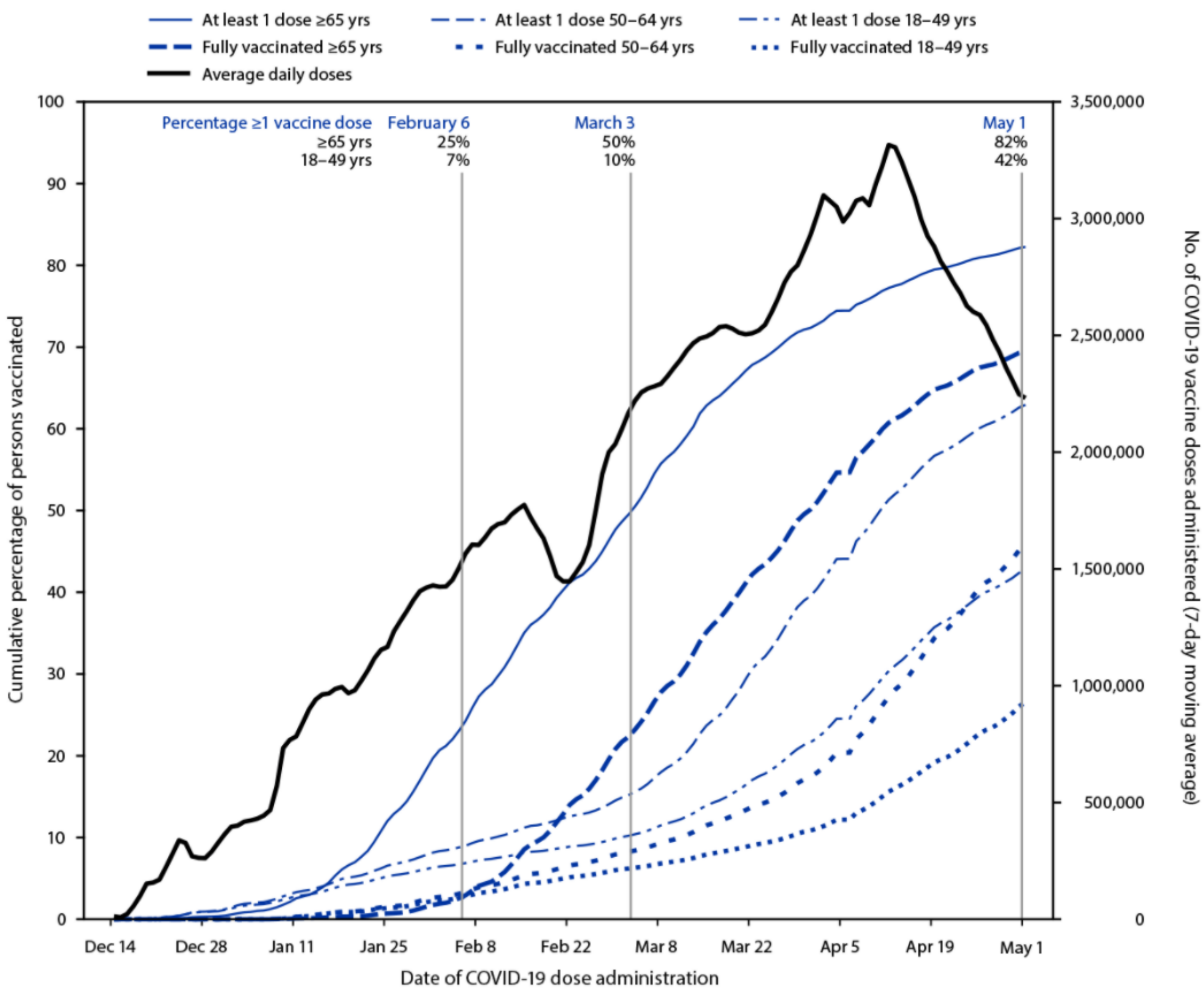
†† https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.htmlexternal icon

§§ Patient age was unknown for 8% of vaccinated persons, 0.7% of cases, 0.4% of ED visits, 4% of hospital admissions, and <0.01% of deaths.

¶¶ Hospital admissions were submitted by predefined age group (<18 years, 18–19 years, 10-year age groups from 20–79 years, and ≥80 years) and could not be aggregated from single year of age as was done for cases, ED visits, and deaths.

*** 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

Figure 4.1 Average daily* number of total COVID-19 vaccine doses administered and cumulative percentage of adults aged ≥18 years who received ≥1 dose and who were fully vaccinated, by age group† — United States,§ December 14, 2020–May 1, 2021



Sources: COVID-19 Vaccination Trends in the United

States, https://data.cdc.gov/Vaccinations/COVID-19-Vaccination-Trends-in-the-United-States-N/rh2h-3yt2 and COVID-19 Vaccination Demographics in the United

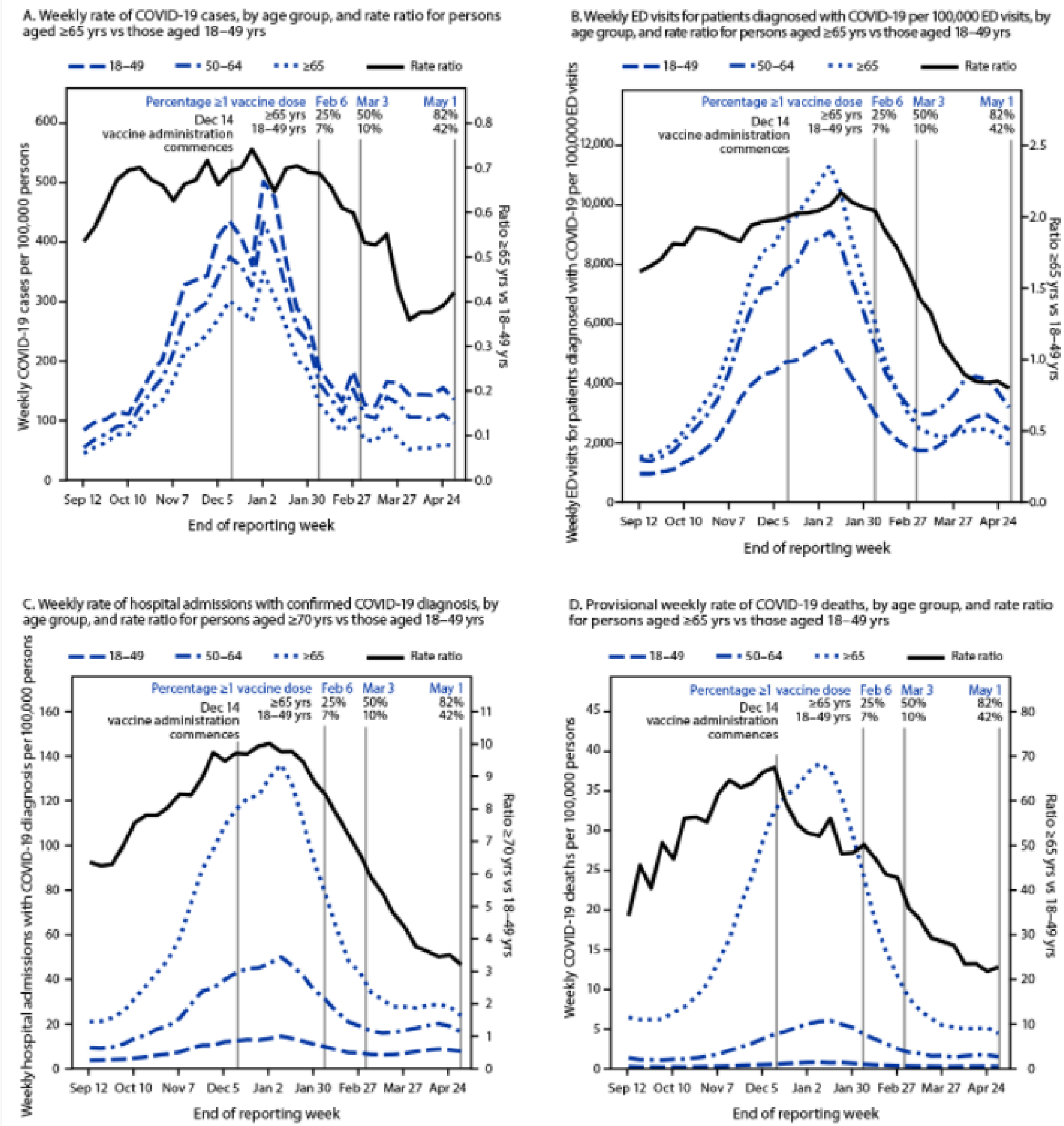
States, https://data.cdc.gov/Vaccinations/COVID-19- Vaccination-Demographics-in-the-United-St/km4m-vcsb; accessed May 26, 2021.

* Based on 7-day moving average.

† Age was unknown for 8% of fully vaccinated persons.

[§] Texas does not report demographic-specific dose number information to CDC, so data for Texas are not represented in cumulative percentage of population vaccinated.

Figure 4.2 Weekly COVID-19 rates (A) emergency department visits for patients with a diagnosis of COVID-19 (B), hospital admissions with confirmed COVID-19 diagnosis (C), and COVID-19 deaths (D) among adults, by age group, and rate ratio for persons aged ≥65 or ≥70 years versus 18–49 years — United States, September 6, 2020–May 1, 2021



Sources: CDC's case-based COVID-19 surveillance system, accessed May 26, 2021 (A); National Syndromic Surveillance Program, accessed May 26, 2021 (B); U.S. Department of Health and Human Services Unified Hospital dataset, accessed May 26, 2021 (C); National Vital Statistics System, accessed May 26, 2021 (D).

Abbreviation: ED = emergency department.

* COVID-19 cases per 100,000 persons.

† Case classifications for COVID-19 are described in https://ndc.services.cdc.gov/case-definitions/coronavirus-disease-2019-2020-08-05 and https://www.cdc.gov/ coronavirus/2019-ncov/covid-data/faq-surveillance.html.

§ Demographic data are based on a subset of COVID-19 cases for whom case-level data have been reported by state and territorial jurisdictions, accounting for approximately 80% of all cases reported to CDC. Patient age was unknown for 0.7% of cases.

¶ ED visits are shown as visits for patients with a diagnosis of COVID-19 per 100,000 ED visits reported. ED visits for patients with a diagnosis of COVID-19 are defined as ED visits with any of the following: International Classification of Diseases, Tenth Revision codes U07.1 or J12.82 or Systematized Nomenclature of Medicine 840539006, 840544004, or 840533007. Patient age was unknown for 0.4% of ED visits.

** Hospital admissions with confirmed COVID-19 diagnosis per 100,000 persons.

†† Dataset includes data reported by hospitals registered with the Centers for Medicare & Medicaid Services. Data were reported to the U.S. Department of Health and Human Services directly from facilities or via a state submission; on May 1, 2021, 98.5% of hospitals reported. This analysis includes Veterans Administration, Defense Health Agency, and Indian Health Services hospitals and excludes psychiatric, rehabilitation, and religious nonmedical hospitals. Patient age was unknown for 4% of hospital admissions.

§§ COVID-19 deaths per 100,000 persons.

¶¶ Deaths with confirmed or presumed COVID-19 as an underlying or contributing cause of death, with International Classification of Diseases, Tenth Revision code U07.1. Provisional data are incomplete. Decedent age was unknown for <0.01% of deaths.

Table 4.1 Number, proportion, rate,* and rate ratio of COVID-19 cases,† emergency department visits for patients with a diagnosis of COVID-19,§ hospital admissions with a confirmed COVID-19 diagnosis, and COVID-19 deaths¶ among adults aged ≥18 years, by age group, for selected 2-week periods — United States, November 29–December 12, 2020, and April 18–May 1, 2021

Period, COVID-19 outcome, and age group (yrs)	Average weekly no. (% by age group)	Average weekly outcome per 100,000	Rate ratio comparing older age groups with age 18–49 yrs (95% CI) **	Change from November 29–December 12, 2020 to April 18–May 1, 2021		
				Absolute change in proportion	Relative change in rate, %	Relative change in rate ratio, %
November 29–December 12, 2020 (prevaccine administration)						
Cases	**964,697 (100.0)**	**378**	**N/A**	**N/A**	**N/A**	**N/A**
≥65	154,829 (16.0)	286	0.68 (0.67–0.68)	N/A	N/A	N/A
50–64	225,715 (23.4)	359	0.85 (0.85–0.85)	N/A	N/A	N/A
18–49	584,154 (60.6)	423	1.0 (referent)	N/A	N/A	N/A
ED visits	**108,689 (100.0)**	**6,409**	**N/A**	**N/A**	**N/A**	**N/A**
≥65	41,208 (37.9)	9,008	1.99 (1.96–2.01)	N/A	N/A	N/A
50–64	28,537 (26.3)	7,513	1.66 (1.64–1.68)	N/A	N/A	N/A
18–49	38,945 (35.8)	4,536	1.0 (referent)	N/A	N/A	N/A
Hospital admissions	**90,349 (100.0)**	**35**	**N/A**	**N/A**	**N/A**	**N/A**
≥70	41,178 (45.6)	112	9.60 (9.45–9.76)	N/A	N/A	N/A
50–69	32,976 (36.5)	41	3.50 (3.45–3.56)	N/A	N/A	N/A
18–49	16,195 (17.9)	12	1.0 (referent)	N/A	N/A	N/A
Deaths	**19,666 (100.0)**	**7.7**	**N/A**	**N/A**	**N/A**	**N/A**
≥65	16,557 (84.2)	30.6	66.93 (62.11–72.29)	N/A	N/A	N/A
50–64	2,477 (12.6)	3.9	8.60 (7.92–9.38)	N/A	N/A	N/A
18–49	633 (3.2)	0.5	1.0 (referent)	N/A	N/A	N/A

Period, COVID-19 outcome, and age group (yrs)	Average weekly no. (% by age group)	Average weekly outcome per 100,000	Rate ratio comparing older age groups with age 18–49 yrs (95% CI) **	Change from November 29–December 12, 2020 to April 18–May 1, 2021		
				Absolute change in proportion	Relative change in rate, %	Relative change in rate ratio, %
April 18–May 1, 2021 (most recent data available at time of report, allowing time for reporting lag)						
Cases	**297,618 (100.0)**	**117**	**N/A**	**N/A**	**−69[††]**	**N/A**
≥65	31,802 (10.7)	59	0.40 (0.40–0.41)	−5.4[††]	−79[††]	−40[††]
50–64	64,796 (21.8)	103	0.71 (0.70–0.71)	−1.6[††]	−71[††]	−17[††]
18–49	201,021 (67.5)	145	1.0 (referent)	7.0[††]	−66[††]	N/A
ED visits	**46,308 (100.0)**	**2,628**	**N/A**	**N/A**	**−59[††]**	**N/A**
≥65	9,580 (20.7)	2,093	0.82 (0.80–0.84)	−17.2[††]	−77[††]	−59[††]
50–64	13,449 (29.0)	3,437	1.35 (1.33–1.37)	2.8[††]	−54[††]	−19[††]
18–49	23,280 (50.3)	2,550	1.0 (referent)	14.4[††]	−44[††]	N/A
Hospital admissions	**33,600 (100.0)**	**13**	**N/A**	**N/A**	**−63[††]**	**N/A**
≥70	9,260 (27.6)	25	3.33 (3.26–3.41)	−18.0[††]	−78[††]	−65[††]
50–69	13,850 (41.2)	17	2.27 (2.22–2.32)	4.7[††]	−58[††]	−35[††]
18–49	10,490 (31.2)	8	1.0 (referent)	13.3[††]	−35[††]	N/A
Deaths	**3,918 (100.0)**	**1.5**	**N/A**	**N/A**	**−80[††]**	**N/A**
≥65	2,663 (68.0)	4.9	22.43 (20.17–25.18)	−16.2[††]	−84[††]	−66[††]
50–64	952 (24.3)	1.5	6.89 (6.12–7.82)	11.7[††]	−62[††]	−20
18–49	304 (7.7)	0.2	1.0 (referent)	4.5[††]	−52[††]	N/A

Sources: CDC's case-based COVID-19 surveillance system, National Syndromic Surveillance Program, U.S. Department of Health and Human Services Unified Hospital dataset, National Vital Statistics System; accessed May 26, 2021.
Abbreviations: CI = confidence interval; ED = emergency department; ICD-10 = *International Classification of Diseases, Tenth Revision*; N/A = not applicable.

* COVID-19 cases, hospital admissions with confirmed COVID-19 diagnosis, and COVID-19 deaths per 100,000 persons and ED visits for patients with a diagnosis of COVID-19 per 100,000 ED visits.
† The case classifications for COVID-19 are described in an updated interim COVID-19 position statement and case definition issued by the Council of State and Territorial Epidemiologists on August 5, 2020 (https://ndc.services.cdc.gov/case-definitions/coronavirus-disease-2019-2020-08-05). However, some variation in how jurisdictions implement these case classifications was observed. More information on how CDC collects COVID-19 case surveillance data can be found at https://www.cdc.gov/coronavirus/2019-ncov/covid-data/faq-surveillance.html.
§ ED visits for COVID-19 are defined as ED visits with any of the following: ICD-10 codes U07.1 or J12.82 or Systematized Nomenclature of Medicine codes 840539006, 840544004, or 840533007.
¶ Deaths with confirmed or presumed COVID-19 as an underlying or contributing cause of death with ICD-10 code U07.1. Provisional data are incomplete. Data from May 2021 are less complete because of reporting lags.
** CIs and p values were constructed using the parametric bootstrap method using 10,001 replicate pseudosamples. CIs were formed using the quantiles of the bootstrap distributions, and p values were based on the proportion of pseudosample values below the 0.025 or above the 0.975 quantile.
†† The change in measure from November 29–December 12, 2020, to April 18–May 1, 2021, was statistically significantly different ($p<0.001$).

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Chapter 5: Guidance for Implementing COVID-19 Prevention Strategies in the Context of Varying Community Transmission Levels and Vaccination Coverage

Athalia Christie, MIA[1]; John T. Brooks, MD[1]; Lauri A. Hicks, DO[1]; Erin K. Sauber-Schatz, PhD[1]; Jonathan S. Yoder, MSW, MPH[1]; Margaret A. Honein, PhD[1]; CDC COVID-19 Response Team.

[1]CDC COVID-19 Response Team

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Summary

What is already known about this topic?

COVID-19 vaccines authorized in the United States are effective against severe illness and death from SARS-CoV-2 infection; however, current U.S. coverage is uneven. Implementation of layered prevention strategies reduces SARS-CoV-2 transmission.

What is added by this report?

Given the spread of the highly transmissible Delta variant, local decision-makers should assess the following factors to inform the need for layered prevention strategies across a range of settings: level of SARS-CoV-2 community transmission, health system capacity, vaccination coverage, capacity for early detection of increases in COVID-19 cases, and populations at risk for severe outcomes from COVID-19.

What are the implications for public health practice?

Although increasing COVID-19 vaccination coverage remains the most effective means to achieve control of the pandemic, additional layered prevention strategies will be needed in the short-term to minimize preventable morbidity and mortality.

Introduction

COVID-19 vaccination remains the most effective means to achieve control of the pandemic. In the United States, COVID-19 cases and deaths have markedly declined since their peak in early January 2021, due in part to increased vaccination coverage (1). However, during June 19–July 23, 2021, COVID-19 cases increased approximately 300% nationally, followed by increases in hospitalizations and deaths, driven by the highly transmissible B.1.617.2 (Delta) variant* of SARS-CoV-2, the virus that causes COVID-19. Available data indicate that the vaccines authorized in the United States (Pfizer-BioNTech, Moderna, and Janssen [Johnson & Johnson]) offer high levels of protection against severe illness and death from infection with the Delta variant and other currently circulating variants of the virus (2). Despite widespread availability, vaccine uptake has slowed nationally with wide variation in coverage by state (range = 33.9%–67.2%) and by county (range = 8.8%–89.0%).† Unvaccinated persons, as well as persons with certain immunocompromising conditions (3), remain at substantial risk for infection, severe illness, and death, especially in areas where the level of SARS-CoV-2 community transmission is high. The Delta variant is more than two times as transmissible as the original strains circulating at the start of the pandemic and is causing large, rapid increases in infections, which could compromise the capacity of some local and regional health care systems to provide medical care for the communities they serve. Until vaccination coverage is high and community transmission is low, public health practitioners, as well as schools, businesses, and institutions (organizations) need to regularly assess the need for prevention strategies to avoid stressing health care capacity and imperiling adequate care for both COVID-19 and other non–COVID-19 conditions. CDC recommends five critical factors be considered to inform local decision-making:

1) level of SARS-CoV-2 community transmission; 2) health system capacity; 3) COVID-19 vaccination coverage; 4) capacity for early detection of increases in COVID-19 cases; and 5) populations at increased risk for severe outcomes from COVID-19. Among strategies to prevent COVID-19, CDC recommends all unvaccinated persons wear masks in public indoor settings. Based on emerging evidence on the Delta variant (2), CDC also recommends that fully vaccinated persons wear masks in public indoor settings in areas of substantial or high transmission. Fully vaccinated persons might consider wearing a mask in public indoor settings, regardless of transmission level, if they or someone in their household is immunocompromised or is at increased risk for severe disease, or if someone in their household is unvaccinated (including children aged <12 years who are currently ineligible for vaccination).

The principal mode by which persons are infected with SARS-CoV-2 is through exposure to respiratory fluids carrying infectious virus.§ The risk for SARS-CoV-2 transmission in outdoor settings is low (4,5). CDC recommends that public health practitioners and organizations prioritize prevention strategies for indoor settings. No one strategy is sufficient to prevent transmission, and multiple interventions should be used concurrently to reduce the spread of disease (6). Proven effective strategies against SARS-CoV-2 transmission, beyond vaccination, include using masks consistently and correctly (7,8), maximizing ventilation both through dilution (9,10) and filtration (11) of air, and maintaining physical distance and avoiding crowds (12,13). Basic public health measures such as staying home when sick, handwashing, and regular cleaning of high-touch surfaces should also be encouraged.

Level of SARS-CoV-2 Community Transmission

A person's risk for SARS-CoV-2 infection is directly related to the risk for exposure to infectious persons, which is largely determined by the extent of SARS-CoV-2 circulation in the surrounding community.¶ CDC recommends assessing the level of community transmission using, at a minimum, two metrics: new COVID-19 cases per 100,000 persons in the last 7 days and percentage of positive SARS-CoV-2 diagnostic nucleic acid amplification tests in the last 7 days. For each of these metrics, CDC classifies transmission values as low, moderate, substantial, or high (Table 5.1). If the values for each of these two metrics differ (e.g., one indicates moderate and the other low), then the higher of the two should be used for decision-making. CDC recommends the geographic unit of analysis be county or core-based statistical area. In rural areas with low population densities, multiple counties might need to be combined to increase available data so that reliable inferences can be made. The level of SARS-CoV-2 transmission for any given area can change rapidly and should be reassessed at least weekly to ensure that the necessary layered prevention strategies are in place. In areas of substantial or high transmission, CDC recommends community leaders encourage vaccination and universal masking in indoor public spaces in addition to other layered prevention strategies to prevent further spread. Updated community transmission levels, as well as other indicators related to COVID-19, are available by county and state at the online CDC COVID Data Tracker** and are already used by many public health departments.

Health System Capacity

Data on usage of clinical care resources to manage patients with COVID-19 reflect underlying community disease incidence and can signal when urgent implementation of layered prevention strategies might be necessary to prevent overloading the health care system. Strains on critical care capacity can increase COVID-19 mortality (14,15) while decreasing the availability and use of health care resources for non–COVID-19 related medical care (16,17). CDC recommends public health departments and health care institutions monitor the available number and fraction of staffed inpatient and intensive care unit beds and develop thresholds, based on local health care system usage and remaining capacity, that would trigger community-wide application of layered prevention strategies.

COVID-19 Vaccination Coverage

Monitoring vaccination coverage in communities and organizations is recommended by CDC to gauge progress, focus vaccination efforts on populations whose coverage is low, and inform the need for additional prevention strategies. As of July 23, 2021, the proportion of the total U.S. population who is fully vaccinated is 48.9%.†† Of the 2,945 (91.4%) U.S. counties reporting, vaccination coverage is <40% in 1,856 (63.0%) and 40%–49.9% in 672 (22.8%); only 417 (14.2%) of counties reported ≥50% COVID-19 vaccination coverage. Primary vaccination efforts should be accelerated in counties with low vaccination coverage. Public health practitioners should work with clinicians and community partners to build confidence in the vaccine and ensure equitable access.§§ Organizations should establish supportive policies, such as allowing workers to receive vaccines during work hours or to take paid leave to get vaccinated at a community site, as well as offering flexible, nonpunitive sick leave options for employees.

Capacity for Early Detection of Increases in COVID-19 Cases

Certain populations are at high risk for exposure to, and thereby infection with, SARS-CoV-2. Such populations are especially well-suited for sentinel monitoring efforts to detect the early introduction and spread of COVID-19, particularly in areas with low vaccination coverage or where layered prevention strategies are not in use. CDC considers the capacity to monitor COVID-19 incidence in the following populations particularly useful due to their high risk of exposure or severe illness: students and staff members of kindergarten–grade 12 schools and institutions of higher education, health care workers, residents and staff members of long-term care facilities, incarcerated persons, homeless persons, and workers in high-density work sites (18–23).

Serial screening testing is an effective method to monitor for the early introduction and spread of COVID-19 (6). Low case detection rates can help demonstrate the effectiveness of current prevention strategies, thereby reducing barriers for returning to in-person learning and work. Rising case detection rates can serve as an early warning signal that prevention strategies need to be strengthened or added in the facility and the broader community. In addition, strategic serial testing can help stop transmission by rapidly identifying asymptomatic cases, which are estimated to be the source for at least 50% of SARS-CoV-2 transmission (24,25). With rapid identification, infectious persons can be isolated and contact tracing and quarantine can be promptly initiated to control further SARS-CoV-2 transmission.

Populations at Risk for Severe Outcomes from COVID-19

CDC recommends additional prevention strategies to safeguard populations at highest risk for severe outcomes from COVID-19, particularly in the context of the highly transmissible Delta variant. Unvaccinated persons remain at risk for infection, severe illness, and death. Advanced age, pregnancy, and an increasingly well-defined set of underlying medical conditions increase the risk for serious outcomes from COVID-19 among unvaccinated persons.¶¶ In addition, long-standing systemic health and social inequities have put members of certain racial and ethnic minority groups at increased risk for serious illness and mortality from COVID-19. Persons taking immunosuppressive medications, persons with hematologic cancers, and hemodialysis patients, among others, have shown reduced immunologic responses to COVID-19 mRNA vaccination and might remain at increased risk for severe COVID-19 following vaccination (3). CDC recommends unvaccinated persons should continue following all prevention strategies, including wearing a mask, until they are fully vaccinated. Immunocompromised persons should continue to take all recommended precautions until advised otherwise by their health care provider. Although COVID-19 vaccines authorized in the United States remain effective against severe outcomes from SARS-CoV-2 infection, a small proportion of persons who are fully vaccinated may become infected. Emerging evidence suggests that fully vaccinated persons who do become infected with the Delta variant are at risk for transmitting it to others (2), (CDC COVID-19 Response Team, unpublished data, 2021); therefore, CDC also recommends that fully vaccinated persons wear a mask in public indoor settings in areas of substantial or high transmission, and consider wearing a mask regardless of transmission level if they or someone in their household is immunocompromised or at increased risk for severe disease, or if someone in their household is unvaccinated (including children aged <12 years who are currently ineligible for vaccination). Public health practitioners and organizations should consider the characteristics of their local or setting-specific populations when determining whether to strengthen or add layered prevention strategies not only for effective disease control, but also to protect those persons at greatest risk for severe illness or death.

Discussion

The most important public health action to end the pandemic remains increasing vaccination coverage, which saves lives, prevents illness, and reduces the spread of COVID-19. Effective COVID-19 prevention strategies are well documented and can help reduce community transmission until high vaccination coverage is achieved (6). To maximize protection of the community, prevention strategies should be strengthened or added if transmission worsens. Prevention strategies should only be relaxed or lifted after several weeks of continuous sustained improvement in the level of community transmission. In areas with low or no SARS-CoV-2 transmission and with testing capacity in place to detect early introduction or increases in spread of the virus, layered prevention strategies might be removed one at a time while monitoring closely for any evidence that COVID-19 cases are increasing.

The widespread availability and administration of COVID-19 vaccines has changed the trajectory of the pandemic in the United States and significantly reduced hospitalization and mortality among vaccinated persons (1). Increasing the proportion of eligible persons who are vaccinated reduces the risk for substantial or high community-wide transmission, which in turn reduces the risk for the emergence of new variants that could have the potential to overcome vaccine-induced immunity. However, vaccination coverage varies across the United States, and transmission risk remains considerable in areas with low vaccination coverage. Decisions to add or remove effective prevention strategies should be based on local data and public health recommendations. The emergence of more transmissible SARS-CoV-2 variants, including Delta, increases the urgency to expand vaccination coverage and for public health agencies and other organizations to collaboratively monitor the status of the pandemic in their communities and continue to apply layered prevention strategies to minimize preventable illness and death.

Footnotes

* Point-in-time information is available from CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker/#variant-proportions

† Persons are considered fully vaccinated if ≥2 weeks have elapsed following receipt of the second dose in a 2-dose series of Moderna or Pfizer-BioNTech mRNA COVID-19 vaccine, or ≥2 weeks following receipt of 1-dose of Janssen (Johnson & Johnson) vaccine. Data are available from CDC COVID Data Tracker. https://covid.cdc.gov/covid-data-tracker

§ https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/sars-cov-2-transmission.html

¶ https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission_k_12_schools.html

** https://covid.cdc.gov/covid-data-tracker/#county-view

†† CDC's COVID Data Tracker accessed July 23, 2021. https://covid.cdc.gov/covid-data-tracker/#vaccinations

§§ https://www.cdc.gov/vaccines/covid-19/vaccinate-with-confidence.html

¶¶ https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/underlying-evidence-table.html

Table 5.1 CDC core indicators of and thresholds for community transmission levels of SARS-CoV-2

Indicator	Transmission level			
	Low	Moderate	Substantial	High
New cases per 100,000 persons in the past 7 days*	0–9.99	10.00–49.99	50.00–99.99	≥100.00
Percentage of positive nucleic acid amplification tests in the past 7 days†	<5.00	5.00–7.99	8.00–9.99	≥10.00

* Number of new cases in the county (or other administrative level) in the past 7 days divided by the population in the county (or other administrative level) multiplied by 100,000.

† Number of positive tests in the county (or other administrative level) during the past 7 days divided by the total number of tests performed in the county (or other administrative level) during the past 7 days. https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/calculating-percent-positivity.html

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Chapter 6: The Future of the U.S. Public Health Response to Covid-19

Acknowledgements: Noah Aleshire, JD[1] and Christopher Braden, MD[1]

[1]CDC COVID-19 Response

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Introduction

During the first 2 years of COVID-19 in the United States (January 20, 2020 to January 19, 2022), public health surveillance will document over 60 million cases, about 4 million hospitalizations, and more than 856,000 deaths. Scientific understanding of SARS-CoV-2 transmission evolved rapidly and allowed for the successful development of safe and effective medical countermeasures (vaccines and therapeutics), as well as a strong evidence base for non-pharmaceutical interventions (NPIs). The central challenge to SARS-CoV-2 control is no longer a limited understanding of a new virus, but public and political support to implement what we know works. The goal is to reduce medically significant illness, particularly hospitalizations and deaths, while appropriately balancing other social goods such as in-person learning and mental health. To achieve this goal, the public health response should adapt to the current phase of the pandemic and, as suggested by the findings in the previous chapters, focus on the proven tools of vaccination, NPIs, and testing.

Public Health Response

Surveillance

Surveillance is conducted at the local, state and national level to monitor trends and intensity of SARS-CoV-2 transmission and identify outbreaks. In February and March 2020, when cases were rare but increasing and testing capacity was limited, public health surveillance relied on detailed epidemiologic investigations. Early cases were subject to intense case investigation and contact tracing, and every diagnostic test was tracked and monitored. The hope was that the

COVID-19 pandemic could be contained and suppressed before widespread and uncontrolled community transmission occurred, or at least contained short-term to delay widespread transmission and allow time for development of NPIs and therapeutics.

Circumstances have changed dramatically since that time, but the nation's approach to COVID-19 surveillance has not adequately adapted to those changes. COVID-19 is no longer a rare, emerging disease—successive waves have spread through virtually every community. The volume of cases across the country during much of 2020 and 2021 has made universal case investigation, contact tracing and detailed individual-level case reporting not only a poor use of resources, but often impossible. When the sheer numbers of reports of cases and test results overwhelm state and local public health capacity for tallying, attempts to provide granular surveillance data on every case creates data bottlenecks and decreases the availability of actionable data.

To facilitate an effective and sustainable public health response, the surveillance approach should be tailored to more efficiently collect the information needed for decision-making. In anticipation of additional surges in COVID-19 cases, surveillance activities should focus on monitoring: infection spread and intensity; severe disease and death; the burden on the healthcare system; and new variants. To address these needs, sustained investment to modernize data infrastructure is needed with the goal of fast movement of interconnected and streamlined data in all jurisdictions in the long-term. In the short-term, during periods of widespread transmission the use of robust estimates is needed to provide decision-makers and the public with information they need to mitigate the worst effects of the pandemic, including the protection of people at higher risk of severe illness. In a period of moderate transmission, surveillance must facilitate fast response efforts to tamp down hot spots and interrupt community transmission. When transmission is low, public health surveillance should enable detailed outbreak response, so isolated outbreaks or small clusters can be controlled quickly through case investigation, contact tracing, quarantine, and vaccination. Given the likelihood that new variants and changes in adherence to mitigation measures will continue to cause fluctuations in the level of transmission, flexibility in the public health response is essential. Certain activities, such as genomic surveillance, need to continue uninterrupted, and others, such as detailed case investigation and contact tracing, should be used at the appropriate time or place.

Genomic Surveillance

Viruses are constantly changing and these genetic variations can lead to the emergence of new variants that may have different characteristics, including changes that impact the effectiveness of vaccines and therapeutics. Variants are routinely monitored through virus genetic sequence-based surveillance and characterized through laboratory studies and epidemiological investigations. CDC, along with academic and government partners (https://www.cdc.gov/coronavirus/2019-ncov/variants/spheres.html), currently sequences an average of 50,000–60,000 positive specimens weekly (1). The U.S. government SARS-CoV-2 Interagency Group classifies new variants based on the risk they pose to US public health. This assessment is determined by the variant’s known or potential impact on approved or authorized medical countermeasures, transmissibility, or disease severity. As the Alpha, Delta and now Omicron variants have demonstrated, new variants may arise anywhere at anytime and the capacity to monitor and rapidly assess them must be maintained regardless of the level of SARS-CoV-2 transmission.

Outbreak Response

Investigation and containment of outbreaks including case investigation, contact tracing, and quarantine remains an essential public health tool in high-risk populations and settings or when the outcome has scientific or policy implications (e.g., cases involving a novel variant). Although the number of COVID-19 cases during the pandemic limited health departments' ability to respond to every outbreak, these basic public health strategies helped identify new introductions, limited transmission, and reduced associated morbidity and mortality (2). Outbreak investigations also established the evidence base for our understanding of the natural history of SARS-CoV-2 (3), risk behaviors and settings (4), the effectiveness of prevention measures (5), as well as properties of new variants (6). Settings at high risk of outbreaks include long-term care facilities, correctional facilities, homeless shelters and other residential living facilities where vaccination coverage is low or other prevention measures are not in place. These facilities should have plans in place for case identification and an established relationship with the local health department to facilitate contact tracing. Local health departments, in turn, need sufficient staff and support to conduct case investigations when warranted, as well as the ability to offer alternative strategies, such as serial testing, when transmission is widespread.

Vaccination

As detailed in Chapters 3, 4, and 5 vaccination remains the most important COVID-19 prevention strategy and has contributed to a decline in severe illness and death (7). In August 2021, people who were unvaccinated were 11 times more likely to die and 12 times more likely to be hospitalized from COVID-19 than people who were fully vaccinated (https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status and https://covid.cdc.gov/covid-data-tracker/#covidnet-hospitalizations-vaccination). CDC recently recommended booster doses for all people over the age of 12 due to waning immunity from primary doses and the Omicron variant's immune escape properties (https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/children-teens.html). However, only 41% of fully vaccinated people ≥ 18 years are boosted and uptake, particularly in long-term care facilities should be urgently accelerated (https://covid.cdc.gov/covid-data-tracker/#vaccinations_vacc-total-admin-rate-total). Vaccine mandates may increase coverage and have a long tradition of use in the United States (8), but to increase U.S. population-level coverage, vaccine hesitancy, misinformation and remaining barriers to access must be addressed. Best practices for overcoming these hurdles should be captured and disseminated to support replication in other geographic locations and settings. In addition, gathering data on the breadth and magnitude of immune response for vaccines against variants of concern will be critical along with maintaining vaccine manufacturing and distribution capacity, as new variants may emerge that necessitate modifications to existing vaccines and rapid administration.

Accelerating global vaccination is also essential to controlling the pandemic. Regional vaccination coverage ranges from 3% of the total population fully vaccinated in the African and Western Pacific Regions to 48% fully vaccinated in Europe (https://app.powerbi.com/view?r=eyJrIjoiMWNjNzZkNjctZTNiNy00YmMzLTkxZjQtNmJiZDM2MTYxNzEwIiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIsImMiOjh9). The Omicron variant has demonstrated how new variants develop and spread, as well as the potential threat variants pose to reducing vaccine effectiveness. Immune escape variants are most likely to evolve in immunosuppressed individuals who get infected but cannot clear the virus and in settings with uncontrolled transmission, heightening the importance of global vaccination. There is also substantial immunologic and epidemiologic evidence indicating that vaccination after infection significantly enhances protection and further reduces risk of reinfection, demonstrating a benefit to vaccination even in populations with high levels of infection-induced immunity (https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/vaccine-induced-immunity.html). The transfer of additional COVID-19 vaccine technology to qualified manufacturers around the world would allow for the rapid scale-up of global vaccination. Technical support to overcome distribution challenges in low-income countries should also be provided, as has been done for previous immunization campaigns such as smallpox, polio, and measles. These steps are not only the right thing to do, they are critical for global health security and are required under our obligations in the International Health Regulations (9).

Non-Pharmaceutical Interventions

Surges in SARS-CoV-2 transmission are likely to persist and continued use of proven NPIs at the individual and community levels, as demonstrated in Chapters 2 and 5, will remain an essential tool to protect the most vulnerable. Effective strategies against SARS-CoV-2 transmission include using masks consistently and correctly, maximizing ventilation both through dilution and filtration of air, and maintaining physical distance and avoiding crowds (10). Masks substantially reduce exhaled respiratory droplets and aerosols from infected wearers (source control) and reduce exposure of uninfected wearers to these particles (personal protection) making universal masking essential for protecting those at high risk of severe illness. Improving ventilation can help prevent virus particles from accumulating in the air; reducing the risk of transmission without requiring individual behavior change. Maintaining physical distance lowers the risk for SARS-CoV-2 infection through exposure to infectious respiratory droplets and aerosols. Basic public health measures such as hand hygiene and staying home when sick are also needed. No one strategy is sufficient to prevent transmission, and multiple interventions should be used concurrently to reduce the spread of disease. Community-level application of prevention strategies, such as mask mandates, have repeatedly been shown to reduce transmission (11). While prevention strategies remain most important for people who are unvaccinated or at high risk of severe illness for other reasons, the transmission of the Delta variant between fully vaccinated people demonstrated the need for universal use of prevention strategies when transmission levels are high or substantial (12).

Testing

Chapters 2 and 5 discuss the benefits of widespread availability and use of COVID-19 testing which, in combination with isolation, could help protect the most vulnerable by identifying cases and reducing onward transmission. Germany and the United Kingdom have invested heavily in inexpensive, do-it-yourself, home antigen tests and, as a result, testing prior to birthday parties or other gatherings, is ubiquitous (13). Although at-home tests are generally less sensitive than lab-based real-time polymerase chain reaction (RT-PCR), most of the available tests have relatively high specificity and many can detect infected individuals in less than 15 minutes providing actionable information quickly and easily (https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html#anchor_1631294997480). Recent investments in at-home testing may increase testing frequency and shorten the timeframe from infection to detection and isolation. However, along with greater availability and decreased costs, better communication on the benefits of at-home testing, when to use them, and the appropriate actions to take following a positive result is needed.

Serial screening testing can also decrease transmission by detecting asymptomatic cases that would otherwise go undetected. It is most useful in high-risk settings, such as long-term care facilities and correctional institutions, settings with large unvaccinated populations, or when transmission is widespread and case investigation and contact tracing are not practical. Serial testing programs have suffered from a lack of participation, pointing again to the importance of better communication and of understanding the perspectives, motivations, and goals of the population (CDC unpublished data). Promising new strategies, such as “test to stay” that allow student contacts of confirmed COVID-19 cases to stay in school with regular testing rather than quarantine, may encourage participation by supporting safe in-person education (https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/transmission_k_12_schools.html).

Discussion

The purpose of public health surveillance is to provide actionable information to policy makers and the public to mitigate the impact of disease. Modifying the U.S. public health response to more efficiently track SARS-CoV-2 transmission will free up limited resources in the short-term that can be focused on proven interventions. As it is, the current surveillance methods capture only an estimated 1 in 4 (95% UI 3.4-4.7) COVID-19 infections and 1 in 1.9 (95% UI 1.7-2.1) COVID-19 hospitalizations (https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html#whycdcestimates). In the long-term, sustained investment is needed to modernize public health data infrastructure and build inter-operable systems capable of responding to future threats.

Focusing our resources on vaccines, NPIs and testing can protect those at risk of severe COVID-19 disease and reduce the burden on the health care system. However, increasing acceptance of these interventions and reducing disparities in access and uptake remain critical challenges. Challenges that to a large part will be overcome person by person through trusted community leaders and medical providers. At the national level, clear communication on what we know, what we don't know, and when we will know it is still needed, as well as concerted efforts to combat misinformation and fragmented approaches that leave large swaths of our communities unprotected. Greater international cooperation is also critical to speed the dissemination of vaccines, thereby reducing the evolution of new variants. COVID-19 is here to stay, but our approach must continue to evolve domestically and expand globally to reduce preventable morbidity and mortality and, eventually, control the pandemic.

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Curriculum Vitae

ATHALIA CHRISTIE

PROFILE

Senior public health specialist with record of achieving significant health impact by leading international, national and local programs. Managed complex international efforts in conflict zones, and represented the Centers for Disease Control and Prevention (CDC) in contentious and challenging domestic settings. Designed and executed novel approaches to controlling infectious disease outbreaks. Forged strong collaborations across diverse organizations. Demonstrated ability to build and lead teams to achieve results.

PROFESSIONAL EXPERIENCE

Deputy Incident Manager 8/2020 - Present
Principal Deputy Incident Manager 7/2021 – 8/15/2021
CDC COVID-19 Emergency Response
Atlanta, GA

Incident management leadership positions responsible for providing strategic, technical and operational leadership to CDC's COVID-19 emergency response.

- Ensure timely and actionable data analytics, surveillance, lab reporting and modeling activities to monitor and forecast epidemic progression and inform data-driven decision making.
- Support epidemiologic and laboratory studies to examine dynamics of disease spread and control, including expanding testing and analyzing serologic studies to assess spread of infection across America.
- Provide community mitigation strategies and tools in support of domestic plans for phased approaches to COVID-19 and provide healthcare systems strengthening and guidance to support patient treatment and infection, prevention and control.
- Provide support to outbreak response, needs assessments, contact tracing and monitoring impact.
- Integrate CDC response activities with the USG response to inform and synchronize public health actions among all key stakeholders in support of the Federal Incident Strategic Plan.
- Ensure active, timely, effective public health and safety messaging around response priorities with key federal, state/local partners, policy-makers, media and the public.

Principal Deputy Incident Manager 01/2020-07/2020
Deputy Incident Manager 03/2019-12/2019
CDC Democratic Republic of Congo (DRC) Ebola Response
Atlanta, GA and Goma, DRC

Incident management leadership positions responsible for providing strategic, technical and operational leadership to CDC's Ebola response in DRC, as well as preparedness activities in South Sudan, Uganda, Tanzania and Rwanda.

- Coordinated with the government of DRC, the World Health Organization, U.S. Ambassadors, other U.S. government agencies and partners to identify ways CDC assistance could best fill critical gaps and help contain the outbreak.
- Improved quality of surveillance and contact tracing efforts and assisted national- and local-level health officials in analysis of data for evidence-based, strategic decision-making.

- Provided technical assistance and guidance for laboratory diagnostics and genome sequencing to understand transmission events when epidemiologic data is limited.
- Provided technical assistance and guidance for infection prevention and control measures, with an emphasis on harmonizing efforts among the partners.
- Supported DRC, Rwanda, Uganda and South Sudan ministries of health and the World Health Organization's vaccine efforts, including effective targeting, community acceptance, and coordination between vaccine and contact tracing efforts.
- Provided technical assistance to countries bordering DRC to strengthen Ebola preparedness.
- Evaluated and leveraged community feedback and social science information to inform the Ebola response and empower communities for active engagement.
- Provided technical assistance in risk communication and develop and disseminated up-to-date information to the general public, healthcare workers, international travelers, and public health partners.
- Served for three months as CDC's Ebola Response Lead in DRC overseeing the 34-member CDC field team and providing direct technical assistance to the DRC Ministry of Health and National Ebola Response Coordination Team.

Senior Liaison, Ebola Response 09/2018 – 02/2019
CDC Democratic Republic of Congo Ebola Response
Washington, DC

Senior liaison to U.S. Agency for International Development's (USAID) DRC Ebola Response Management Team providing technical guidance to USAID's Ebola response and overseeing inter-agency coordination.

- Provided technical oversight and guidance to USAID's Ebola program planning and execution including on epidemiology, surveillance, case investigation and contact tracing, infection prevention and control, safe and dignified burial, and emergency management.
- Led coordination between CDC and USAID, State Department, Health and Human Services, National Institutes of Health and the National Security Council to ensure a unified evidence-based approach to the Ebola outbreak.
- Provided technical and strategic direction to CDC's Ebola response in DRC and neighboring countries as part of the Ebola Coordination Leadership Team.

Expert Review Team Member 06/2018 – 08/2018
Independent Monitoring Board, Global Polio Eradication Initiative
Afghanistan, Pakistan, and Nigeria

Member of 5-person expert review team selected by the Independent Monitoring Board to provide an independent assessment on the status of the polio eradication program in the three remaining endemic countries.

- Reviewed the performance and structure of the polio eradication program in each endemic country, looking at: national ownership and political commitment, leadership, management, finances, and accountability mechanisms.
- Evaluated program implementation, including surveillance, data accuracy, validation processes, robustness of epidemiological investigations, and the use of social science data.
- Assessed ongoing collaboration with other health programs (e.g. EPI, malaria control, nutrition).
- Provided concrete recommendations to the Independent Monitoring Board to address areas where improvement was needed ensuring that they fit within the broader context/architecture.

Long-Term Training at Johns Hopkins University 09/2016 – 08/2018
Center for Global Health, CDC
Washington, DC

Doctoral candidate in the Department of Epidemiology. Completed all required coursework, written comprehensive and oral exams for a doctoral degree in epidemiology. From 2016 to the present, regularly lecture and design laboratories for graduate students on public health surveillance, global health security and outbreak response.

Deputy Director for Policy, Communication and Strategy (acting) 08/2015 – 8/2016
Center for Global Health, CDC
Washington, DC

Senior executive service position responsible for the development and execution of strategic policy and communication activities to increase the impact and effectiveness of CDC's $2 billion portfolio of global health programs operating in more than 60 countries.

- Serve as the senior CDC representative in Washington for global health; represent and successfully advocate for CDC positions with the National Security Council, other U.S. government agencies, multilateral organizations and key partners.
- Provide strategic input and analysis to the CDC Director, Director for Global Health, and other senior leaders on key international policy issues and engagements.
- Develop and oversee new strategic partnerships and program opportunities to further CDC's global health mission.
- Ensure CDC's global programmatic results and research findings are effectively communicated and disseminated across traditional and social media to policymakers, partners, and the public.
- Identify and address potential vulnerabilities to CDC's capacity to carry out its mission overseas and clarify areas of controversy to policymakers.
- Oversee the offices of the Associate Director for Policy and the Associate Director for Communication responsible for a broad and complex range of public health program and policy issues including budget formulation and tracking, congressional relations, and strategic planning and communication.

Response Lead 10/2015 – 11/2015
Sierra Leone Ebola Response Team, CDC
Sierra Leone

Led and directed 70-member CDC response team. Provided technical assistance to the National Ebola Response Center and Ministry of Health and Social Welfare of Sierra Leone.

- Provided technical input on national policies for the enhanced surveillance period to follow the official end of the Ebola outbreak. Supported the development of operational plans to implement the new policies.
- Developed initial operational plan for the roll-out of rapid diagnostic testing for Ebola in high priority districts.
- Supervised the epidemiology, infection prevention and control, laboratory, special studies, and health promotion staff and programs.

Country Director (acting), Response Lead, & Response Deputy 8/2014 – 07/2015
Liberia Ebola Response Team, CDC
Liberia

Five deployments (7+ months) in senior leadership positions on CDC's Ebola response team in Liberia. Designed and implemented overall response strategy in coordination with the government of Liberia and working closely with international partners. Oversaw strategic direction and safety of 65-member CDC team.

- Provided technical guidance to Liberian counterparts on epidemiology, surveillance, laboratory, infection prevention and control, dead body management, incident management, risk communication and health promotion.
- Developed new strategies to address evolving epidemic including: rapid isolation and treatment of Ebola (RITE strategy) in remote areas; a decentralized approach to case investigation and contact tracing in the densely populated capital; and a rapid response strategy for focused infection prevention and control at health care facilities at increased risk for exposure to persons with Ebola (RING IPC).
- Led epidemiological investigation that demonstrated possible sexual transmission of Ebola for the first time and resulted in new CDC and WHO recommendations for survivors.
- Served on the Liberian Presidential Advisory Committee on Ebola to provide counsel on policy decisions for the President of the Republic.

Deputy, Global Health 3/2012 – 7/2015
Center for Global Health, CDC
Washington, DC

Led strategic direction on complex inter-agency issues and managed relationships affecting CDC's global health portfolio and 2000-person global workforce. Oversaw agency efforts on high profile United States government (USG) or global initiatives requiring collaboration with the White House and federal agencies.

- Served as CDC representative for high-level inter-agency negotiations to resolve challenging policy and programmatic issues that impact CDC's global health programs.
- Effectively represented CDC interests in National Security Council deliberations on the Global Health Security Agenda.
- Designed outcome oriented metrics for all USG global health activities ensuring accountability across programs, in collaboration with USAID, Department of State, and others.
- Built strong relationships with major partners including UN Foundation, ONE campaign, and Kaiser Family Foundation resulting in increased visibility of CDC's global health programs.
- Provided strategic advice on agency priorities such as health security, polio eradication, and non-communicable diseases to the CDC Director and other global health leaders.
- Guided 25 policy and communication staff in the Center for Global Health in actions cutting across multiple CDC centers, Health and Human Services Operating Divisions and partners.
- Designed and implemented strategy for workforce roles, structure, recruitment and retention that re-focused policy and communication staff on serving field offices and program goals.

Senior Technical Advisor 12/2005 - 2/2012
International Services Division, American Red Cross
Washington, DC

Seconded to American Red Cross to lead the Measles Initiative, a public-private partnership to reduce global measles mortality. During my tenure, the Initiative provided technical and financial support resulting in the vaccination of more than 800 million children in 75 countries. The partnership also expanded its support to rubella elimination. The Measles Initiative has been hailed in the Lancet and other publications as a model public health partnership and is credited with reducing global measles mortality by 78% between 2000 and 2012.

- Coordinated daily operations of the Measles Initiative including program activities (averaging 28 countries/year), fundraising, advocacy, and communications.
- Provided direct technical assistance on mass vaccination campaigns, surveillance, and routine immunization to ministries of health, UNICEF and World Health Organization (WHO) regional and country offices, and national Red Cross/Red Crescent societies across Africa and Asia.
- Assured integrated campaigns providing key child survival interventions alongside measles vaccine. Under my stewardship, the Measles Initiative distributed 159 million doses of polio vaccine, 202 million doses of Vitamin A, 121 million deworming tablets, and 37 million insecticide-treated bednets.
- Managed annual budget (US $77-150 million) to ensure accountability and maximize value for money. Secured contributions of more than $50 million from American Red Cross and other donors.
- Brought technical leadership and vision that helped anchor the American Red Cross' revised global health strategy in sound science, data, and the use of accurate and verifiable methods for measuring public health impact.

Horn of Africa Polio Coordinator 12/2001 - 11/2005
Eastern Mediterranean Regional Office, World Health Organization (WHO)
Somalia, South Sudan and Kenya

Initially seconded to WHO as a Technical Officer for Somalia. Advanced rapidly to serve as the Horn of Africa Polio Coordinator. Achieved certification-standard surveillance for the first time in Somalia and in South Sudan despite civil conflict, and a complete absence of basic infrastructure and health services. Stopped transmission of indigenous wild poliovirus in Somalia. Organized immunization campaigns that reached more than 1 million additional children than in previous years. Led multi-agency responses to rapidly contain measles, yellow fever, and Ebola outbreaks in South Sudan.

- Oversaw the polio eradication programs in Somalia and South Sudan, including, surveillance, immunization, administration, finance, security, and logistics.
- Managed and directed more than 500 staff representing a dozen nationalities whose jobs ranged from medical epidemiologists to accountants and drivers. Stabilized staffing levels in areas with severe hardship and insecurity.
- Negotiated increased access and "days of tranquility" (ceasefires) allowing the vaccination of previously unreached populations.
- Guided the expansion of polio surveillance networks to enhance detection and response to outbreaks from other priority diseases.
- Coordinated with UN agencies, NGOs, donors, and the media to promote polio eradication activities in the Horn of Africa and to develop sustainable strategies to strengthen routine immunization and disease surveillance.
- Developed multi-million dollar annual budgets, five-year financial resource requirement projections, and successful donor proposals to USAID, Department of International Development, European Community Humanitarian Office, and others.

Technical Officer 09/2000 - 11/2001
Global Immunization Division, CDC
Somalia and Pakistan; Atlanta, GA

Assisted WHO, Ministry of Health, and NGOs to improve vaccine-preventable disease surveillance and polio eradication activities in Somalia and Pakistan. Provided direct technical assistance by planning, implementing, and evaluating supplemental immunization activities; strengthening surveillance performance; and facilitating training workshops on polio eradication activities.

- Re-designed surveillance system in Somalia to collect critical information on patients' immunity profiles and health-seeking behaviors. Used the new data in my subsequent position to transform active surveillance and achieve certification standards for the first time.
- Served as part of CDC's Anthrax Investigation Emergency Response Team by assisting in the coordination of the emergency response line for public, professional, and media calls.
- Collaborated in developing and implementing a training course for CDC Smallpox Response Teams.

Coordinator, Expanded Contact Investigation Unit 09/1998 - 08/2000
New York City Tuberculosis (TB) Control Program
New York, NY

Seconded to New York City TB Control Program. Supervised more than 30 large-scale outbreak investigations in work sites, schools, and housing facilities.

- Supervised outbreak investigations, including testing, analysis, and reporting.
- Led educational sessions for potentially exposed individuals (20-200 attendees/each).
- Analyzed TB cases in single-room occupancy hotels and shelters; developed recommendations adopted by the NYC Health Commissioner to reduce transmission among transient populations.
- Evaluated the new health care worker surveillance system and analyzed findings. Developed recommendations implemented by the TB Program to facilitate early identification and communication regarding TB exposures in healthcare facilities and established clear procedures for case management and follow-up of health care workers until completion of treatment.
- Developed performance indicators for contact investigations and used the data collected to refine protocols and procedures for TB investigations.
- Trained more than 100 epidemiologists, health educators, nurses and physicians on the epidemiology of TB, contact investigations in congregate settings, and outbreak protocols and procedures.

Technical Officer 09/1999 - 12/1999
World Health Organization
North West Frontier Province, Pakistan

Selected for the second Stop Transmission of Polio (STOP) team and assigned to the World Health Organization in Pakistan. Significantly improved surveillance indicators in the North West Frontier Province. **Initiated AFP surveillance in the tribal areas along the Afghan border despite ever-present insecurity. Coordinated the vaccination of 5 million children - the most successful immunization campaign in provincial history.**

- Led planning for immunization campaign including detailed district-level planning; procurement of vaccine and supplies; recruitment and training of vaccinators; organizing waste management; community mobilization; monitoring and evaluation; and building relationships with partners who contributed services and in-kind assistance.

- Conducted more than 40 trainings for staff from the Ministry of Health, NGOs, hospitals, and private clinics to improve active surveillance.
- Coordinated data management and reporting for vaccine-preventable disease surveillance.
- Conducted epidemiological investigations of wild polio cases.

Prevention Specialist 03/1998 - 08/1998
National Center for Injury Prevention and Control, CDC
Atlanta, GA

Designed and wrote the first injury mortality atlas of American Indian and Alaskan Native Children, 1985-1996, analyzing mortality and hospital discharge data.

Prevention Specialist 09/1997 - 02/1998
National Center for Infectious Diseases, CDC
Atlanta, GA and Haiti

Designed a model Lymphatic Filariasis elimination program for Haiti that was adopted by the Ministry of Health. Identified the organizations able and equipped to initiate and maintain the program. Also developed a strategic plan for the new WHO Collaborating Center for Control and Elimination of Lymphatic Filariasis in the Americas. Identified and established NGO and foundation partnerships for the Center.

EDUCATION

Doctoral Candidate, Department of Epidemiology Present
Johns Hopkins University, Baltimore, MD

Master of International Affairs (Concentration: Public Health) 5/1997
Columbia University, New York, NY

Bachelor of Arts in Latin American Studies and in Economics 5/1995
University of Miami, Miami, FL

SELECTED HONORS AND AWARDS

- On-the-Spot Awards, CDC - 1998, 2001, 2002, 2004, 2005, 2008, 2009, 2014, 2016, 2019, 2020, and 2021
- Incident Manager's Medal of Excellence, CDC DRC Ebola Response - 2020
- Epidemiology Department Award (full tuition and stipend), Johns Hopkins University - 2018-2020
- Incident Manager's Award, CDC DRC Ebola Response - 2019
- Mary B. Meyer Memorial Fund Scholar (full tuition and stipend), Johns Hopkins University - 2016-2018
- Long-term Education Award (full salary), CDC - 2016-2018
- James H. Nakano Citation for Scientific Excellence, CDC - 2017
- Public Health Advisor of the Year Award, Watsonian Society - 2015
- Excellence in Emergency Response, CDC - 2015
- Spirit of Excellence Award, American Red Cross - 2007
- Secretary's Award for Distinguished Service, Department of Health and Human Services - 2002
- Group Honor Award, CDC - 2002
- International Group Health Award, CDC - 2000
- Departmental Research Assistant (full tuition + stipend), Columbia University - 1996
- Latin American Studies Award, University of Miami - 1995
- Graduated with Honors, University of Miami - 1995
- Bowman-Ashe Academic Scholarship, University of Miami – 1992, 1993 and 1994

LANGUAGES

Proficient in Spanish

PUBLICATIONS

Christie A, Brooks JT, Hicks LA, Sauber-Schatz EK, Yoder JS, Honein MA, CDC COVID-19 Response Team. Guidance for Implementing COVID-19 Prevention Strategies in the Context of Varying Community Transmission Levels and Vaccination Coverage. *Morbidity and Mortality Weekly Report* 2021;70:1044–1047. DOI: http://dx.doi.org/10.15585/mmwr.mm7030e2

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Fallah MP, Skrip LA, Raftery P, Kullie M, Borbor W, Laney AS, Blackley DJ, **Christie A**, Dokubo EK, Lo TQ, Coulter S, Baller A, Vonhm BT, Bemah P, Lomax S, Yeih A, Wapoe-Sakie, Y, Mann J, Clement P, Davies-Wayne G, Hamblion E, Wolfe C, Williams D, Gasasira, A, Kateh F, Nyenswah TG, Galvani AP (2017). Bolstering Community Cooperation in Ebola Resurgence Protocols: Combining Field Blood Draw and Point-of-Care Diagnosis. *PLoS Med* 14(1): e1002227. DOI:10.1371/journal.pmed.1002227

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