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Outbreaks Associated with Treated Recreational Water — United States, 2015–2019

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Outbreaks associated with treated recreational water can be caused by pathogens or chemicals in aquatic venues such as pools, hot tubs, water playgrounds, or other artificially constructed structures that are intended for recreational or therapeutic purposes. For the period 2015–2019, public health officials from 36 states and the District of Columbia (DC) voluntarily reported 208 outbreaks associated with treated recreational water. Almost all (199; 96%) of the outbreaks were associated with public (nonbackyard) pools, hot tubs, or water playgrounds. These outbreaks resulted in at least 3,646 cases of illness, 286 hospitalizations, and 13 deaths. Among the 155 (75%) outbreaks with a confirmed infectious etiology, 76 (49%) were caused by *Cryptosporidium* (which causes cryptosporidiosis, a gastrointestinal illness) and 65 (42%) by *Legionella* (which causes Legionnaires' disease, a severe pneumonia, and Pontiac fever, a milder illness with flu-like symptoms). *Cryptosporidium* accounted for 2,492 (84%) of 2,953 cases resulting from the 155 outbreaks with a confirmed etiology. All 13 deaths occurred in persons affected by a Legionnaires' disease outbreak. Among the 208 outbreaks, 71 (34%) were associated with a hotel (i.e., hotel, motel, lodge, or inn) or a resort, and 107 (51%) started during June–August. Implementing recommendations in CDC's Model Aquatic Health Code (MAHC) (*1*) can help prevent outbreaks associated with treated recreational water in public aquatic venues.

An outbreak associated with recreational water is the occurrence of similar illness in two or more persons whose illnesses are epidemiologically linked by location and time of exposure to 1) recreational water or 2) pathogens or chemicals aerosolized or volatilized into the air from recreational water. Public health officials in U.S. jurisdictions (the 50 states, DC, U.S. territories, and freely associated states) voluntarily report outbreaks to CDC via the National Outbreak Reporting System. This report examines data on outbreaks that were associated with treated recreational water and reported by February 4, 2021, and for which the first illness occurred during 2015–2019. Data on each outbreak include earliest illness onset date, count of cases of illness, counts of hospitalizations and deaths, etiology, and setting (e.g., hotel) and venue (e.g., pool, hot tub, or water playground) of the outbreak exposure. This

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activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.*

For the period 2015–2019, public health officials from 36 states† and DC reported 208 outbreaks associated with treated recreational water, which resulted in at least 3,646 cases of illness (Table), 286 hospitalizations, and 13 deaths. Almost all (199; 96%) of the outbreaks were associated with public pools, hot tubs, or water playgrounds. Etiology was confirmed for 155 (75%) of the 208 outbreaks. These 155 outbreaks were all caused by pathogens and resulted in at least 2,953 (81%) cases and 266 (93%) hospitalizations. The 76 (49%) outbreaks caused by *Cryptosporidium* accounted for 2,492 (84%) of the 2,953 cases and 82 (31%) of the 266 hospitalizations. Unlike other pathogens, which caused outbreaks resulting in <100 cases of illness, *Cryptosporidium* caused outbreaks resulting in >100 cases of illness. The four such cryptosporidiosis outbreaks resulted in a total of 1,380 cases; the largest outbreak resulted in 638 cases. The 65 (42%) outbreaks caused by *Legionella* accounted for 354 (12%) of the 2,953 cases and 177 (67%) of the 266 hospitalizations. Four outbreaks caused by *Legionella* accounted for 178 (6%) of the 2,953 cases and 54 (20%) of the 266 hospitalizations. All 13 deaths occurred in persons affected by a Legionnaires' disease outbreak. Among the 53 outbreaks with a nonconfirmed (i.e., suspected or unknown) etiology, 20 (38%) were suspected to be caused by chemical etiologies (e.g., excess chlorine, one or more disinfection byproducts, or altered pool chemistry) (Table).

Hotels (i.e., hotels, motels, lodges, or inns) or resorts were associated with 71 (34%) of the 208 outbreaks; 50 (70%) of these outbreaks were associated with hot tubs. Among the 43 hotel- or resort-associated outbreaks with a confirmed etiology, 31 (72%) were caused by *Legionella* and were associated with a hot tub. Among the 208 outbreaks, 107 (51%) started during June–August (Figure 1). The June–August peak was driven by 63 outbreaks caused by *Cryptosporidium*; 58 (92%) of these outbreaks were associated with pools and seven (11%) with water playgrounds.§ One half (38) of the 76 outbreaks caused by *Cryptosporidium* occurred during 2016 (Figure 2). Twenty-six (13%) of the 208 outbreaks occurred during 2019.

Discussion

At least 208 outbreaks associated with treated recreational water occurred in the United States during 2015–2019. Most of these outbreaks were caused by *Cryptosporidium,* associated

* 45 C.F.R. part 46.102(l)(2); 21 C.F.R. part 56; 42 U.S.C. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. 3501 et seq.

† Alabama, Alaska, Arizona, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, and Wisconsin.

§ Five cryptosporidiosis outbreaks were associated with both pools and water playgrounds.

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TABLE. Outbreaks associated with treated recreational water,* by etiology — National Outbreak Reporting System, United States, 2015–2019

Etiology	No. of outbreaks (%)†	No. of cases (%)†	Median no. of cases (minimum–maximum)
Total	**208 (100)**	**3,646 (100)**	**5 (2–638)**
Confirmed infectious etiology	**155 (75)**	**2,953 (81)**	**4 (2–638)**
Bacterium	**72 (35)**	**386 (11)**	**2 (2–92)**
Legionella	65 (31)	354 (10)	2 (2–92)
Shiga toxin–producing *Escherichia coli*	4 (2)	17 (<1)	4.5 (2–6)
Campylobacter	1 (<1)	4 (<1)	—§
Nontuberculous mycobacteria	1 (<1)	9 (<1)	—
Shigella	1 (<1)	2 (<1)	—
Parasite	**80 (38)**	**2,503 (69)**	**8.5 (2–638)**
Cryptosporidium	76 (37)	2,492 (68)	9.5 (2–638)
Giardia	3 (1)	9 (<1)	3 (2–4)
Acanthamoeba	1 (<1)	2 (<1)	—
Virus	**3 (1)**	**64 (2)**	**14 (14–36)**
Norovirus	3 (1)	64 (2)	14 (14–36)
Nonconfirmed¶	**53 (25)**	**693 (19)**	**8 (2–94)**

* Treated recreational water is water in a pool, hot tub, water playground, or other artificially constructed structure that is intended for recreational or therapeutic purposes. Outbreaks are the occurrence of similar illness in two or more persons who are epidemiologically linked by location and time of exposure to 1) treated recreational water or 2) pathogens or chemicals that were aerosolized or volatilized into the air from treated recreational water.
† Percentages do not sum to 100 because of rounding.
§ Dashes indicate median not provided because only one outbreak was reported for that specific etiology.
¶ Includes outbreaks with the following reported etiologies: suspected chemical (e.g., excess chlorine, one or more disinfection byproducts, or altered pool chemistry) for 20 outbreaks (10%), unknown for 12 (6%), suspected *Cryptosporidium* for six (3%), suspected *Legionella* for six (3%), suspected *Pseudomonas* for five (2%), suspected norovirus for two (1%), suspected *Giardia* for one (<1%), and unknown bacterial for one (<1%).

with pools, and started during June–August or were caused by *Legionella* and associated with hot tubs in hotels, motels, lodges, inns, or resorts. Outbreaks caused by *Cryptosporidium* can occur even if the pool or water playground is properly treated. Prevention steps beyond traditional operation, like those outlined in CDC's 2018 MAHC (third edition) are needed to decrease the incidence of these outbreaks associated with public aquatic venues. Outbreaks caused by *Legionella* indicate that hot tub operation needs improvement, and taking steps as outlined in CDC's MAHC, *Legionella* Control Toolkit,¶ and Water Management Program Toolkit** would decrease the incidence of these outbreaks associated with public hot tubs.

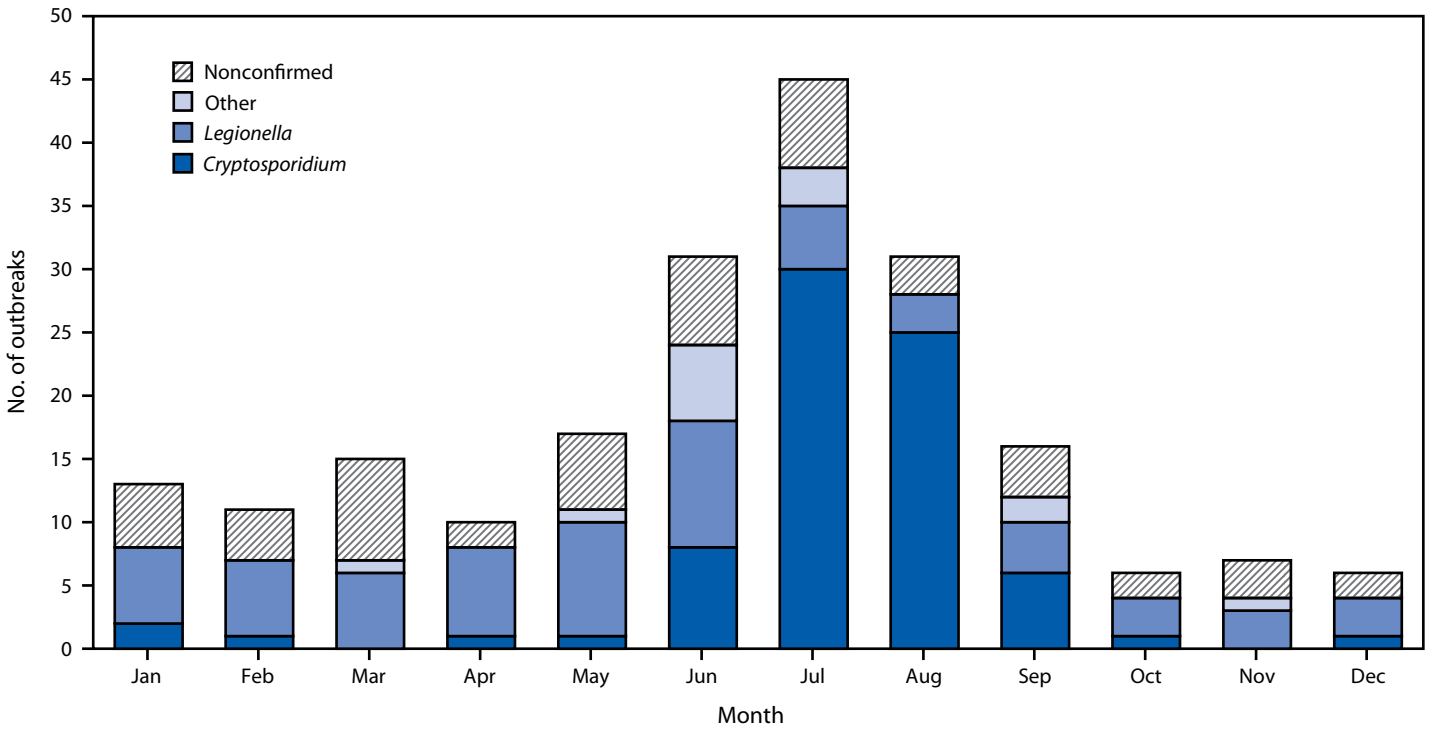
Cryptosporidium is transmitted when oocysts, the infectious life stage, are ingested (e.g., in contaminated recreational water). Oocysts are extremely tolerant to chlorine, the primary barrier to the transmission of pathogens in treated recreational water. At 1 ppm free available chlorine (*2*,*3*), oocysts can survive for >7 days in water, at pH 7.2–7.8†† and temperature 77°F (25°C). This is the minimum concentration recommended by CDC and typically required in U.S. jurisdictions for public aquatic venues. Because *Cryptosporidium* can persist in properly chlorinated water, it can cause larger outbreaks than those caused by pathogens that are inactivated within minutes by freely available chlorine at said concentrations and water pH and temperature. Other disinfection methods (e.g., ultraviolet light or ozone) have been found to be effective against oocysts (*4*,*5*). CDC's 2018 MAHC recommends using these methods to achieve a minimum 3-$\log_{10}$ (99.9%) reduction of infectious oocysts in water playgrounds and a minimum 2-$\log_{10}$ (99%) reduction in all other aquatic venues (MAHC 4.7.3.3.2.1).§§ The difference accounts for the substantially smaller volume of water in water playgrounds. In addition, water playgrounds are intended for young children aged <5 years, who have higher rates of cryptosporidiosis (*6*) and who sit on water playground jets and ingest recirculated, potentially fecally contaminated water from the jets (*7*).

When responding to diarrheal incidents (i.e., high-risk *Cryptosporidium* contamination events) in public pools or to cryptosporidiosis outbreaks associated with public pools, operators can follow the 2018 MAHC's hyperchlorination¶¶ recommendations to inactivate oocysts. MAHC defines hyperchlorination as raising the free available chlorine to 20 ppm for 12.75 hours (MAHC 6.5.3.2) or, in the presence

¶ https://www.cdc.gov/legionella/wmp/control-toolkit/index.html
** https://www.cdc.gov/legionella/wmp/toolkit
†† pH will determine the relative amounts of hypochlorous acid, the active disinfectant form of chlorine referred to as free available chlorine, and hypochlorite ion, a less active disinfectant form of chlorine. The pH range 7.2–7.8 is one that balances maximizing free available chlorine with swimmer comfort and preventing equipment corrosion.

§§ For reference purposes, MAHC elements discussed in this report are followed by the specific section number that corresponds to that element.
¶¶ https://www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html

FIGURE 1. Outbreaks associated with treated recreational water* (N = 208), by etiology†,§ and month — National Outbreak Reporting System, United States, 2015–2019



* Treated recreational water is water in a pool, hot tub, water playground, or other artificially constructed structure that is intended for recreational or therapeutic purposes. Outbreaks are the occurrence of similar illness in two or more persons who are epidemiologically linked by location and time of exposure to 1) treated recreational water or 2) pathogens or chemicals that were aerosolized or volatilized into the air from treated recreational water.

† "Nonconfirmed" includes outbreaks with the following reported etiologies: suspected chemical (e.g., excess chlorine, one or more disinfection byproducts, or altered pool chemistry), suspected *Cryptosporidium*, suspected *Giardia*, suspected *Legionella*, suspected norovirus, suspected *Pseudomonas*, unknown bacterial, and unknown.

§ "Other" includes outbreaks with the following confirmed etiologies: *Acanthamoeba*, *Campylobacter*, Shiga toxin–producing *Escherichia coli*, *Giardia*, nontuberculous mycobacteria, norovirus, or *Shigella*.

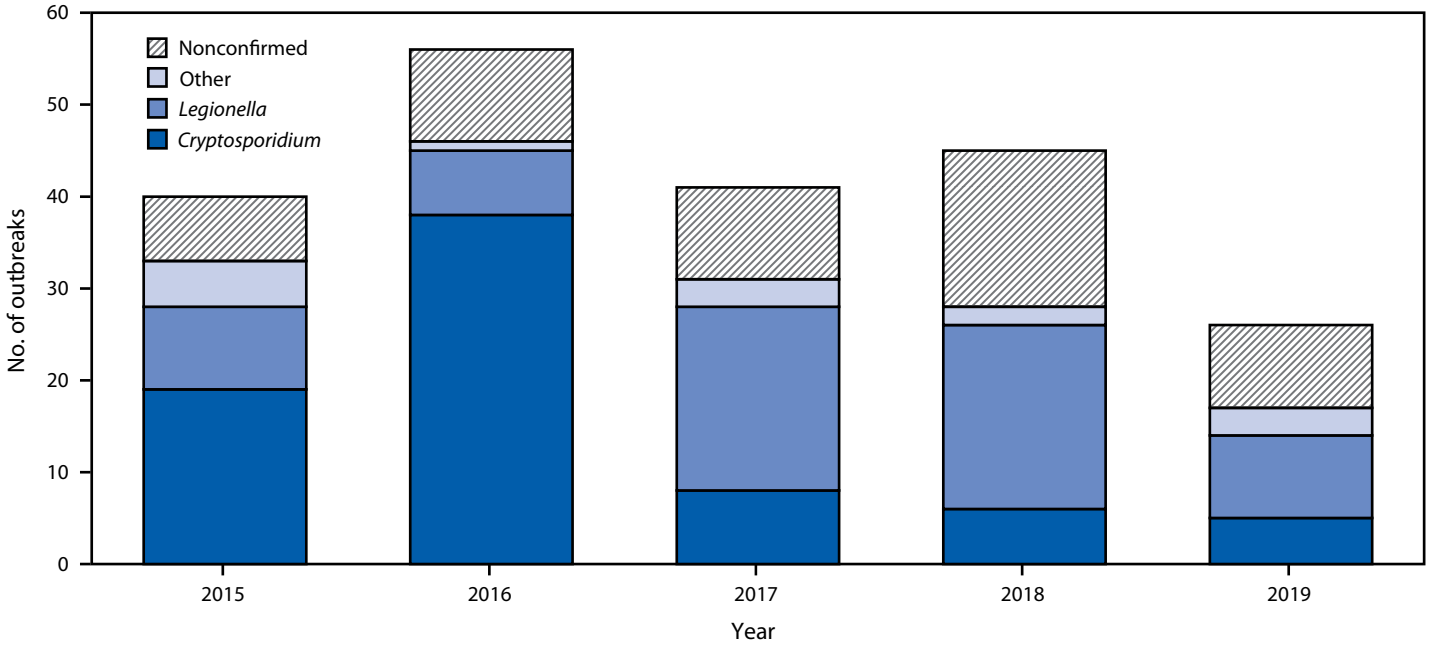
of ≤15 ppm cyanuric acid, 20 ppm free available chlorine for 28 hours (MAHC 6.5.3.2.1). Cyanuric acid is added to the water in outdoor pools to slow down the degradation of free available chlorine by the sun's ultraviolet light; it does so by bonding with free available chlorine, consequently increasing the amount of time needed to inactivate *Cryptosporidium* (*3*) and other pathogens. The 2018 MAHC will be updated in 2021 with the release of the fourth edition. One proposed revision would establish parameters at which cyanuric acid concentration constitutes an imminent health hazard that requires immediate closure of a public aquatic venue pending correction. This would enable enforcement of maximum limits on the use of cyanuric acid.

Legionella is transmitted when aerosolized water droplets (e.g., droplets produced by hot tub jets) containing the bacteria are inhaled. *Legionella* can amplify when disinfectant concentration is not properly maintained, sediment or biofilm is present, water is not replaced frequently enough, or temperature is favorable (77–113°F [25–45°C]). Hot tubs operate in the temperature range that is favorable for *Legionella* growth (up to 104°F [40°C]), so maintaining disinfectant concentration, vigorously scrubbing all surfaces each time the hot tub is drained, and frequently replacing water are critical for *Legionella* control. These control measures are delineated in the *Legionella* Control Toolkit and the Water Management Program Toolkit Investigations of outbreaks caused by *Legionella* indicate that an effective water management program for hot tubs, as described in the toolkit, can reduce the risk of Legionnaires' disease (*8*,*9*). Likewise, the 2018 MAHC recommends higher minimum disinfectant concentrations (3.0 ppm free available chlorine [MAHC 5.7.3.1.1.2.3] or 4.0 ppm bromine [MAHC 5.7.3.1.2.2]) than in other aquatic venues,*** not using cyanuric acid in hot tubs (MAHC 5.7.3.1.3.1), daily inspection for and removal of biofilm (MAHC 6.1.2.1.5.4), and regular water replacement (MAHC 5.12.1.2.1).††† The 2018 MAHC also

*** The difference accounts for the depletion of the disinfectant concentration by higher water temperatures and aerosolization of water by hot tub jets.

††† The formula for calculating water replacement is frequency in days = (hot tub volume in gallons/3)/average number of users per day.

FIGURE 2. Outbreaks associated with treated recreational water* (N = 208), by etiology†,§ and year — National Outbreak Reporting System, United States, 2015–2019



* Treated recreational water is water in a pool, hot tub, water playground, or other artificially constructed structure that is intended for recreational or therapeutic purposes. Outbreaks are the occurrence of similar illness in two or more persons who are epidemiologically linked by location and time of exposure to 1) treated recreational water or 2) pathogens or chemicals that were aerosolized or volatilized into the air from treated recreational water.

† "Nonconfirmed" includes outbreaks with the following reported etiologies: suspected chemical (e.g., excess chlorine, one or more disinfection byproducts, or altered pool chemistry), suspected *Cryptosporidium*, suspected *Giardia*, suspected *Legionella*, suspected norovirus, suspected *Pseudomonas*, unknown bacterial, and unknown.

§ "Other" includes outbreaks with the following confirmed etiologies: *Acanthamoeba*, *Campylobacter*, Shiga toxin–producing *Escherichia coli*, *Giardia*, nontuberculous mycobacteria, norovirus, or *Shigella*.

provides recommendations for disinfecting hot tubs associated with outbreaks caused by *Legionella*[§§§] (MAHC 6.5.3.6.1).

The findings in this report are subject to at least four limitations. First, the outbreak counts presented are likely an underestimate of actual incidence. Many factors can present barriers to the detection, investigation, and reporting of outbreaks, such as voluntary reporting, lengthy incubation periods (e.g., of *Cryptosporidium*) and detection and investigation periods (e.g., of Legionnaires' disease cases), and wide geographic dispersion of ill swimmers. Moreover, the public health response to the COVID-19 pandemic has been resource- and time-intensive. This circumstance could have been an additional barrier to 2020 efforts to finalize data on outbreaks that occurred during 2018 or 2019. Second, data might be skewed to include outbreaks of notifiable diseases (e.g., cryptosporidiosis and Legionnaires' disease), cases of which are reported to and investigated by public health officials. Third, data on outbreaks with a chemical etiology might be limited because of the potentially transient nature of chemical contamination and potential lack of communication between those who respond to these outbreaks (e.g., hazardous materials personnel) and those who report them (e.g., infectious disease epidemiologists). Finally, data on factors contributing to the outbreaks were limited and could not be analyzed. Revisions to corresponding National

Summary

What is already known about this topic?

Outbreaks associated with treated recreational water in pools, hot tubs, and water playgrounds can be caused by pathogens or chemicals.

What is added by this report?

For the period 2015–2019, a total of 208 outbreaks associated with treated recreational water were reported to CDC. *Cryptosporidium* caused 76 outbreaks, resulting in 2,492 cases. *Legionella* caused 65 outbreaks, resulting in 13 deaths.

What are the implications for public health practice?

To help prevent outbreaks, operators of public aquatic venues and U.S. jurisdictions can voluntarily adopt CDC's Model Aquatic Health Code, *Legionella* Control Toolkit, and Water Management Program Toolkit recommendations, and swimmers can follow CDC's healthy swimming steps.

[§§§] https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf

Outbreak Reporting System data fields are underway to improve data quality and as part of data modernization efforts.

In addition to voluntarily adopting the MAHC and Legionnaires' disease prevention recommendations, public health officials and operators of public aquatic venues can help prevent outbreaks associated with treated recreational water by educating the public. Given *Cryptosporidium*'s extreme chlorine tolerance, "don't swim or let your kids swim if sick with diarrhea" and "don't swallow the water you swim in" are important messages. The public can help prevent *Legionella* transmission by checking inspection scores, online or on-site, before getting in the water. The public can also conduct mini-inspections (e.g., measuring the bromine or chlorine level and pH with test strips available at most superstores, hardware stores, and pool supply stores) before getting into hot tubs. Persons at increased risk for Legionnaires' disease[¶¶¶] might choose to avoid hot tubs. These and other healthy swimming steps have been published.[****]

¶¶¶ https://www.cdc.gov/legionella/downloads/fs-legionnaires.pdf

**** https://www.cdc.gov/healthywater/swimming/swimmers/steps-healthy-swimming.html

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State, District of Columbia, and local waterborne disease coordinators, epidemiologists, environmental health practitioners, and microbiologists.

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Update to U.S. Selected Practice Recommendations for Contraceptive Use: Self-Administration of Subcutaneous Depot Medroxyprogesterone Acetate

Kathryn M. Curtis, PhD[1]; Antoinette Nguyen, MD[1]; Jennifer A. Reeves, MD[1]; Elizabeth A. Clark, MD[1]; Suzanne G. Folger, PhD[1]; Maura K. Whiteman, PhD[1]

U.S. Selected Practice Recommendations for Contraceptive Use (U.S. SPR), adapted by CDC from global guidance developed by the World Health Organization (WHO), provides evidence-based guidance on contraceptive use for U.S. health care providers (*1*). During January–February, 2021, CDC evaluated the 2019 WHO recommendation on self-administered subcutaneous depot medroxyprogesterone acetate (DMPA-SC) (*2*). CDC adopted the WHO recommendation on the basis of moderate-certainty evidence that self-administered DMPA-SC is safe and effective, and has higher continuation rates compared with provider-administered DMPA. The new U.S. SPR recommendation states that self-administered DMPA-SC should be made available as an additional approach to deliver injectable contraception. Provider-administered DMPA should remain available. Self-administered DMPA-SC is a user-controlled method that has the potential to improve contraceptive access and increase reproductive autonomy. Self-administered DMPA-SC should be offered in a noncoercive manner through a shared decision-making process between patients and their health care providers, with a focus on patient preferences and equitable access to the full range of contraceptive methods.

Background

DMPA-SC is a progestin-only injectable contraception method approved by the Food and Drug Administration (FDA) that is similar to intramuscular DMPA (DMPA-IM), but delivered subcutaneously.* Recommendations regarding eligibility and provision of DMPA-SC and DMPA-IM are included in U.S. Medical Eligibility Criteria for Contraceptive Use (U.S. MEC) and U.S. SPR and are the same for both formulations (*1*,*3*). During 2017–2019, 2% of U.S. women aged 15–49 years used DMPA (IM or SC) for contraception; use was most common in younger women (aged 15–24 years), non-Hispanic Black women, and women with lower income.†,§ Because DMPA-SC is administered subcutaneously, the approach lends itself to self-injection.¶ Results from U.S. and international studies indicate that self-administered DMPA-SC improves contraceptive continuation rates and has rates of pregnancy, side effects, and adverse events equivalent to those associated with provider administration (*4*).

As part of 2019 guidance on self-care interventions for sexual and reproductive health and rights, WHO recommended that self-administered injectable contraception should be made available as an additional approach to deliver injectable contraception to persons of reproductive age (*2*). The guidance takes into consideration that persons can access information to guide their decisions, make use of appropriate technologies, and seek health services and professional help when necessary (*2*). This approach is consistent with a shared decision-making model to meet patients' pregnancy planning and reproductive health needs, with a focus on patient preferences and access to the full range of contraceptive methods to minimize risk for coercion** (*5*). Because of the WHO recommendation, CDC initiated a process to determine whether to add a recommendation about self-administration of DMPA-SC to update the U.S. SPR.

Methods

CDC considered several factors in determining whether to adopt or adapt the WHO recommendation on self-administered DMPA-SC. CDC evaluated a 2019 systematic review (*4*) that contributed to the WHO recommendation. The review assessed the question "Should self-administration be made available as an additional approach to deliver injectable contraception?" and included randomized clinical trials (RCTs) and observational studies comparing self-administered DMPA-SC with provider-administered DMPA-SC or DMPA-IM.†† Outcomes included pregnancy; side effects or adverse events; initial use of injectable contraception; continuation rate of injectable contraception; self-efficacy, knowledge, and empowerment; and social harms. Risk of bias was evaluated using The Cochrane Collaboration tool for RCTs

* https://www.accessdata.fda.gov/drugsatfda_docs/label/2020/021583s033s034lbl.pdf
† https://www.cdc.gov/nchs/products/databriefs/db388.htm
§ https://www.cdc.gov/nchs/data/nhsr/nhsr086.pdf
¶ "Self-administration" and "self-injection" include injection by the DMPA-SC user or by someone who is not the user's health care provider, such as a family or community member.

** https://www.acog.org/clinical-information/policy-and-position-statements/position-statements/2019/opposition-to-coercive-contraception-practices-and-policies
†† Studies in the systematic review were identified by searching the PubMed, CINAHL, LILACS, and EMBASE databases through September 2018. Meta-analyses were conducted when multiple studies reported the same outcome. WHO used the Grading of Recommendations Assessment, Development and Evaluation approach for recommendation development (full evidence tables can be found at https://apps.who.int/iris/bitstream/handle/10665/325487/WHO-RHR-19.13-eng.pdf?ua).

and the Evidence Project tool for observational studies. CDC updated the search to identify additional articles published through January 15, 2021, using the same search strategy and inclusion criteria as the 2019 published review. CDC also considered global information on values and preferences about self-administration of DMPA-SC (*2*), and information on implementation of self-administered DMPA-SC in the United States (*6–8*).

CDC invited 18 external experts to serve as ad hoc reviewers of the evidence and the WHO recommendation. These reviewers were selected because of their knowledge of methods of contraception and experience in providing family planning services in various settings and to a range of patient populations, including adolescents and persons with disabilities. The reviewers joined one of three teleconferences held in January and February 2021, during which CDC presented the evidence, the WHO recommendation process and outcome, and information about implementing self-administered DMPA-SC in the United States. Participants provided their individual perspectives and experiences about how the evidence might influence U.S. clinical practice and how the WHO recommendation is applicable to the U.S. context. The teleconferences were designed to exchange information; participants were not asked to develop recommendations or a consensus opinion. After the teleconferences, CDC developed the recommendation described in this report, taking into consideration the evidence, the WHO recommendation, and the individual perspectives provided by the expert reviewers.

Evidence and Rationale

The 2019 systematic review identified six studies that assessed self-administered DMPA-SC compared with provider-administered DMPA-SC or DMPA-IM (*4*). Studies included participants of different age ranges; five studies included participants aged ≥18 years and one study included participants aged ≥15 years. Two of the studies were conducted in the United States. Three of the studies were RCTs and three were prospective cohort studies; all of the studies followed participants for 12 months. Higher rates of continuation were observed with self-administered DMPA-SC than with provider-administered DMPA (SC or IM) (metaanalysis pooled relative risk [RR] = 1.27, 95% confidence interval [CI] = 1.16–1.39 for RCTs and pooled RR = 1.18, 95% CI = 1.10–1.26 for observational studies). Pregnancy was measured in four studies; rates were low overall (≤1%) and did not differ between self-administered and provider-administered groups. Two studies found higher rates of injection site reactions with self-administered DMPA-SC compared with provider-administered DMPA-IM, and two studies found no differences. No other side effects or adverse events were increased with self-administration. None of the studies reported on self-efficacy, knowledge, and empowerment, or social harms. CDC identified one additional secondary analysis from a primary study included in the 2019 published systematic review; this analysis found similar 12-month continuation rates for self-administered DMPA-SC among younger (aged 18–24 years) and older (aged ≥25 years) participants (*9*).

WHO determined the evidence to be of moderate-certainty and that the benefits of self-administration outweighed any potential harms, resulting in a strong recommendation that self-administered injectable contraception should be made available as an additional approach to deliver injectable contraception to persons of reproductive age (*2*). WHO also considered resources, feasibility, equity and human rights, and the potential for the intervention to improve health equity if implemented in the context of an enabling environment (*2*). Implementation issues, such as safe disposal of self-injection equipment, were also considered as were values and preferences about self-administered DMPA-SC through literature review and a global survey (*2*). Self-administered DMPA-SC was found to be acceptable, easy to use, and preferable to provider administration. Convenience, accessibility, ease of administration, and privacy and confidentiality were important in choosing self-administration. Potential barriers included fear of needles, fear of incorrect administration, and preference for seeing a health care provider. WHO noted insufficient evidence to assess values and preferences from some subgroups, including persons of different age groups. Data on health care providers' perspectives were limited (*2*).

The 2019 published systematic review (*4*) included two U.S. RCTs that reported implementation outcomes (*6,7*). Participants in both studies were provided brief instructional sessions using information from the DMPA-SC package insert, after which they were able to self-administer DMPA-SC. In one of the studies, 97% of participants reported that it was easy to administer the injection at 12 months, and 87% reported high satisfaction with self-administration at 12 months, which was similar to that for provider-administration (92%) (*7*). An additional U.S. study on self-administered DMPA-SC implementation during the COVID-19 pandemic found that 37% of contacted DMPA-IM patients were interested in self-administration of DMPA-SC, and 58% of interested persons reported that they initiated self-administration (*8*). Reasons for not initiating the approach included deciding not to self-administer, moving away, and pharmacy and insurance barriers (*8*).

Recommendation for Self-Administration of DMPA-SC

CDC adopted the WHO recommendation for self-administered DMPA-SC, which was guided by evidence that the practice increases contraceptive continuation and has equivalent rates of pregnancy, side effects, and associated adverse events compared with provider-administration. The new U.S. SPR recommendation states that self-administered DMPA-SC should be made available as an additional approach to deliver injectable contraception (Box).

Discussion

Self-administered DMPA-SC might improve access to contraception by removing barriers, such as in-person visits to a health care provider, while promoting empowerment through self-care. As with the WHO recommendation, CDC emphasized that self-administered DMPA-SC should be made available as an additional approach; provider-administered DMPA should remain available. Self-administered DMPA-SC should be offered in a noncoercive, person-centered, and equitable manner, as part of access to the full range of contraceptive methods.

Self-administered DMPA-SC is an option for anyone eligible to use provider-administered DMPA, including adolescents, and the U.S. MEC can be used to assess medical eligibility for DMPA-SC use[§§,¶¶] (*3*). Recommendations for initiation, follow-up, and reinjection intervals for self-administered

[§§] The recommendations refer to contraceptive methods being used for contraceptive purposes; the recommendations do not consider the use of contraceptive methods for treatment of medical conditions because the eligibility in these situations might differ.

[¶¶] https://www.cdc.gov/reproductivehealth/contraception/pdf/summary-chart-us-medical-eligibility-criteria_508tagged.pdf

BOX. Update to U.S. Selected Practice Recommendations for Contraceptive Use*

New recommendation

- Self-administered subcutaneous depot medroxyprogesterone acetate (DMPA-SC) should be made available as an additional approach to deliver injectable contraception.

Comments and evidence summary

- Self-administered DMPA-SC is a user-controlled method that has the potential to improve contraceptive access and increase reproductive autonomy.
- Self-administered DMPA-SC should be made available as an additional approach; provider-administered DMPA should remain available.
- Self-administered DMPA-SC should be offered in the context of shared decision-making, with a focus on patient preferences and access to the full range of contraceptive methods.
- Existing recommendations in the U.S. Medical Eligibility Criteria for Contraceptive Use and U.S. Selected Practice Recommendations for Contraceptive Use for provider-administered DMPA also apply to self-administered DMPA-SC.
- As with provider-administered DMPA, no routine follow-up is required; however, the patient should be encouraged to contact a health care provider at any time 1) to discuss side effects or other problems, 2) if there is a desire to change the method being used (including requesting provider-administered DMPA), or 3) if there are questions or concerns around re-injection.
- A systematic review and meta-analysis of three randomized controlled trials (RCTs) and three prospective cohort studies compared self-administration of DMPA-SC with provider-administered DMPA-SC or DMPA-IM.[†]
  - Higher rates of continuation were observed with self-administration compared with provider-administration (pooled relative risk [RR] = 1.27, 95% confidence interval [CI] = 1.16–1.39 for three RCTs and pooled RR = 1.18, 95% CI = 1.10–1.26 for three cohort studies).
  - Pregnancy rates were low and did not differ between self-administered and provider-administered groups (four studies).
  - Two studies found higher rates of injection site reactions with self-administered DMPA-SC compared with provider-administered DMPA-IM, and two studies found no differences.
  - No other side effects or adverse events were increased with self-administered DMPA-SC.

* https://www.cdc.gov/reproductivehealth/contraception/mmwr/spr/summary.html

† Kennedy CE, Yeh PT, Gaffield ML, Brady M, Narasimhan M. Self-administration of injectable contraception: a systematic review and meta-analysis. BMJ Glob Health 2019;4:e001350.

DMPA-SC are the same as those for provider-administered DMPA (*1*). Repeat DMPA injections should be provided every 3 months (13 weeks); the repeat DMPA injection can be given up to 2 weeks late (15 weeks from the last injection) without requiring additional contraceptive protection (*1*). Although the FDA label states that DMPA-SC is only to be administered by a health care professional, health care providers might prescribe an FDA-approved drug for off-label use (including administering a drug in a different way, such as self-administration) when medically indicated, as determined by the health care provider, for their patient.[***,†††] Resources for implementing self-administration of DMPA-SC have been developed by several organizations[§§§,¶¶¶,****] (*8*). Critical implementation elements to consider include instruction (e.g., in-person or through telemedicine) on self-injection and sharps disposal; access to follow-up care for questions or to switch to provider-administration or another contraceptive method; reinjection reminders; and administrative issues, such as ordering, billing, and reimbursement. Availability of self-administered DMPA-SC expands options for pregnancy prevention and enhances reproductive autonomy when offered in a noncoercive manner through a shared decision-making process between patients and their health care providers, with a focus on patient preferences and equitable access to the full range of contraceptive methods.

Summary

What is already known about this topic?

Subcutaneous depot medroxyprogesterone acetate (DMPA-SC) is an FDA-approved injectable contraceptive method available in the United States.

What is added by this report?

CDC updated recommendations in the U.S. Selected Practice Recommendations for Contraceptive Use to state that self-administered DMPA-SC should be made available as an additional approach to deliver injectable contraception.

What are the implications for public health practice?

Self-administration of DMPA-SC is safe and effective and might expand access to a user-controlled contraceptive method. This option should be offered in a noncoercive manner through shared decision-making, with a focus on patient preferences and equitable access to the full range of contraceptive methods, including provider-administered DMPA.

*** FDA labeling states that DMPA-SC is only to be administered by a health care professional. Therefore, self-administration of DMPA-SC is considered "off-label."

††† https://www.fda.gov/patients/learn-about-expanded-access-and-other-treatment-options/understanding-unapproved-use-approved-drugs-label

§§§ https://www.nationalfamilyplanning.org/file/documents---service-delivery-tools/NFPRHA---Depo-SQ-Resource-guide---FINAL-FOR-DISTRIBUTION.pdf

¶¶¶ https://rhntc.org/resources/covid-19-and-family-planning-services-faq

**** https://societyfp.org/wp-content/uploads/2021/02/SFP-Interim-Recommendations-Contraception-and-COVID-19_-02.18.2021.pdf

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Competing Interests for Expert Reviewers and Expert Review Teleconference Attendees: Sally Rafie is a member of the Clinical Advisory Board for Afaxys, Inc. and Jacki Witt is an Advisory Board Member for Mayne Pharmaceuticals.

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Characteristics of COVID-19 Cases and Outbreaks at Child Care Facilities — District of Columbia, July–December 2020

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The occurrence of cases of COVID-19 reported by child care facilities among children, teachers, and staff members is correlated with the level of community spread (*1*,*2*). To describe characteristics of COVID-19 cases at child care facilities and facility adherence to guidance and recommendations, the District of Columbia (DC) Department of Health (DC Health) and CDC reviewed COVID-19 case reports associated with child care facilities submitted to DC Health and publicly available data from the DC Office of the State Superintendent of Education (OSSE) during July 1–December 31, 2020. Among 469 licensed child care facilities, 112 (23.9%) submitted 269 reports documenting 316 laboratory-confirmed cases and three additional cases identified through DC Health's contact tracers. Outbreaks associated with child care facilities,[†] defined as two or more laboratory-confirmed and epidemiologically linked cases at a facility within a 14-day period (*3*), occurred in 27 (5.8%) facilities and accounted for nearly one half (156; 48.9%) of total cases. Among the 319 total cases, 180 (56.4%) were among teachers or staff members. The majority (56.4%) of facilities reported cases to DC Health on the same day that they were notified of a positive test result for SARS-CoV-2, the virus that causes COVID-19, by staff members or parents.[§] Facilities were at increased risk for an outbreak if they had been operating for <3 years, if symptomatic persons sought testing ≥3 days after symptom onset, or if persons with asymptomatic COVID-19 were at the facility. The number of outbreaks associated with child care facilities was limited. Continued implementation and maintenance of multiple prevention strategies, including vaccination, masking, physical distancing, cohorting, screening, and reporting, are important to reduce transmission of SARS-CoV-2 in child care facilities and to facilitate a timely public health response to prevent outbreaks.[¶]

During May 29–June 21, 2020, DC Health instituted phase 1 reopening guidance for child care facilities, which recommended daily health screening; mandatory use of cloth or disposable face masks for adults and recommended use for children aged ≥2 years; physical distancing (≥6 ft), especially during meals and naps; limiting the size of classes or cohorts[**] to ≤10 persons; limiting interactions between cohorts; using partitions between groups; and increasing the frequency of hand hygiene, cleaning, and disinfection of high-touch surfaces. It was recommended that mouthed or soiled toys should be set aside, cleaned, and sanitized before reuse. Proper operation of ventilation systems according to the manufacturer and increased circulation of outdoor air (open windows) were also recommended. On June 22, DC Health instituted phase 2 guidance, in which previous recommendations were changed to requirements and updated to include limiting cohort sizes to 12 persons,[††] minimizing the use of floating teachers or staff members between classes,[§§] staggering arrival and departure times for children, requiring masks for children aged ≥2 years (other than those with developmental exceptions), and detailed requirements for reporting cases to DC Health (*4*).

Child care facilities were required to report COVID-19 cases among attending employees, children, or visitors through an online consult form on a dedicated website (*5*). Upon receipt of a report, DC Health investigated the case, shared public

* These authors contributed equally to this report.

† The Council of State and Territorial Epidemiologists defines an outbreak as two or more laboratory-confirmed COVID-19 cases among students or staff members with onset of illness within a 14-day period, that are epidemiologically linked, among persons who do not share a household, and are not listed as a close contact of each other in another setting during standard case investigation or contact tracing.

§ A COVID-19 case was defined as a positive nucleic acid amplification test, including positive reverse transcription–polymerase chain reaction test, or positive rapid antigen test result for SARS-CoV-2, in a person who was physically present at a child care facility. Symptomatic persons who did not have laboratory confirmation of infection were not included.

¶ Even after child care providers and staff members are vaccinated, prevention measures will need to be continued for the foreseeable future including wearing masks, physical distancing, and other important prevention strategies outlined in the latest CDC guidance document available at https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/guidance-for-childcare.html.

** CDC's definition for cohorts was used (https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/schools.html). Examples of not adhering to cohorts are adding persons to cohorts that they are not assigned to or combining cohorts because of limited staffing.

†† Phase 2 guidance was updated in mid-December 2020.

§§ Floating teachers or staff members are those who leave their assigned cohort to cover for another teacher or staff member who might be absent or on break.

health guidance, and identified a list of close contacts[¶] who needed to quarantine (*6*). This study reviewed data, including qualitative notes, from case investigations of child care facilities that reported to DC Health during July 1–December 31, 2020. The analysis also used publicly available data from OSSE[***] on child care facilities licensed in DC as of December 31, 2020. During July 1–December 31, a total of 354 reports were submitted by 145 child care facilities (Supplementary Figure, https://stacks.cdc.gov/view/cdc/105818). Most (291; 72%) cases were reported to DC Health on the same day that staff members or parents notified the facility of a positive SARS-CoV-2 test result.[†††] Of the 354 reports received, 85 were excluded from the analysis for the following reasons: 1) duplicate submissions (14); 2) incomplete investigations because of facility nonresponse or lack of information (17); and 3) incorrect reporting of cases (e.g., household member not attending the facility received a positive SARS-CoV-2 test result [54]). The final analysis included 112 facilities that submitted 269 reports documenting laboratory-confirmed COVID-19 in 316 cases; three additional cases were identified through DC Health's contact tracing data. Symptomatic persons without laboratory confirmation of infection were not included. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[§§§]

Characteristics of child care facilities, cases, and facility-associated outbreaks were included in the analysis. Modified Poisson generalized linear models with robust error variance were used to estimate the crude risk ratios (RRs) and 95% confidence intervals of facility characteristics associated with outbreak status. P-values ≤0.05 were considered statistically significant. Statistical analyses were conducted using Stata (version 16; StataCorp).

During July 1–December 31, COVID-19 cases were reported from 112 facilities, including 102 (91.1%) center-based facilities and 10 (8.9%) home-based facilities (Table 1). Among facilities with reported cases, 55 (49.1%) had one COVID-19 case, and 30 (26.8%) had two or more cases not identified as outbreak-associated (i.e., not epidemiologically linked within a 14-day period). Twenty-nine index cases from 27 facilities resulted in 127 additional cases that met the outbreak-associated case definition (median of three outbreak-associated cases per index case); 69 (44.2%) outbreak-associated cases were from five facilities with ≥10 cases each. Among 319 total cases reported, 148 (46.4%) were among teachers, 139 (43.6%) were among children, and 32 (10.0%) were among staff members. Sixty-eight (21.3%) persons with COVID-19 were asymptomatic,[¶¶¶] 43 (63.2%) of whom were children. A total of 1,830 close contacts were identified, with a median of five close contacts per case or 11 per facility (a median of nine close contacts per facility without an outbreak and a median of 27 close contacts per facility with an outbreak). Three facility characteristics were associated with increased risk for an outbreak. First, being in operation for ≤3 years (compared with ≥10 years) was associated with a RR of 3.29. Second, facilities with COVID-19 cases among symptomatic persons who sought testing ≥3 days after symptom onset were at increased risk compared with those in which symptomatic persons sought testing 1–2 days after symptom onset (RR = 2.03). Finally, facilities with asymptomatic cases were at increased risk compared with those without asymptomatic cases (RR = 2.10). Nearly three quarters of overall cases (231; 72.4%) and facility-associated outbreak cases (111; 71.2%) were reported after October 27, 2020, when percentages of positive test results in the community began to increase (Figure).

Summary

What is already known about this topic?

COVID-19 cases reported at child care facilities are correlated with level of community transmission.

What is added by this report?

Among 469 child care facilities in the District of Columbia, 23.9% reported at least one COVID-19 case, and 5.8% reported outbreak-associated cases during July 1–December 31, 2020. Among 319 cases, approximately one half were among teachers or staff members. Outbreak risk was increased in facilities operating <3 years, with symptomatic persons who sought testing ≥3 days after symptom onset, or with asymptomatic cases.

What are the implications for public health practice?

Implementation and maintenance of multiple prevention strategies are important to reduce SARS-CoV-2 transmission in child care facilities and to facilitate a timely public health response to prevent outbreaks.

[¶] Close contacts were defined as persons exposed to an index patient at a facility within 6 ft for ≥15 minutes during a 24-hour period while the index patient was infectious (48 hours before through 10 days after symptom onset or, if asymptomatic, 48 hours before through 10 days after specimen collection). DC Health's approach was to quarantine the class or cohort to which the index patient belonged whenever the person was physically present at the facility during their infectious period, given the limited capacity to maintain physical distancing. Quarantine up to 14 days was recommended for all close contacts; follow-up was conducted by DC Health's contact tracing team.

[***] https://osse.dc.gov/publication/child-development-facilities-listing

[†††] Based on the date when a facility reported being notified of a positive SARS-CoV-2 test result and date when a consult form was submitted to DC Health.

[§§§] 45 C.F.R. part 46.102(l)(2), 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.

[¶¶¶] Asymptomatic persons with COVID-19 when interviewed by a case investigator or followed up with public health monitoring if they were DC residents.

TABLE 1. Characteristics of child care facilities and reported COVID-19 cases* — District of Columbia, July–December 2020

Characteristic	Total (N = 112)†	No. (%)		RR (95% CI)¶
		Facilities with cases not associated with outbreaks (n = 85)	Facilities with outbreak-associated cases§ (n = 27)	
Total facilities				
Center-based	102	78 (76.5)	24 (23.5)	Ref
Home-based	10	7 (70.0)	3 (30.0)	1.28 (0.46–3.50)
No. of years of operation				
≤3	28	16 (57.1)	12 (42.9)	3.29** (1.38–7.80)
4–9	35	26 (74.3)	9 (25.7)	1.97 (0.77–5.04)
≥10	46	40 (87.0)	6 (13.0)	Ref
No. of children enrolled				
≤20	12	10 (83.3)	2 (16.7)	0.59 (0.15–2.28)
21–80	47	35 (74.5)	12 (25.5)	0.90 (0.46–1.77)
>80	46	33 (71.7)	13 (28.3)	Ref
Average no. of days from symptom onset to SARS-CoV-2 testing				
0 (same day)	5	5 (100.0)	0	—††
1–2	58	47 (81.0)	11 (19.0)	Ref
≥3	39	24 (61.5)	15 (38.5)	2.03** (1.04–3.95)
Asymptomatic or presymptomatic during testing	10	N/A	N/A	N/A
Average no. of days from specimen collection to facility notification of result				
0 (same day)	11	10 (90.9)	1 (9.1)	Ref
1–2	64	50 (78.1)	14 (21.9)	2.41 (0.35–16.64)
≥3	37	25 (67.6)	12 (32.4)	3.57 (0.52–24.69)
Average no. of days for facility to report case to DC Department of Health				
0 (same day)	62	51 (82.3)	11 (17.7)	Ref
1	24	15 (62.5)	9 (37.5)	2.11** (1.00–4.46)
≥2	24	18 (75.0)	6 (25.0)	1.41 (0.58–3.40)
Asymptomatic cases				
No	74	61 (82.4)	13 (17.6)	Ref
Yes	38	24 (63.2)	14 (36.8)	2.10** (1.10–4.01)

Abbreviations: CI = confidence interval; DC = District of Columbia; N/A = not applicable; Ref = referent; RR = risk ratio.

* A COVID-19 case was defined as a positive nucleic acid amplification test, including positive reverse transcription–polymerase chain reaction test, or positive rapid antigen test result for SARS-CoV-2 in a person who was physically present at a child care facility.

† Some characteristics might not sum to 112 because of missing values.

§ A facility-associated outbreak was defined as two or more laboratory-confirmed COVID-19 cases among children or staff members with onset of illness within a 14-day period, who are epidemiologically linked, do not share a household, and are not listed as a close contact of one another in another setting during standard case investigation or contact tracing.

¶ Calculated using a modified Poisson generalized linear model with robust error variance.

** p-value ≤0.05.

†† Category omitted from model because of perfect prediction.

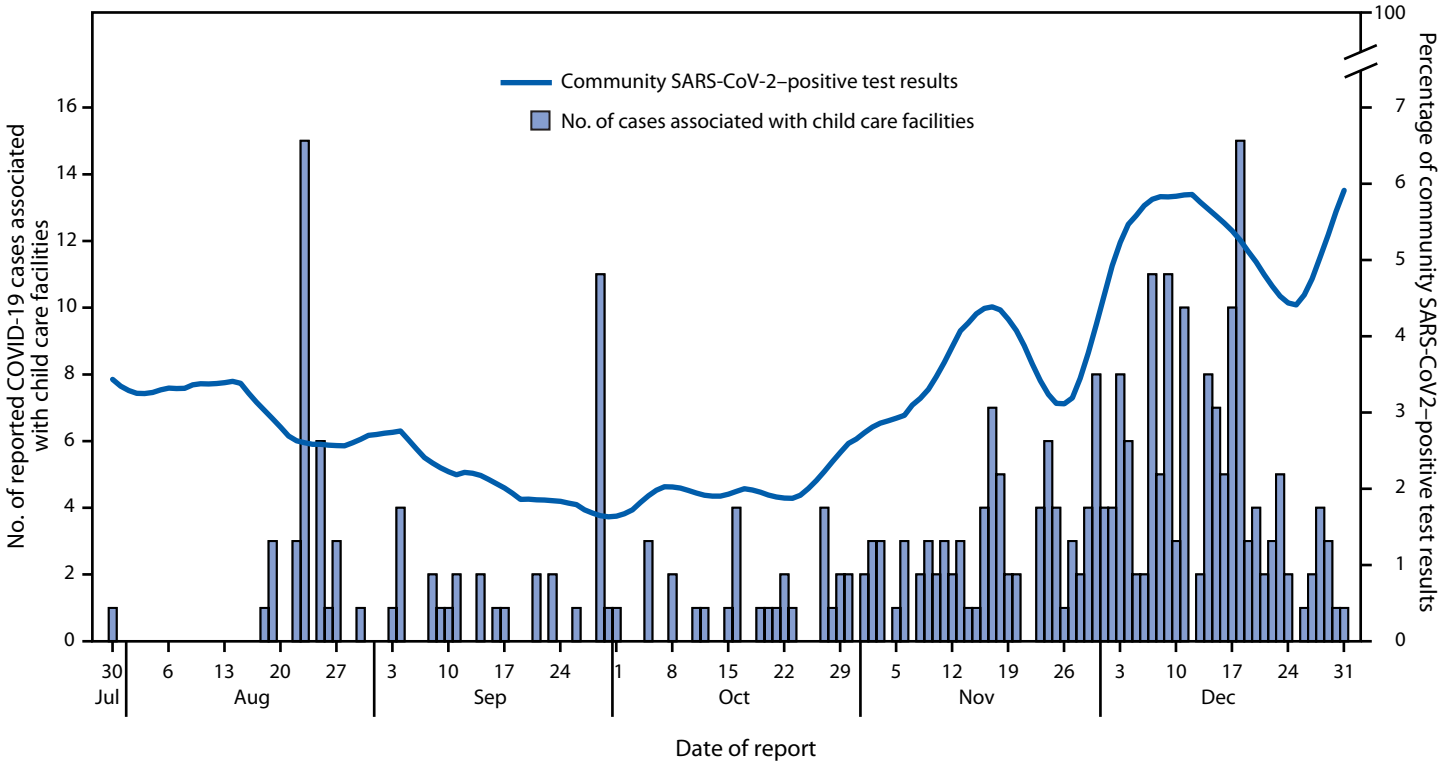
The most commonly reported prevention measures implemented by facilities with outbreaks were requirements that masks be worn by teachers and staff members (100%), sending symptomatic employees home immediately (96.3%), limiting class sizes to ≤10 persons (92.6%), and increasing frequency of cleaning and disinfection (74.1%) (Table 2). Facilities with outbreaks often reported difficulty adhering to guidance on symptom monitoring, cohorting, staggered arrival and departure times, limiting physical distance among teachers or staff members (e.g., congregating before classes or carpooling), and minimizing floating of teachers or staff members between classes because of staffing shortages.

Discussion

This study found limited occurrence of facility-associated outbreaks within DC child care facilities. One quarter of licensed child care facilities reported at least one case; however, facility-associated outbreaks occurred in 27 (5.8%) facilities, accounting for approximately one half of total cases reported from child care facilities (approximately one half of which were reported from five facility-associated outbreaks). Child care facilities in DC were able to adhere to many recommended prevention measures and reporting requirements to prevent the spread of COVID-19.

As has been observed in other studies, the rise in COVID-19 cases and outbreaks among these facilities correlated with the level of community spread (*1*). Although most facilities reported one or two isolated cases during the study period,

FIGURE. COVID-19 cases associated with child care facilities (N = 319), by date of case report and 7-day moving average percentage of community SARS-CoV-2–positive test results — District of Columbia, July 30–December 31, 2020



overall, five close contacts per case were identified in child care facilities, compared with 1.2 per case from a study on community-level contact tracing during a similar period (*7*). Delays of ≥3 days in seeking testing of symptomatic persons was associated with outbreaks. The large number of close contacts identified in these facilities and extended exposure to symptomatic persons might have increased the likelihood of spread and delayed notification and public health response; symptom monitoring for early isolation and diagnosis upon symptom onset is critical to reduce outbreak-associated cases.

Approximately 20% of cases occurred in asymptomatic persons, and most asymptomatic cases were in children, which is similar to findings from a Wisconsin report describing outbreaks in schools (*2*). In addition, outbreaks associated with child care facilities typically involved a large proportion of asymptomatic cases, underscoring the importance of implementing a combination of prevention strategies, including quarantine of close contacts, to prevent outbreaks. Outbreak-associated cases were more likely to occur in facilities operating for ≤3 years, compared with those in facilities operating for ≥10 years. Older, more established facilities might have increased resources or experience in implementing infectious disease prevention measures (*8*). Implementing prevention measures requires resources, and additional revenue losses also might occur because of decreased enrollment and insufficient staffing following quarantining of children, teachers, or staff members (*8*). DC Health's guidance recommended that teachers and staff members not float between classrooms, but some facilities reported continuing the practice because of challenges associated with staffing shortages. For facilities with subsidized child care services, OSSE introduced a Public Health Emergency Subsidy Rate in January 2021 to offset increased costs or reduced revenues associated with the pandemic (*8*).

The findings in this report are subject to at least five limitations. First, data come from child care facility–based case investigations at a single time point and might miss secondary cases. Although facilities were required to report every case, if subsequent cases were not reported, DC Health was unable to account for residents of other jurisdictions, or those who received tests in other jurisdictions. Second, cases might be underestimated because symptomatic persons who did not have laboratory confirmation of COVID-19 were not included. Third, asymptomatic persons identified through investigations are also likely underestimated because asymptomatic contacts were unlikely to receive tests. Fourth, verifying prevention measures implemented and risks or challenges documented was not possible. Finally, data on whether child care facilities closed and reopened during the study period were not available, and

TABLE 2. Prevention measures, risk factors, and challenges associated with prevention of COVID-19 transmission reported during investigations of child care facilities with COVID-19 outbreaks (n = 27)* — District of Columbia, July–December 2020

Prevention measures, risk factors, and challenges	No. (%)
Prevention measure	
Masks worn by teachers and staff members	27 (100.0)
Teachers or staff members with symptoms sent home immediately	26 (96.3)
Cohort size limited to ≤10 persons†	25 (92.6)
Increased daily cleaning and disinfection	20 (74.1)
Temperature monitoring	17 (63.0)
Symptom monitoring of children and staff members	15 (55.6)
No interactions between cohorts	14 (51.9)
Cleaning and disinfecting by third party	10 (37.0)
Staggered arrival and departure times	2 (7.4)
Risk and challenge	
Limited physical distancing within cohort	27 (100.0)
Limited physical distancing among teachers or staff members from different cohorts	15 (55.6)
Teachers or staff members floated§ between classrooms	10 (37.0)
Break room available for teachers and staff members	4 (14.8)
Siblings in multiple affected cohorts	3 (11.1)
Interactions between separate cohorts	2 (7.4)
External playdates among children of same or different cohorts from child care facility	2 (7.4)
Symptomatic teachers or staff members told to continue working	1 (3.7)

* All guidance recommendations are not included in this table because they might not have been documented during case investigations. Only facilities with an outbreak are included.

† Cohort size limit increased to 12 persons during phase 2 guidance updated in mid-December 2020 (https://coronavirus.dc.gov/sites/default/files/dc/sites/coronavirus/page_content/attachments/Phase_Two_COVID-19_DC_Health_Guidance_For-Childcare_2021.01.15_FINAL.pdf).

§ Floating teachers or staff members are those who leave their assigned cohort to cover for another teacher or staff member who is absent or on break.

information on prevention measures was more readily available for facilities with outbreaks because of the more in-depth investigations that took place.

Similar to outbreaks reported in school settings (*2*,*9*,*10*), those associated with child care facilities, including outbreak-associated cases, remained low. Implementation and maintenance of multiple prevention strategies, including vaccination, masking, physical distancing, cohorting, screening, and reporting, are important to reduce transmission of SARS-CoV-2 in child care facilities and to facilitate a timely public health response to prevent outbreaks.

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The Advisory Committee on Immunization Practices' Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine in Adolescents Aged 12–15 Years — United States, May 2021

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The Pfizer-BioNTech COVID-19 (BNT162b2) vaccine is a lipid nanoparticle–formulated, nucleoside-modified mRNA vaccine encoding the prefusion spike glycoprotein of SARS-CoV-2, the virus that causes COVID-19. Vaccination with the Pfizer-BioNTech COVID-19 vaccine consists of 2 intramuscular doses (30 μg, 0.3 mL each) administered 3 weeks apart. On December 11, 2020, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for use of the Pfizer-BioNTech COVID-19 vaccine (Pfizer, Inc; Philadelphia, Pennsylvania) in persons aged ≥16 years (*1*); on December 12, 2020, the Advisory Committee on Immunization Practices (ACIP) issued an interim recommendation for use of the vaccine in the same age group (*2*). As of May 12, 2021, approximately 141.6 million doses of the Pfizer-BioNTech COVID-19 vaccine had been administered to persons aged ≥16 years.* On May 10, 2021, FDA expanded the EUA for the Pfizer-BioNTech COVID-19 vaccine to include adolescents aged 12–15 years (*1*). On May 12, 2021, ACIP issued an interim recommendation† for use of the Pfizer-BioNTech COVID-19 vaccine in adolescents aged 12–15 years for the prevention of COVID-19. To guide its deliberations regarding the vaccine, ACIP used the Evidence to Recommendation (EtR) Framework,§ using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.¶ The ACIP recommendation for the use of the Pfizer-BioNTech COVID-19 vaccine in persons aged ≥12 years under an EUA is interim and will be updated as additional information becomes available.

Since June 2020, ACIP has convened 14 public meetings to review data on the epidemiology of COVID-19 and the potential use of COVID-19 vaccines, including the Pfizer-BioNTech COVID-19 vaccine (*3*). The ACIP COVID-19 Vaccines Work Group, comprising experts in infectious diseases, vaccinology, vaccine safety, public health, and ethics, has held weekly meetings to review COVID-19 surveillance data, evidence for vaccine efficacy and safety, and implementation considerations for COVID-19 vaccines. Within the EtR Framework for the Pfizer-BioNTech COVID-19 vaccine for adolescents aged 12–15 years, ACIP considered the importance of COVID-19 as a public health problem, as well as issues of resource use, benefits and harms, patients' and parents' values and preferences, acceptability, feasibility, and equity for use of the vaccine among adolescents. After a systematic review of published and unpublished evidence for benefits and harms, the Work Group used the GRADE approach to assess the certainty of evidence for outcomes related to the vaccine, rated on a scale of 1 (high certainty) to 4 (very low certainty) (*4*). Work Group conclusions regarding the evidence for the Pfizer-BioNTech COVID-19 vaccine were presented to ACIP at a public meeting on May 12, 2021.

The body of evidence for the Pfizer-BioNTech COVID-19 vaccine was primarily guided by one randomized, double-blind, placebo-controlled Phase II/III clinical trial that was expanded to enroll approximately 2,200 participants aged 12–15 years, randomized 1:1 to receive vaccine or saline placebo (*5*). Interim findings from this clinical trial were based on data from participants with a median of 2 months of follow-up. The estimated efficacy of the Pfizer-BioNTech COVID-19 vaccine was supported by two types of evidence: clinical efficacy and immunobridging. In the direct clinical assessment, efficacy was 100% (95% confidence interval [CI] = 75.3%–100%) in preventing symptomatic, laboratory-confirmed COVID-19 in adolescents aged 12–15 years without evidence of previous SARS-CoV-2 infection. Vaccine efficacy was also supported by immunobridging data from vaccine recipients aged 12–15 years compared with those from recipients aged 16–25 years. The immune response to 2 doses of the Pfizer-BioNTech COVID-19 vaccine in adolescents aged 12–15 years without evidence of previous SARS-CoV-2 infection was at least as high as the response observed in persons aged 16–25 years; the geometric mean ratio for 50% neutralizing antibody titer

* Accessed May 12, 2021. https://covid.cdc.gov/covid-data-tracker/#vaccinations

† On May 12, 2021, ACIP voted 14–0 (one recusal) in favor of the interim recommendation for use of Pfizer BioNTech COVID-19 vaccine for persons aged 12–15 years. One ACIP member recused herself because of participation in clinical trials and other studies involving companies producing COVID-19 vaccines.

§ https://www.cdc.gov/vaccines/acip/recs/grade/downloads/ACIP-evidence-rec-frame-508.pdf

¶ https://www.cdc.gov/vaccines/acip/recs/grade/about-grade.html

was 1.76 (95% CI = 1.47–2.10), demonstrating statistical noninferiority.** Among adolescent vaccine recipients aged 12–15 years, reactogenicity symptoms, defined as solicited local injection site or systemic reactions during the 7 days after vaccination, were frequent (90.9% of vaccine recipients reported any local reaction, and 90.7% reported any systemic reaction) and mostly mild to moderate. Systemic adverse reactions were more commonly reported after the second dose than after the first dose, had a median onset of 1–4 days after vaccine receipt, and resolved in a median of 1–2 days. Severe local and systemic adverse reactions (grade ≥3, defined as interfering with daily activity) occurred more commonly in vaccine recipients than in placebo recipients. Among vaccine recipients, 10.7% reported any reaction of grade ≥3; the most common symptoms were fatigue (3.5%), fever (3.0%), headache (2.7%), chills (2.1%), and injection-site pain (1.5%). Overall, reactions of grade ≥3 were also more commonly reported after the second dose than after the first dose. The frequency of serious adverse events†† was low among all participants; five serious adverse events (0.4%) were reported among vaccine recipients and two (0.2%) among placebo recipients, with no statistically significant difference in frequency observed between the two groups (*5*). These serious adverse events encompassed medical events occurring at a frequency similar to that in the general population aged 12–15 years, with none considered to be related to vaccination (*5*). No specific safety concerns were identified among adolescent vaccine recipients. A detailed summary of safety data, including information on reactogenicity, is available at https://www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/reactogenicity.html.

From the GRADE evidence assessment, the level of certainty for the benefits of Pfizer-BioNTech COVID-19 vaccination among adolescents aged 12–15 years was type 1 (high certainty) for the prevention of symptomatic COVID-19. Regarding potential harms after vaccination, evidence was type 4 (very low certainty) for serious adverse events and type 1 (high certainty) for reactogenicity. No data were available to assess the other GRADE benefits and harms including prevention of hospitalization due to COVID-19, prevention of multisystem inflammatory syndrome in children (MIS-C), SARS-CoV-2 seroconversion to a nonspike protein, or prevention of asymptomatic SARS-CoV-2 infection.

Data reviewed within the EtR Framework supported the use of the Pfizer-BioNTech COVID-19 vaccine in adolescents aged 12–15 years. ACIP determined that COVID-19 in adolescents is a major public health problem. Adolescents represent a growing proportion of new COVID-19 cases reported to CDC§§ and have been shown to contribute to household transmission (*6*). As of May 1, 2021, the cumulative COVID-19–associated hospitalization rate for adolescents aged 12–17 years was 51.3 per 100,000 population,¶¶ which is higher than the influenza-associated hospitalization rate for the same age group during the 2009 H1N1 influenza pandemic (23.9 per 100,000 population).*** As of May 3, 2021, CDC had received reports of 3,742 cases of MIS-C, a severe hyperinflammatory syndrome occurring several weeks after acute SARS-CoV-2 infection; 21.5% of the MIS-C cases have occurred in adolescents aged 12–17 years.††† ACIP determined that use of the Pfizer-BioNTech COVID-19 vaccine among adolescents is a reasonable and efficient allocation of resources. Whereas there might be uncertainty regarding how different populations value the vaccine, results from several surveys suggest that approximately one half of parents were willing to have their adolescent children vaccinated (range = 46%–60%).§§§ Overall, ACIP determined that the desirable effects clearly outweighed any undesirable effects in most settings. In expanding COVID-19 vaccine access, additional considerations should be given to demographic groups with disproportionate COVID-19 morbidity and mortality, as well as those with barriers to routine health care (e.g., adolescents of certain racial/ethnic groups and those living in a rural or frontier area, experiencing homelessness, having a disability, or lacking health insurance). Providing rapid and equitable access to COVID-19 vaccine for adolescents will require a stepwise approach, including augmenting existing infrastructure for vaccination, increasing enrollment of providers caring for adolescents into the COVID-19 vaccination program, and applying school-focused strategies to ensure vaccination opportunities for a diverse population. Some aspects of the Pfizer-BioNTech COVID-19 vaccine (e.g., cold-chain storage requirements or large minimum order sizes) might limit access to the vaccine among some populations, which could negatively affect health equity. Advancing health equity, particularly in populations that experience disproportionate COVID-19 morbidity and mortality, requires engagement with community leaders, adolescent health care providers, and parents to identify and remove barriers to COVID-19 vaccination, including those related to vaccine access and vaccine

** 1.5-fold noninferiority criterion: lower bound of the two-sided 95% CI for geometric mean ratio >0.67.

†† Serious adverse events are defined as any untoward medical occurrence that results in death, is life-threatening, requires inpatient hospitalization or prolongation of existing hospitalization, or results in persistent disability/incapacity.

§§ https://covid.cdc.gov/covid-data-tracker/#demographicsovertime

¶¶ https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html

*** https://gis.cdc.gov/GRASP/Fluview/FluHospRates.html

††† https://www.cdc.gov/mis-c/cases/index.html

§§§ https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-pfizer-biontech-etr-12-15-years.html

confidence. The GRADE evidence profile and EtR supporting evidence are available at https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-pfizer-biontech-vaccine-12-15-years.html and https://www.cdc.gov/vaccines/acip/recs/grade/covid-19-pfizer-biontech-etr-12-15-years.html.

Before vaccination, the EUA Fact Sheet should be provided to recipients and parents or guardians. There is no federal, legal requirement for caregiver consent for COVID-19 vaccination or any other vaccination; however, COVID-19 vaccine must be administered according to applicable state and territorial vaccination laws. Providers should counsel Pfizer-BioNTech COVID-19 vaccine recipients and parents or guardians about expected systemic and local reactogenicity. Additional clinical considerations are available at https://www.cdc.gov/vaccines/covid-19/info-by-manufacturer/pfizer/clinical-considerations.html. The interim recommendation and clinical considerations are based on use of the Pfizer-BioNTech COVID-19 vaccine under an EUA and might change as more evidence becomes available. ACIP will continue to review additional data as they become available; updates to recommendations or clinical considerations will be posted on the ACIP website (https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html).

Reporting of Vaccine Adverse Events

FDA requires that vaccination providers report vaccination administration errors, serious adverse events, cases of multisystem inflammatory syndrome, and cases of COVID-19 that result in hospitalization or death after administration of COVID-19 vaccine under an EUA (*7*). Adverse events that occur after receipt of any COVID-19 vaccine should be reported to the Vaccine Adverse Events Reporting System (VAERS). Information on how to submit a report to VAERS is available at https://vaers.hhs.gov/index.html or 1-800-822-7967. Any person who administers or receives a COVID-19 vaccine is encouraged to report any clinically significant adverse event, whether or not it is clear that a vaccine caused the adverse event. In addition, CDC has developed a new, voluntary smartphone-based online tool (v-safe) that uses text messaging and online surveys to provide near real-time health check-ins after receipt of a COVID-19 vaccine. Parents or guardians can register their adolescent children in v-safe and complete the health surveys on their behalf. CDC's v-safe call center follows up on reports to v-safe that include possible medically significant health events to collect additional information for completion of a VAERS report. Information on v-safe is available at https://www.cdc.gov/vsafe.

Summary

What is already known about this topic?

On May 10, 2021, the Food and Drug Administration expanded Emergency Use Authorization for the Pfizer-BioNTech COVID-19 vaccine to include adolescents aged 12–15 years.

What is added by this report?

On May 12, 2021, after a systematic review of all available data, the Advisory Committee on Immunization Practices made an interim recommendation for use of the Pfizer-BioNTech COVID-19 vaccine in adolescents aged 12–15 years for the prevention of COVID-19.

What are the implications for public health practice?

The Pfizer-BioNTech COVID-19 vaccine is the first COVID-19 vaccine approved for use in adolescents and has high efficacy against symptomatic COVID-19. Vaccination will be important to protect adolescents against symptomatic COVID-19 disease and to reduce community transmission of SARS-CoV-2.

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Please note: This report has been corrected.

Morbidity and Mortality Weekly Report

Interim Estimates of Vaccine Effectiveness of Pfizer-BioNTech and Moderna COVID-19 Vaccines Among Health Care Personnel — 33 U.S. Sites, January–March 2021

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On May 14, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Throughout the COVID-19 pandemic, health care personnel (HCP) have been at high risk for exposure to SARS-CoV-2, the virus that causes COVID-19, through patient interactions and community exposure (*1*). The Advisory Committee on Immunization Practices recommended prioritization of HCP for COVID-19 vaccination to maintain provision of critical services and reduce spread of infection in health care settings (*2*). Early distribution of two mRNA COVID-19 vaccines (Pfizer-BioNTech and Moderna) to HCP allowed assessment of the effectiveness of these vaccines in a real-world setting. A test-negative case-control study is underway to evaluate mRNA COVID-19 vaccine effectiveness (VE) against symptomatic illness among HCP at 33 U.S. sites across 25 U.S. states. Interim analyses indicated that the VE of a single dose (measured 14 days after the first dose through 6 days after the second dose) was 82% (95% confidence interval [CI] = 74%–87%), adjusted for age, race/ethnicity, and underlying medical conditions. The adjusted VE of 2 doses (measured ≥7 days after the second dose) was 94% (95% CI = 87%–97%). VE of partial (1-dose) and complete (2-dose) vaccination in this population is comparable to that reported from clinical trials and recent observational studies, supporting the effectiveness of mRNA COVID-19 vaccines against symptomatic disease in adults, with strong 2-dose protection.

A test-negative design case-control study of mRNA COVID-19 VE is underway, with HCP being enrolled at 33 sites across 25 U.S. states; the planned interim analysis presented in this report includes data collected during January–March 2021.* A majority (75%) of enrolled HCP worked at acute care hospitals (including emergency departments), 25% worked in outpatient or specialty clinics, and <1% worked in long-term care facilities and urgent care clinics. HCP with the potential for exposure to SARS-CoV-2 through direct patient contact or for indirect exposure (e.g., through infectious materials) were eligible for enrollment.† Case-patients and control participants (controls) were identified through routine employee testing performed based on site-specific occupational health practices. HCP with a positive SARS-CoV-2 polymerase chain reaction (PCR) or antigen-based test result and at least one COVID-19–like illness symptom§ were enrolled as case-patients, and HCP with a negative SARS-CoV-2 PCR test result, regardless of symptoms, were eligible for enrollment as controls. Controls were frequency matched to case-patients (aiming for a ratio of three controls per case-patient) by site and week of test. HCP who reported having received a positive SARS-CoV-2 PCR or antigen-based test result >60 days earlier (i.e., with a previous SARS-CoV-2 infection) were excluded. Information on demographics, COVID-19–like illness symptoms within 14 days before or after the testing date, and presence of underlying conditions and risk factors for severe COVID-19¶ were collected through HCP interviews or self-completed surveys. Medical records were reviewed to collect data on SARS-CoV-2 test dates, type, and results and on medical care sought for COVID-19–like illness. Vaccination records, including dates and type of COVID-19 vaccine received, were obtained from occupational health or other verified sources (e.g., vaccine card, state registry, or medical record).

* https://www.cdc.gov/vaccines/covid-19/downloads/hcp-early-phase-protocol-508.pdf

† https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-risk-assesment-hcp.html

§ Health care personnel are considered symptomatic if one or more of the following signs and symptoms are present 14 days before or after the test date: fever (documented ≥100.4°F [38.0°C] or subjective), chills, cough (dry or productive), shortness of breath, chest pain or tightness, fatigue or malaise, sore throat, headache, runny nose, congestion, muscle aches, nausea or vomiting, diarrhea, abdominal pain, altered sense of smell or taste, loss of appetite, or red or bruised toes or feet.

¶ Underlying conditions grouped based on CDC guidelines identifying conditions associated or potentially associated with risk for severe COVID-19 illness. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

HCP were defined as unvaccinated if they had not received any COVID-19 vaccine doses or had received their first dose after the test date. The interval of 0–13 days from receipt of the first dose was defined as the time before first dose vaccine effect. The effectiveness of a single dose was measured during the interval from 14 days after the first dose through 6 days after the second dose. Because of the potential for vaccine-related reactions to influence HCP testing behaviors, sensitivity analyses of single-dose VE were conducted 1) excluding participants tested within 0–2 days of receiving the second dose and 2) measuring VE before receiving the second dose. Effectiveness of 2 doses was measured ≥7 days after the receipt of the second dose, consistent with the Pfizer-BioNTech clinical trial procedure (*3*). Sensitivity analyses measuring 2-dose effectiveness ≥14 days after the second dose were conducted, consistent with the Moderna clinical trial procedure (*4*). Conditional logistic regression was used to estimate matched odds ratios (mORs) adjusted for age, race/ethnicity, and presence of underlying conditions. VE was estimated as 100% × (1–mOR) for 1 or 2 doses, compared with no doses. Because of the small sample size, analyses could not be stratified by COVID-19 vaccine type. All statistical analyses were conducted using SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.**

As of March 18, 2021, 623 case-patients and 1,220 controls had been enrolled. The median ages of case-patients and controls were 38 years (range = 19–69 years) and 37 years (range = 19–76 years), respectively (Table 1). The majority of HCP (60% of case-patients and 64% of controls) worked in occupational categories with substantial anticipated direct patient contact and were aged 19–49 years (75% and 76%, respectively), female (84% and 82%, respectively), and non-Hispanic White (64% and 70%, respectively). Underlying conditions associated with increased risk for severe COVID-19 were reported by 77% of case-patients and 75% of controls. Case-patients were significantly more likely than controls to have fever (40% versus 23%, p<0.001), cough (56% versus 22%, p<0.001), or shortness of breath (26% versus 7%, p<0.001); 5% of case-patients and 14% of controls reported only mild symptoms (sore throat, headache, runny nose, or congestion; p<0.001); 17% of controls reported no symptoms. Only 12 (2%) case-patients and 10 (1%) controls had severe illness requiring hospitalization, and no deaths occurred in either group.

Ten percent of case-patients and 20% of controls had received 1 dose of COVID-19 vaccine ≥14 days before the test date, and 3% of case-patients and 15% of controls had received 2 doses ≥7 days before the test date (Table 2). Among vaccinated persons, 76% of case-patients and 78% of controls received the Pfizer-BioNTech vaccine; the remainder received the Moderna vaccine. The adjusted single-dose VE was 82% (95% CI = 74%–87%) and was similar for both 1-dose sensitivity analyses (before dose 2: VE = 74%, 95% CI = 62%–82%; excluding days 0–2 after dose 2: VE = 78%, 95% CI = 68%–84%). The adjusted 2-dose VE was 94% (95% CI = 87%–97%); effectiveness ≥14 days after the second dose was similar (VE = 90%, 95% CI = 77%–96%).

Discussion

This multisite test-negative design case-control study found that authorized mRNA COVID-19 vaccines (Pfizer-BioNTech and Moderna) are highly effective against symptomatic COVID-19 among HCP. Effectiveness of a complete 2-dose regimen of these vaccines was estimated to be 94%, consistent with findings from two clinical trials (*3*,*4*). Although the case definition applied in this study was broader than that used in both clinical trials (*3*,*4*), 93% and 88% of cases included in this study met the respective Pfizer-BioNTech and Moderna trial case definitions. The results are also consistent with findings from an observational study among the general adult population from Israel (*5*), two cohort studies among HCP from the United Kingdom,†† and recently reported interim results from a U.S. cohort evaluation among HCP and frontline workers (*6*).

Effectiveness of a single dose, estimated to be 82% in this report, has also been demonstrated in phase III trials and recent observational studies. The estimated effectiveness found in this report is higher than estimates of single-dose effectiveness found in the Pfizer-BioNTech clinical trial (efficacy 52%; 95% CI = 30%–68%) (*3*) and an observational study from Israel (*5*). In the Israeli study, the Pfizer-BioNTech VE against symptomatic illness among the general adult population was 57% (95% CI = 50%–63%) and 66% (95% CI = 57%–73%) measured during 14–20 and 21–27 days, respectively, after the first dose (*5*). These differences might be related to the younger age of the HCP population in this study (<2% of participants aged ≥65 years) compared with the age of the Israeli study population (13% aged ≥70 years). In two cohort studies among HCP, the single-dose effectiveness of the Pfizer-BioNTech vaccine was consistent with the estimates in this report, with 72% effectiveness (95% CI = 58%–86%) 21 days after the first dose in a U.K. study (*7*) and 80% effectiveness (95% CI = 59%–90%) ≥14 days after the first dose in a U.S. cohort study (*6*). Because the single-dose

** This investigation was defined as having met the requirements for public health surveillance as defined in 45 C.F.R. part 46.102(l)(2) 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.

†† https://doi.org/10.1101/2021.03.09.21253218; https://doi.org/10.1101/2021.03.11.21253275

TABLE 1. Characteristics of health care personnel case-patients and controls — 33 U.S. sites, January–March 2021

Characteristic	No. (%) Case-patients* (N = 623)	Controls* (N = 1,220)
Age group, yrs		
Median (range)	**38 (19–69)**	**37 (19–76)**
19–49	470 (75)	931 (76)
50–64	144 (23)	257 (21)
≥65	7 (1)	24 (2)
Missing	2(<1)	8 (<1)
Sex		
Male	99 (16)	223 (18)
Female	521 (84)	996 (82)
Other	3 (<1)	1 (<1)
Race/Ethnicity		
White, non-Hispanic	401 (64)	853 (70)
Black, non-Hispanic	64 (10)	64 (5)
Hispanic/Latino	81 (13)	124 (10)
Other†	77 (13)	179 (15)
Anticipated level of HCP patient contact based on occupational category		
Substantial§	375 (60)	785 (64)
Moderate¶	60 (10)	120 (10)
Minimal**	147 (24)	221 (18)
Undefined††	41 (7)	94 (8)
Presence of one or more underlying conditions or risk factors associated with increased risk for severe COVID-19§§	**480 (77)**	**920 (75)**
Obesity (BMI >30 kg/m^2 or listed in medical record)	217 (35)	395 (32)
Overweight (BMI 25–29 kg/m^2 or listed in medical record)	186 (30)	355 (29)
Asthma	98 (16)	211 (17)
Hypertension	92 (15)	159 (13)
Diabetes mellitus¶¶	28 (4)	57 (5)
Immunocompromising condition***	25 (4)	46 (4)
Heart disease	15 (2)	61 (5)
Cerebrovascular disease	2 (<1)	4 (<1)
Neurologic condition	2 (<1)	7 (<1)
Chronic kidney disease	1 (<1)	5 (<1)
Chronic obstructive pulmonary disease	1 (<1)	6 (<1)
Other chronic lung disease	6 (<1)	16 (1)
Chronic liver disease	2 (<1)	6 (<1)
Current or former smoking†††	130 (21)	255 (21)
Pregnancy (proportion among female HCP)	13 (3)	40 (4)
Reported symptoms of illness		
Fever (measured temperature ≥100.4°F [38.0°C] or subjective)§§§	249 (40)	281 (23)
Cough (dry or productive)§§§	348 (56)	267 (22)
Shortness of breath§§§	161 (26)	80 (7)
Chills§§§	275 (44)	324 (27)
Muscle pain§§§	289 (46)	342 (28)
Altered sense of smell or taste§§§	351 (56)	45 (4)
Sore throat§§§	215 (35)	344 (28)
Diarrhea§§§	154 (25)	173 (14)
Nausea or vomiting§§§	132 (21)	186 (15)
Other symptoms¶¶¶	560 (90)	796 (65)
Hospitalized	**12 (2)**	**10 (1)**
COVID-19 vaccine status		
Unvaccinated	340 (55)	302 (25)
Received ≥1 dose before test date, by vaccine type	283 (45)	918 (75)
Pfizer-BioNTech	214 (76)	712 (78)
Moderna	68 (24)	200 (22)
Mixed product****	0	1 (0.4)
Missing product information	1 (0.4)	5 (0.5)

See table footnotes on the next page.

TABLE 1. (*Continued*) Characteristics of health care personnel case-patients and controls — 33 U.S. sites, January–March 2021

Abbreviations: HCP = health care personnel; PCR = polymerase chain reaction.

* Case-patients: HCP who received positive SARS-CoV-2 PCR or antigen-based test results and had one or more symptoms of COVID-19–like illness; controls: HCP who received negative SARS-CoV-2 PCR test results.

† Includes Asian or Pacific Islander (44 case-patients, 109 controls), American Indian or Alaska Native (23 case-patients, 35 controls), multiple races (5 case-patients, 19 controls), and missing race (5 case-patients, 16 controls).

§ Substantial patient contact occupational categories: health care providers (physicians, residents, fellows, attending physicians, nurse practitioners, and physician assistants), nurses (registered nurses, other nursing providers including intensive care unit nurses, nurse managers, and midwives), direct patient assistants (licensed practical nurses, certified nursing assistants, patient care technicians and assistants, medical assistants, COVID-19 testers, phlebotomists, home health care providers, emergency medical services providers, and paramedics), and medical therapists (physical therapists; physical therapy assistants; rehabilitation providers; rehabilitation aides; occupational therapists; speech and language pathologists; respiratory therapists; radiology technicians; dental health care providers, including dentists or dental hygienists; and surgical, medical, or emergency technicians).

¶ Moderate patient contact occupational categories: behavioral/social services providers (behavioral health providers [excluding physician psychiatrists], chaplains, social workers and assistants, care coordinators, interpreters, patient registration personnel, health educators, genetic counselors, ambulance dispatchers, dieticians, and research staff members), and environmental services providers (facilities staff members, food services workers, transport workers, patient transport workers, and drivers).

** Minimal patient contact occupational categories: administrative or ward clerks, symptom checkers, telehealth trainers, clinical support staff members, equipment and sterile processing technicians, medical equipment sales personnel, laboratory personnel, and pharmacists.

†† Undefined patient contact occupational categories: others who could not be classified into any of the preceding categories and those with missing information.

§§ Conditions associated with definite or potential increased risk for severe COVID-19 illness as defined by CDC. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fneed-extra-precautions%2Fgroups-at-higher-risk.html

¶¶ Among HCP who reported diabetes mellitus, no case-patients and two controls (<1% of all controls) reported type 1 diabetes, eight case-patients (1% of all case-patients) and nine controls (<1% of all controls) reported type 2 diabetes, and 20 case-patients (3%) and 46 controls (4%) did not specify a diabetes type.

*** Immunocompromising conditions include immunosuppression medication (e.g., corticosteroids, chemotherapy, or other immunosuppressive medications), solid organ transplant, hematopoietic stem cell transplant, HIV, thalassemia, or active cancer (current cancer or in treatment or received diagnosis within last 12 months).

††† Smoking includes cigarettes, tobacco, e-cigarettes/vaping, or marijuana use.

§§§ Statistically significant difference between case-patients and controls; chi-square test, p-value<0.001.

¶¶¶ Other symptoms include chest pain or tightness, abdominal pain, loss of appetite, red or bruised toes or feet, headache, runny nose, or congestion.

**** One person's first dose was Moderna vaccine and second dose was Pfizer-BioNTech vaccine.

TABLE 2. COVID-19 vaccine effectiveness among health care personnel case-patients and controls, by number of COVID-19 vaccine doses received before SARS-CoV-2 test date — 33 U.S. sites, January–March 2021

Interval from dose to test date	No. (%) Case-patients* (N = 623)	No. (%) Controls* (N = 1,220)	Vaccine effectiveness† % (95% CI) Unadjusted	Vaccine effectiveness† % (95% CI) Adjusted§
Dose 1				
≥14 days	64 (10)	241 (20)	82.2 (75.1–87.3)	81.7 (74.3–86.9)
Dose 2				
≤2 days	5 (<1)	109 (9)		
3–6 days	16 (3)	85 (7)		
≥7 days	19 (3)	184 (15)	93.4 (86.4–96.8)	93.5 (86.5–96.9)

Abbreviations: CI = confidence interval; HCP = health care personnel; mOR = matched odds ratio; OR = odds ratio; PCR = polymerase chain reaction; VE = vaccine effectiveness.

* Case-patients: HCP who received positive SARS-CoV-2 PCR or antigen-based test results and had one or more symptoms of COVID-19–like illness; controls: HCP who received negative SARS-CoV-2 PCR test results.

† VE (Pfizer-BioNTech and Moderna) was estimated using a conditional logistic regression model accounting for matching by site of enrollment and week of test date.

§ OR used in conditional logistic regression model to calculate VE was adjusted for age, race, and presence of underlying conditions: VE = 100% × (1−mOR).

effectiveness estimates in this and other studies were based on a short follow-up, the duration of this level of protection from a single dose is unknown.

The findings in this report are subject to at least four limitations. First, testing for SARS-CoV-2 infection among HCP was based on occupational health practices at each facility, and no changes in routine testing practices were reported after vaccine introduction. If vaccinated HCP were less likely to obtain testing than unvaccinated HCP, the VE might have been underestimated. Alternatively, if postvaccination reactions increased the likelihood that vaccinated HCP would seek testing, the VE might have been overestimated. However, the sensitivity analysis excluding the interval of 0–2 days after receipt of dose 2, the interval during which most postvaccination reactions would be expected to occur, did not significantly change effectiveness estimates. Second, because of the limited sample size, effectiveness by vaccine product, presence of underlying medical conditions, and disease severity could not be estimated. In addition, because of limited statistical power, effectiveness estimates could not be adjusted for other potential confounders, such as use of personal protective equipment, occupational categories, or workplace or community exposures. Third, the VE estimates might not be generalizable to the U.S. adult population because racial/ethnic minority groups disproportionately affected by COVID-19 and who may have had higher exposure risks in the community were underrepresented in this population, and the overall HCP population was younger than the general U.S. adult population. However, the study's geographic coverage was broad, representing the population of U.S. HCP, and vaccination data were obtained from multiple sources. Finally, although HCP with a known past acute SARS-CoV-2 infection were excluded, those whose previous infection was unknown could not be excluded. Data collection for this study is ongoing and will allow effectiveness to be evaluated by vaccine type and among HCP subgroups.

These interim results demonstrate that complete vaccination with authorized mRNA COVID-19 vaccines is highly effective in preventing symptomatic COVID-19 among HCP,

Summary

What is already known about this topic?

Health care personnel (HCP) are at high risk for COVID-19. The early distribution of two mRNA COVID-19 vaccines (Pfizer-BioNTech and Moderna) to HCP provided an opportunity to examine vaccine effectiveness in a real-world setting.

What is added by this report?

The first U.S. multisite test-negative design vaccine effectiveness study among HCP found a single dose of Pfizer-BioNTech or Moderna COVID-19 vaccines to be 82% effective against symptomatic COVID-19 and 2 doses to be 94% effective.

What are the implications for public health practice?

The mRNA vaccines are highly effective at preventing symptomatic COVID-19 among U.S. HCP. High vaccination coverage among HCP and the general population is critical to prevent COVID-19 in the United States.

supporting the results of phase III trials and additional accruing evidence in recent observational studies. Real-world VE data are critical to guiding evolving COVID-19 vaccine policy. In addition to adherence to recommended infection control and prevention practices, a critical component of controlling the U.S. COVID-19 pandemic and protecting HCP is ensuring high coverage with safe and effective COVID-19 vaccines.

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Vaccine Effectiveness Among Healthcare Personnel Study Team

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Disparities in COVID-19 Vaccination Coverage Between Urban and Rural Counties — United States, December 14, 2020–April 10, 2021

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Approximately 60 million persons in the United States live in rural counties, representing almost one fifth (19.3%) of the population.* In September 2020, COVID-19 incidence (cases per 100,000 population) in rural counties surpassed that in urban counties (*1*). Rural communities often have a higher proportion of residents who lack health insurance, live with comorbidities or disabilities, are aged ≥65 years, and have limited access to health care facilities with intensive care capabilities, which places these residents at increased risk for COVID-19–associated morbidity and mortality (*2*,*3*). To better understand COVID-19 vaccination disparities across the urban-rural continuum, CDC analyzed county-level vaccine administration data among adults aged ≥18 years who received their first dose of either the Pfizer-BioNTech or Moderna COVID-19 vaccine, or a single dose of the Janssen COVID-19 vaccine (Johnson & Johnson) during December 14, 2020–April 10, 2021 in 50 U.S. jurisdictions (49 states and the District of Columbia [DC]). Adult COVID-19 vaccination coverage was lower in rural counties (38.9%) than in urban counties (45.7%) overall and among adults aged 18–64 years (29.1% rural, 37.7% urban), those aged ≥65 years (67.6% rural, 76.1% urban), women (41.7% rural, 48.4% urban), and men (35.3% rural, 41.9% urban). Vaccination coverage varied among jurisdictions: 36 jurisdictions had higher coverage in urban counties, five had higher coverage in rural counties, and five had similar coverage (i.e., within 1%) in urban and rural counties; in four jurisdictions with no rural counties, the urban-rural comparison could not be assessed. A larger proportion of persons in the most rural counties (14.6%) traveled for vaccination to nonadjacent counties (i.e., farther from their county of residence) compared with persons in the most urban counties (10.3%). As availability of COVID-19 vaccines expands, public health practitioners should continue collaborating with health care providers, pharmacies, employers, faith leaders, and other community partners to identify and address barriers to COVID-19 vaccination in rural areas (*2*).

Data on COVID-19 vaccine doses administered in the United States are reported to CDC by jurisdictions, pharmacies, and federal entities through immunization information systems (IISs),† the Vaccine Administration Management System,§ or direct data submission.¶ Adults aged ≥18 years with a valid county of residence in one of 49 states or DC who received their first COVID-19 vaccine dose** during December 14, 2020–April 10, 2021, and whose data were reported to CDC by April 15, 2021, were included in the analysis.†† COVID-19 vaccine doses administered to persons living in Hawaii and in eight counties in California with <20,000 residents were excluded, because these states have data-sharing restrictions on county-level information reported to CDC. Vaccine doses administered to persons living in U.S. territories were also excluded because territorial jurisdictional divisions could not be mapped to urban-rural classifications at the county level.

First doses of COVID-19 vaccine were matched by county of residence to one of six urban-rural categories according to the 2013 National Center for Health Statistics (NCHS) urban-rural classification scheme. To further classify counties into two categories (urban versus rural), four of these six categories (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan) were combined into urban areas, and two (micropolitan and noncore) were combined into rural areas (*4*).

Vaccination coverage for adults aged ≥18 years was calculated overall and by age group (18–64 and ≥65 years), sex,

* https://www.census.gov/library/stories/2017/08/rural-america.html

† IISs are confidential, computerized, population-based systems that collect and consolidate vaccination data from providers in 64 jurisdictions nationwide and can be used to track administered vaccines and measure vaccination coverage. The 64 IIS jurisdictions comprise the 50 U.S. states, five U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands), three freely associated states (Marshall Islands, Micronesia, and Palau), and six local jurisdictions (Chicago, Illinois; Houston, Texas; San Antonio, Texas; Philadelphia, Pennsylvania; New York, New York; and Washington, DC).

§ https://www.cdc.gov/vaccines/covid-19/reporting/vams/program-information.html

¶ https://www.cdc.gov/vaccines/covid-19/reporting/overview/IT-systems.html

** First dose of COVID-19 vaccine is defined either as the first of 2 doses for the Pfizer-BioNTech or Moderna vaccines, or a single dose for the Janssen (Johnson & Johnson) vaccine.

†† Providers are required to document vaccination in their medical records within 24 hours of administration and submit this documentation to their jurisdiction's immunization information systems within 72 hours of administration. Five days of observation were included to account for any delays in reporting and transmission of records to CDC.

jurisdiction, and two- and six-level urban-rural classification. Coverage by race and ethnicity was not calculated because information on race and ethnicity was missing for 40% of data. Population size was obtained by county, age group, and sex from the U.S. Census Bureau's 2019 Population Estimates Program (*5*). Because only the first dose of a 2-dose vaccination series or the only dose for a single-dose vaccine were analyzed, the total number of doses allowed per county was capped at the population size of the county.[§§] The percentage of persons who traveled outside their county of residence for vaccination was calculated at the national level and stratified by jurisdiction for both the two- and six-level urban-rural classifications. Tests for statistical significance were not conducted because the data represent the U.S. population (minus Hawaii and eight counties in California) and were not based on population samples.

First-dose COVID-19 vaccination coverage was lower in rural than in urban counties for adults overall (38.9% rural, 45.7% urban) (Table); for adults aged 18–64 years (29.1% rural, 37.7% urban) and for those aged ≥65 years (67.6% rural, 76.1% urban); for women (41.7% rural, 48.4% urban); and for men (35.3% rural, 41.9% urban). Among jurisdictions, coverage varied by urban-rural classification; in 36 (72%) jurisdictions, coverage was higher in urban counties, in five (10%) coverage was higher in rural counties, and in five (10%) coverage was similar (i.e., within 1%) in both urban and rural counties. Vaccination coverage by urban-rural classification could not be calculated for four jurisdictions that had no rural counties.

Overall, 67.1% of vaccinated persons were vaccinated in their county of residence and 98.3% in their state of residence. The proportion of persons who traveled outside their county of residence for vaccination varied by jurisdiction, based on the two-level urban-rural classification (Figure 1). Analysis using the six-level urban-rural classification found that a larger proportion of persons in large fringe metropolitan counties (i.e., suburban areas) and noncore counties (i.e., the most rural areas) traveled to nonadjacent counties (i.e., farther from their county of residence) for vaccination (13.9% and 14.6%, respectively) compared with persons in the most urban counties (10.3%) (Figure 2).

Discussion

Among most U.S. jurisdictions analyzed, COVID-19 vaccination coverage was lower overall, among all age groups, and among men and women in rural compared with urban counties. Coverage among adults aged ≥65 years was higher than among younger adults in both rural and urban areas, likely because of vaccine eligibility criteria that prioritized older adults earlier in the implementation of the vaccination program before vaccination was expanded to other age groups. Notably, vaccination coverage among women in both urban and rural areas was higher than that among men, possibly because of the increased likelihood of women seeking and using preventive care services (*6*), or women working in sectors that were prioritized for early vaccination, such as health care and education.[¶¶] Because residents of rural communities are at increased risk for severe COVID-19–associated illness and death (*2*,*3*), vaccination disparities between urban and rural areas might hinder efforts to reduce morbidity and mortality from COVID-19 nationally.

Travel outside county of residence was used as a marker of potential vaccine access difficulties that might be exacerbated in rural areas with sparse vaccination sites. Analysis using the six-level urban-rural classification identified that a higher percentage of persons in the most rural counties traveled to nonadjacent counties for vaccination compared with those in the most urban counties, which might be related to challenges with vaccine access and the dearth of pharmacies in some rural areas (*7*). In addition, more persons in suburban (i.e., large fringe metropolitan) areas traveled outside their county of residence for vaccination; the reasons for this are unclear.

Although vaccination coverage was higher in urban counties compared with that in rural counties in most jurisdictions, five jurisdictions had similar vaccination rates between urban and rural counties and in another five, the rate in rural counties surpassed that of urban counties. Jurisdictional characteristics reported in news media that might have contributed to increased vaccination coverage in rural areas included implementing tailored approaches based on local needs, partnering with local community-based organizations and faith leaders, and engaging with underserved populations directly and through partners.[***,†††] Local jurisdictions are collaborating with CDC to improve access to COVID-19 vaccines in rural areas by identifying and addressing barriers to vaccination. CDC is also using multiple channels to distribute vaccines, such as federal partners (e.g., the Indian Health Service and the Health Resources and Services Administration) and the Federal Retail Pharmacy program.[§§§]

Vaccine hesitancy in rural areas is a major barrier that public health practitioners, health care providers, and local partners need to address to achieve vaccination equity. In March 2021,

[§§] For statistical analysis, the number of doses allowed per county was capped at population size minus one for a maximum vaccination coverage of 100%.

[¶¶] https://khn.org/news/article/gender-vaccine-gap-more-women-than-men-vaccinated-against-covid/

[***] https://www.cnn.com/2021/03/04/health/gila-county-arizona-vaccine-trnd/index.html

[†††] https://www.cnn.com/2021/03/09/us/alaska-covid-19-vaccine-success-trnd/index.html

[§§§] https://www.cdc.gov/vaccines/covid-19/retail-pharmacy-program/index.html

TABLE. Vaccination coverage among adults aged ≥18 years who received their first dose of COVID-19 vaccine,* by jurisdiction, sex, age group, and urban-rural classification† — United States,§ December 14, 2020–April 10, 2021

	No. (%) vaccinated								
		Six-level urban-rural classification						Two-level urban-rural classification	
Jurisdiction	Overall	Large central metropolitan	Large fringe metropolitan¶	Medium metropolitan	Small metropolitan	Micropolitan	Noncore	Urban	Rural
United States	**113,554,259 (44.7)**	**37,075,718 (47.1)**	**29,206,614 (45.8)**	**23,861,372 (45.4)**	**9,505,176 (40.9)**	**8,368,195 (39.7)**	**5,537,184 (37.8)**	**99,648,880 (45.7)**	**13,905,379 (38.9)**
Alabama	**1,294,410 (33.9)**	221,812 (43.6)	99,898 (26.1)	366,648 (36.1)	336,235 (33.0)	124,904 (30.5)	144,913 (30.4)	1,024,593 (35.0)	269,817 (30.4)
Alaska	**273,888 (49.7)**	—**	—**	148,209 (49.6)	31,389 (42.5)	22,787 (63.1)	71,503 (50.0)	179,598 (48.2)	94,290 (52.6)
Arizona	**2,514,666 (44.6)**	1,444,473 (42.1)	137,650 (38.2)	442,370 (53.2)	333,991 (44.6)	109,132 (58.1)	47,050 (61.1)	2,358,484 (43.9)	156,182 (59.0)
Arkansas	**838,457 (36.2)**	—**	10,405 (29.7)	432,025 (38.7)	96,973 (33.2)	149,145 (34.1)	149,909 (34.3)	539,403 (37.4)	299,054 (34.2)
California	**15,349,193 (50.3)**	10,168,806 (51.7)	1,986,161 (49.5)	2,543,570 (47.4)	385,248 (42.3)	200,457 (44.1)	64,951 (45.4)	15,083,785 (50.4)	265,408 (44.4)
Colorado	**2,177,824 (48.4)**	301,043 (51.1)	838,482 (48.6)	649,740 (47.7)	106,506 (42.2)	164,065 (51.3)	117,988 (47.0)	1,895,771 (48.3)	282,053 (49.4)
Connecticut	**1,565,628 (55.2)**	390,071 (55.3)	147,437 (56.9)	945,420 (54.8)	—**	82,700 (55.9)	—**	1,482,928 (55.1)	82,700 (55.9)
Delaware	**376,448 (48.9)**	—**	215,689 (49.1)	106,497 (55.7)	54,262 (38.9)	—**	—**	376,448 (48.9)	—**
District of Columbia	**272,747 (47.2)**	272,747 (47.2)	—**	—**	—**	—**	—**	272,747 (47.2)	—**
Florida	**7,558,301 (43.8)**	2,612,865 (43.8)	2,098,598 (43.9)	2,181,338 (44.4)	487,184 (48.1)	98,684 (33.7)	79,632 (28.2)	7,379,985 (44.3)	178,316 (31.0)
Georgia	**1,570,189 (19.4)**	188,126 (22.5)	725,542 (19.4)	248,864 (26.8)	226,829 (18.7)	115,309 (15.0)	65,519 (10.3)	1,389,361 (20.7)	180,828 (12.9)
Idaho	**545,857 (40.8)**	—**	—**	250,086 (44.3)	135,313 (39.9)	120,446 (37.3)	40,012 (35.9)	385,399 (42.6)	160,458 (36.9)
Illinois	**4,798,337 (48.7)**	2,024,718 (50.2)	1,573,694 (50.0)	339,073 (48.5)	381,873 (46.1)	291,296 (43.1)	187,683 (40.4)	4,319,358 (49.6)	478,979 (42.0)
Indiana	**2,057,161 (39.8)**	263,355 (36.2)	727,655 (43.9)	319,160 (42.6)	342,196 (37.5)	281,902 (36.6)	122,893 (35.2)	1,652,366 (40.9)	404,795 (36.1)
Iowa	**1,187,572 (48.9)**	—**	—**	461,103 (49.4)	267,887 (51.4)	174,447 (46.2)	284,135 (47.6)	728,990 (50.1)	458,582 (47.1)
Kansas	**1,041,465 (47.1)**	—**	367,647 (54.6)	208,267 (43.0)	179,347 (49.3)	165,309 (41.2)	120,895 (41.5)	755,261 (49.7)	286,204 (41.3)
Kentucky	**1,523,875 (44.0)**	313,875 (52.5)	230,936 (43.6)	286,818 (50.6)	136,493 (39.4)	266,331 (39.9)	289,422 (38.2)	968,122 (47.4)	555,753 (39.0)
Louisiana	**1,343,593 (37.7)**	165,679 (53.0)	308,584 (45.6)	484,513 (36.2)	217,680 (32.7)	88,773 (29.9)	78,364 (29.0)	1,176,456 (39.3)	167,137 (29.5)
Maine	**575,911 (52.6)**	—**	—**	244,914 (55.7)	101,952 (48.6)	49,521 (50.0)	179,524 (51.7)	346,866 (53.4)	229,045 (51.3)
Maryland	**2,300,883 (48.8)**	191,933 (40.5)	1,875,332 (50.6)	111,818 (42.4)	62,256 (43.0)	29,755 (53.5)	29,789 (45.4)	2,241,339 (48.8)	59,544 (49.1)
Massachusetts	**2,611,958 (47.1)**	306,989 (45.7)	1,707,107 (51.1)	518,678 (44.6)	49,567 (17.4)	29,535 (40.8)	82 (0.9)	2,582,341 (47.3)	29,617 (36.4)
Michigan	**3,414,578 (43.5)**	768,690 (41.8)	1,051,335 (44.6)	579,511 (44.3)	385,356 (42.9)	391,849 (43.4)	237,837 (44.2)	2,784,892 (43.5)	629,686 (43.7)
Minnesota	**2,121,068 (48.9)**	736,642 (52.2)	562,068 (43.8)	108,924 (57.5)	241,769 (49.4)	258,667 (50.1)	212,998 (47.7)	1,649,403 (48.9)	471,665 (49.0)
Mississippi	**828,073 (36.4)**	—**	65,816 (32.7)	298,780 (39.9)	39,999 (34.9)	257,322 (36.0)	166,156 (33.4)	404,595 (38.0)	423,478 (34.9)
Missouri	**1,843,060 (38.7)**	320,345 (40.9)	800,596 (43.5)	137,447 (35.9)	213,023 (38.0)	174,846 (31.3)	196,803 (30.6)	1,471,411 (41.3)	371,649 (31.0)
Montana	**372,927 (44.4)**	—**	—**	—**	139,699 (47.5)	109,748 (41.4)	123,480 (43.9)	139,699 (47.5)	233,228 (42.7)
Nebraska	**718,993 (49.3)**	—**	—**	450,638 (51.6)	40,185 (49.7)	112,525 (45.6)	115,645 (45.1)	490,823 (51.4)	228,170 (45.3)
Nevada	**1,015,950 (42.6)**	739,037 (42.3)	—**	179,391 (47.9)	21,360 (47.9)	67,238 (34.2)	8,924 (34.5)	939,788 (43.4)	76,162 (34.2)
New Hampshire	**605,093 (54.8)**	—**	204,277 (57.1)	158,455 (47.6)	—**	214,430 (57.5)	27,931 (67.4)	362,732 (52.5)	242,361 (58.5)
New Jersey	**3,516,994 (50.7)**	728,029 (46.3)	2,408,516 (52.4)	287,894 (49.4)	92,555 (48.7)	—**	—**	3,516,994 (50.7)	—**
New Mexico	**943,664 (58.2)**	—**	—**	411,876 (57.3)	247,917 (65.1)	245,120 (54.6)	38,751 (53.0)	659,793 (60.0)	283,871 (54.4)
New York	**7,449,653 (48.3)**	3,646,082 (45.9)	2,201,835 (51.7)	759,849 (52.3)	342,276 (50.5)	366,736 (46.9)	132,875 (42.5)	6,950,042 (48.5)	499,611 (45.7)
North Carolina	**3,497,654 (42.7)**	807,462 (47.5)	384,965 (35.9)	1,326,943 (45.4)	302,213 (41.4)	485,062 (38.7)	191,009 (37.9)	2,821,583 (43.9)	676,071 (38.5)
North Dakota	**266,915 (45.9)**	—**	—**	—**	148,378 (49.9)	51,760 (37.9)	66,777 (45.1)	148,378 (49.9)	118,537 (41.7)
Ohio	**3,980,433 (43.7)**	1,225,497 (46.7)	876,242 (45.7)	1,053,437 (44.6)	146,003 (37.9)	558,642 (37.7)	120,612 (35.3)	3,301,179 (45.3)	679,254 (37.2)
Oklahoma	**1,311,507 (43.6)**	316,961 (53.3)	195,507 (41.6)	361,732 (43.9)	40,249 (41.6)	240,550 (39.6)	156,508 (38.1)	914,449 (46.0)	397,058 (39.0)
Oregon	**1,494,454 (44.6)**	332,259 (50.1)	393,659 (42.7)	286,399 (44.6)	247,465 (42.4)	194,569 (42.4)	40,103 (48.9)	1,259,782 (44.8)	234,672 (43.4)
Pennsylvania	**4,817,265 (47.4)**	1,098,792 (49.2)	1,556,236 (52.9)	1,328,061 (46.2)	382,538 (40.3)	327,898 (38.9)	123,740 (38.0)	4,365,627 (48.5)	451,638 (38.7)
Rhode Island	**407,784 (47.7)**	229,134 (45.1)	178,650 (51.5)	—**	—**	—**	—**	407,784 (47.7)	—**
South Carolina	**1,575,298 (39.0)**	—**	105,409 (33.4)	1,071,517 (39.5)	182,137 (43.3)	132,651 (37.6)	83,584 (35.7)	1,359,063 (39.4)	216,235 (36.8)
South Dakota	**247,945 (37.1)**	—**	—**	—**	128,452 (39.1)	64,444 (35.7)	55,049 (34.7)	128,452 (39.1)	119,493 (35.2)
Tennessee	**2,032,692 (38.2)**	533,687 (42.5)	383,619 (36.9)	559,029 (41.0)	168,327 (36.7)	223,523 (32.6)	164,507 (31.9)	1,644,662 (39.9)	388,030 (32.3)
Texas	**9,325,215 (43.2)**	4,562,747 (44.5)	1,848,021 (43.2)	1,575,372 (47.3)	502,046 (36.1)	458,287 (36.9)	378,742 (34.2)	8,488,186 (44.1)	837,029 (35.6)
Utah	**1,039,555 (45.7)**	423,864 (49.8)	19,552 (39.9)	390,166 (42.8)	98,050 (44.2)	63,274 (47.2)	44,649 (41.9)	931,632 (45.8)	107,923 (44.8)
Vermont	**269,382 (52.8)**	—**	—**	—**	93,365 (51.9)	110,027 (55.4)	65,990 (50.1)	93,365 (51.9)	176,017 (53.3)
Virginia	**3,162,645 (47.4)**	463,230 (43.6)	1,799,645 (50.0)	244,719 (45.6)	302,185 (47.0)	86,015 (41.3)	266,851 (42.5)	2,809,779 (48.1)	352,866 (42.2)
Washington	**2,745,505 (46.1)**	918,867 (51.0)	736,446 (42.9)	478,192 (42.9)	342,357 (48.2)	201,142 (42.3)	68,501 (51.2)	2,475,862 (46.3)	269,643 (44.3)
West Virginia	**325,762 (22.7)**	—**	11,485 (25.8)	58,693 (22.8)	139,026 (23.8)	53,402 (22.7)	63,156 (20.2)	209,204 (23.6)	116,558 (21.3)
Wisconsin	**2,267,575 (49.8)**	357,901 (49.7)	371,918 (51.0)	465,236 (57.3)	528,622 (48.0)	275,088 (44.4)	268,810 (47.0)	1,723,677 (51.2)	543,898 (45.6)
Wyoming	**178,257 (40.1)**	—**	—**	—**	56,443 (41.1)	78,882 (42.7)	42,932 (34.9)	56,443 (41.1)	121,814 (39.6)

See table footnotes on the next page.

a poll by the Kaiser Family Foundation found that vaccine hesitancy was highest in rural communities, with 21% of rural residents stating that they would "definitely not" get a vaccine compared with 10% of urban residents. Among the rural respondents, 45% of younger adults (aged 18–64 years) stated that they would "definitely not" get a vaccine compared with 8% of older adults (aged 60–69 years) (*8*). Rural residents who reported that they would "definitely not" get a vaccine were more likely to report not having a college degree and earning <$40,000 per year (*8*). Notably, 86% of rural residents report they trust their own health care providers for information on COVID-19 vaccines, which highlights the importance of public health practitioners working with established outpatient health care systems in rural areas (*9*). Through its Vaccinate with Confidence initiative,

TABLE. (*Continued*) Vaccination coverage among adults aged ≥18 years who received their first dose of COVID-19 vaccine,* by jurisdiction, sex, age group, and urban-rural classification† — United States,§ December 14, 2020–April 10, 2021

	No. (%) vaccinated								
		Six-level urban-rural classification						Two-level urban-rural classification	
Jurisdiction	Overall	Large central metropolitan	Large fringe metropolitan¶	Medium metropolitan	Small metropolitan	Micropolitan	Noncore	Urban	Rural
Demographic characteristics									
Sex									
Male	**50,684,095 (41.0)**	16,606,553 (43.6)	12,926,239 (41.8)	10,606,151 (41.5)	4,266,165 (37.4)	3,756,557 (35.9)	2,522,430 (34.4)	44,405,108 (41.9)	6,278,987 (35.3)
Female	**61,803,696 (47.4)**	20,118,007 (49.6)	16,023,200 (48.8)	13,032,454 (48.2)	5,149,771 (43.5)	4,519,824 (42.5)	2,960,440 (40.5)	54,323,432 (48.4)	7,480,264 (41.7)
Age group, yrs									
18–64	**73,245,975 (36.6)**	25,903,354 (40.3)	18,997,421 (37.6)	14,910,642 (36.4)	5,681,032 (31.8)	4,798,499 (30.0)	2,955,027 (27.7)	65,492,449 (37.7)	7,753,526 (29.1)
≥65	**40,147,289 (74.7)**	11,035,258 (76.4)	10,205,186 (76.9)	8,949,648 (77.3)	3,812,281 (70.8)	3,566,401 (69.8)	2,578,515 (64.7)	34,002,373 (76.1)	6,144,916 (67.6)

* First dose of COVID-19 vaccine is defined either as the first of 2 doses for the Pfizer-BioNTech or Moderna vaccines, or a single dose for the Janssen (Johnson & Johnson) vaccine.
† First doses of COVID-19 vaccine were matched by county of residence to one of six urban-rural categories according to the 2013 National Center for Health Statistics urban-rural classification scheme (https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). To further classify counties into two categories (urban versus rural), four of these six categories were combined into urban areas (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan) and two were combined into rural areas (micropolitan and noncore).
§ Excludes doses with state of residence reported as Hawaii, a territory, an island, or a county of residence in California with population <20,000. Completeness of county data varied by jurisdiction. Three states (Georgia, South Dakota, and West Virginia) had <80% completeness for county of residence data.
¶ Large fringe metropolitan refers to suburban areas.
** Jurisdiction does not have any counties at this level of urban-rural classification.

CDC continues to support rural jurisdictions and local partners in their efforts to improve access to, and bolster trust and confidence in, COVID-19 vaccines.¶¶¶

The findings in this report are subject to at least five limitations. First, vaccination coverage is not representative of the entire United States, because county of residence was missing for 9.2% of persons.**** Second, each jurisdiction prioritized population subgroups for vaccination differently, which might have also contributed to vaccination coverage differences between urban and rural populations. Third, COVID-19 vaccine supply changed substantially during the observed time period, and persons may have been willing to travel farther for vaccination at the beginning of this time period when vaccine supplies were low, compared with later time periods. Fourth, race and ethnicity were unknown for approximately 40% of persons with available county information; therefore, vaccination coverage could not be calculated on the basis of race and ethnicity. Improved data completeness is critical to measure and address racial and ethnic disparities in vaccination coverage. Finally, the NCHS urban-rural classification was developed in 2013, and counties that were classified as rural in 2013 might not be classified as rural during 2020–2021.

Disparities in COVID-19 vaccination between urban and rural communities can hinder progress toward ending the pandemic. Public health practitioners should continue collaborating with health care providers, pharmacies, community-based organizations, faith leaders, and local employers†††† to address vaccine hesitancy and ensure equitable vaccine access and distribution, particularly in rural areas (*10*). These focused, multipartner efforts can help increase nationwide vaccination coverage and reduce morbidity and mortality from COVID-19.

Summary

What is already known about this topic?

Residents of rural communities are at increased risk for severe COVID-19–associated morbidity and mortality. In September 2020, COVID-19 incidence (cases per 100,000 population) in rural counties surpassed that in urban counties.

What is added by this report?

COVID-19 vaccination coverage was lower in rural counties (38.9%) than in urban counties (45.7%); disparities persisted among age groups and by sex.

What are the implications for public health practice?

Disparities in COVID-19 vaccination access and coverage between urban and rural communities can hinder progress toward ending the pandemic. Public health practitioners should collaborate with health care providers, pharmacies, employers, faith leaders, and other community partners to identify and address barriers to COVID-19 vaccination in rural areas.

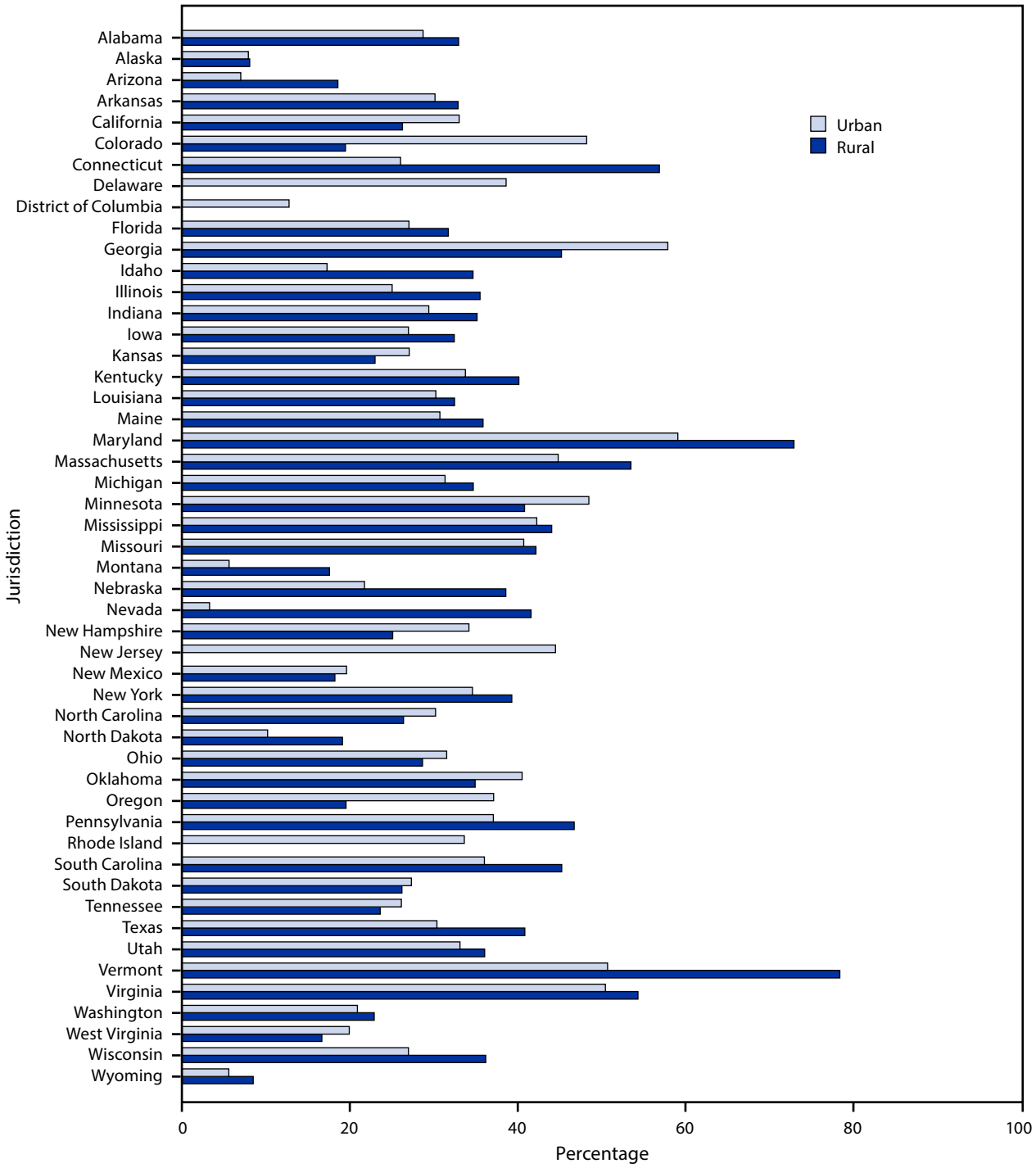
¶¶¶ https://www.cdc.gov/vaccines/covid-19/vaccinate-with-confidence/strategy.html
**** Hawaii and eight California counties were excluded from analysis. More than 20% of persons receiving the first dose of a COVID-19 vaccine who live in Georgia, South Dakota, and West Virginia did not have data available for county of residence.

†††† https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/essentialworker/workplace-vaccination-program.html

Acknowledgments

CDC COVID-19 Vaccine Task Force; U.S. Department of Defense; immunization program managers; immunization information system managers; other staff members of the immunization programs in the 64 jurisdictions and five federal entities.

FIGURE 1. Percentage of vaccinated persons who traveled outside their county of residence* for their first dose of COVID-19 vaccine,† by jurisdiction and urban-rural classification§ — United States, December 14, 2020–April 10, 2021

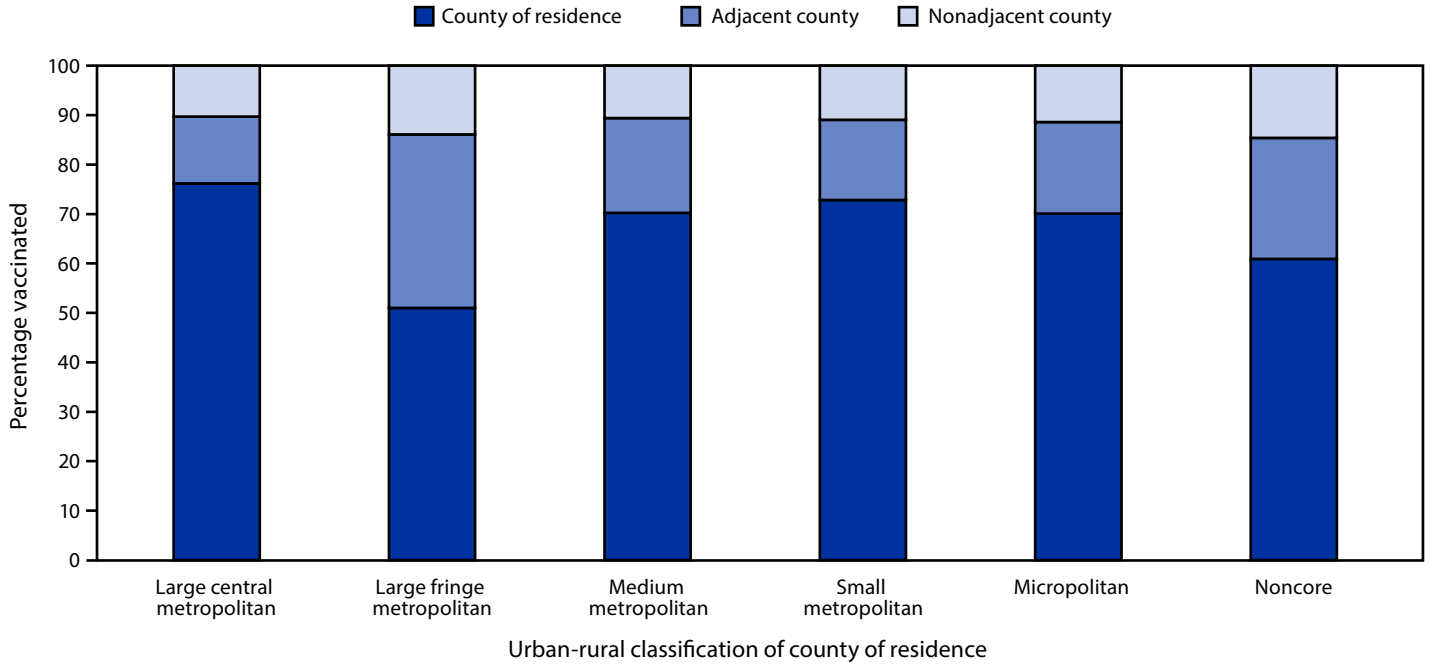


* Excludes doses with state of residence reported as Hawaii, a territory, an island, or a county of residence in California with population <20,000. Completeness of county data varied by jurisdiction. Three states (Georgia, South Dakota, and West Virginia) had <80% completeness for county of residence data. Four jurisdictions (Delaware, New Jersey, Rhode Island, and District of Columbia) did not have rural counties.

† First dose of COVID-19 vaccine is defined either as the first of 2 doses for the Pfizer-BioNTech or Moderna vaccines, or a single dose for the Janssen (Johnson & Johnson) vaccine.

§ First doses of COVID-19 vaccine were matched by county of residence to one of six urban-rural categories according to the 2013 National Center for Health Statistics urban-rural classification scheme (https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf). To further classify counties into two categories (urban versus rural), four of these six categories were combined into urban areas (large central metropolitan, large fringe metropolitan, medium metropolitan, and small metropolitan) and two were combined into rural areas (micropolitan and noncore).

FIGURE 2. Location of receipt of first COVID-19 vaccine dose* among vaccinated persons, by urban-rural classification of county of residence†,§,¶ — United States, December 14, 2020–April 10, 2021



* First dose of COVID-19 vaccine is defined either as the first of 2 doses for the Pfizer-BioNTech or Moderna vaccines, or a single dose for the Janssen (Johnson & Johnson) vaccine.
† Excludes doses with state of residence reported as Hawaii, a territory, an island, or a county of residence in California with population <20,000. Completeness of county data varied by jurisdiction. Three states (Georgia, South Dakota, and West Virginia) had <80% completeness for county of residence data.
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¶ Large fringe metropolitan refers to suburban areas.

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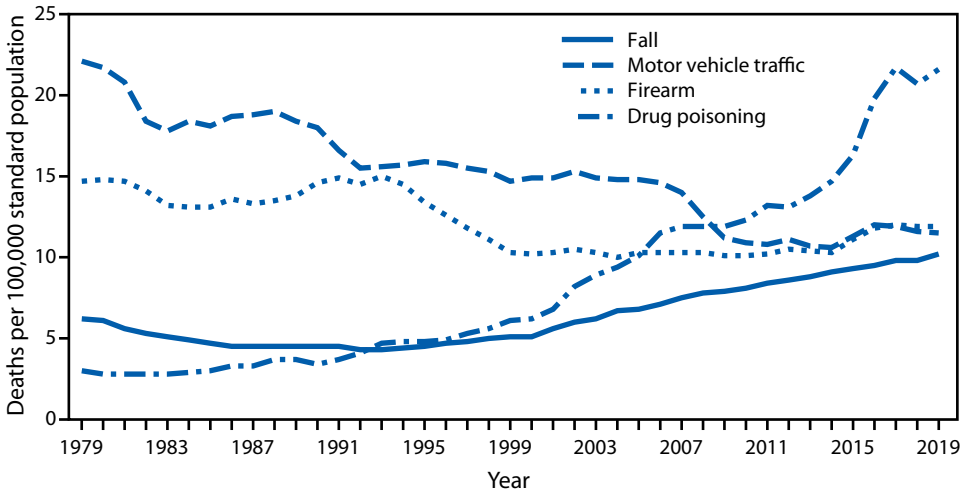
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* for Four Selected Mechanisms of Injury† — National Vital Statistics System, United States, 1979–2019§



* Per 100,000, age-adjusted to the 2000 U.S. standard population.
† Four of the most frequently occurring mechanisms of injury that caused deaths over the study period. Injuries are from all manners, including unintentional, suicide, homicide, undetermined intent, and legal intervention.
§ Deaths are classified using the *International Classification of Diseases* (ICD). In 1999, the *ICD Tenth Revision* replaced the *ICD Ninth Revision*, which had been used from 1979 through 1998. Coding updates in the later revision resulted in approximately 5% fewer deaths being classified as motor vehicle traffic deaths, 2% more deaths being classified as drug poisoning deaths, and minimal change in the classification of fall- and firearm-related deaths.

In 1979, of the four mechanisms of injury, age-adjusted mortality rates were highest for motor vehicle traffic deaths and lowest for drug poisoning deaths. From 1979 to 2019, the age-adjusted rate of motor vehicle traffic deaths decreased from 22.1 per 100,000 to 11.1, and the rate of firearm-related deaths decreased from 14.7 to 11.9. During the same period, the rate of drug poisoning (overdose) deaths increased from 3.0 to 21.6, and the rate of fall-related deaths increased from 6.2 to 10.1. In 2019, the rates were highest for drug poisoning deaths and lowest for fall-related deaths.

Source: National Vital Statistics System compressed mortality file, underlying cause of death. http://wonder.cdc.gov/mortsql.html

Reported by: Matthew Garnett, MPH, Mgarnett@cdc.gov, 301-458-4383; Holly Hedegaard, MD; Merianne R. Spencer, MPH.

For more information on these topics, CDC recommends the following link: https://www.cdc.gov/injury

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