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Use of Selected Recommended Clinical Preventive Services — Behavioral Risk Factor Surveillance System, United States, 2018

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Clinical preventive services play an important role in preventing deaths, and Healthy People 2020 has set national goals for using clinical preventive services to improve population health (*1*). The Patient Protection and Affordable Care Act (ACA) requires many health plans to cover certain recommended clinical preventive services without cost-sharing when provided in-network (covered clinical preventive services).* To ascertain prevalence of the use of selected recommended clinical preventive services among persons aged ≥18 years, CDC analyzed data from the 2018 Behavioral Risk Factor Surveillance System (BRFSS), a state-based annual nationwide survey conducted via landline and mobile phones in the United States, for 10 clinical preventive services covered in-network with no cost-sharing pursuant to the ACA. The weighted prevalence of colon, cervical, and breast cancer screening, pneumococcal and tetanus vaccination, and diabetes screening ranged from 66.0% to 79.2%; the prevalence of the other four clinical preventive services were <50%: 16.5% for human papillomavirus (HPV) vaccination, 26.6% for zoster (shingles) vaccination, 33.2% for influenza vaccination, and 45.8% for HIV testing. Prevalence of HIV testing had the widest variation (3.1-fold differences) across states among the 10 services included in this report. The prevalence of use of clinical preventive services varied by insurance status, income level, and rurality, findings that are consistent with previous studies (*2*–*6*). The use of nine of the 10 services examined was lower among the uninsured, those with lower income, and those living in rural communities. Among those factors examined, insurance status was the dominant factor strongly associated with use of clinical preventive services, followed by income-level and rurality. Understanding factors influencing use of recommended clinical preventive services can potentially help decision makers better identify policies to increase their use including strategies to increase insurance coverage.

* The Patient Protection and Affordable Care Act, Pub L. No. 111–148, 124 Stat. 131, Sect. 1001 (Mar. 23, 2010). The covered clinical preventive services were recommended by the U.S. Preventive Services Task Force, the Advisory Committee on Immunization Practices, and the Health Resources and Services Administration.

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Six of the 10 recommended clinical preventive services that health plans are required to cover without cost-sharing were included in the 2018 BRFSS core questionnaire, which was used by all 50 states, the District of Columbia (DC), Guam, and Puerto Rico; these include colon, cervical, and breast cancer screening; HIV testing; and pneumococcal and influenza vaccination. The other four services were included in the optional modules, which are asked by some states; these include diabetes screening (asked by 28 states, DC, Guam, and Puerto Rico), HPV vaccination (asked by eight states), shingles vaccination (asked by four states), and tetanus vaccination (asked by four states).† Survey participants were classified as having used a clinical preventive service if they reported using a clinical preventive service as recommended at the time of interview. Because of changes over time to recommendations and to policies and practices that affect use of clinical preventive services, continued monitoring of their use could offer decision makers updated information for achieving public health goals.

In the 2018 BRFSS, the median survey response rate was 49.9% with a sample size of 437,436 adults aged ≥18 years. Participants were considered uninsured if they didn't have any health care coverage at the time of the interview. Federal poverty level (FPL) was calculated by using the number of adults, the number of children, and the midpoint income value of the categorical household income level (*7*). Persons with household income ≤138% of FPL as defined by the 2017 FPL threshold were categorized as lower income. BRFSS uses the 2013 CDC National Center for Health Statistics' Urban-Rural Classification Scheme for Counties: urban counties are those coded as all four metropolitan categories plus micropolitan; rural counties are those coded as noncore.§ Weighted utilization prevalence and 95% confidence intervals (CIs) are presented. Generalized linear modeling was used to estimate prevalence ratios (PRs) and 95% CIs for the differences in use of clinical preventive services between persons in three categories: 1) insured versus uninsured, 2) higher versus lower income, and 3) rural versus urban residence. Subgroups were generated representing the interaction of these three variables, which resulted in eight insurance-income-residence combinations. Generalized linear modeling was also used to compare use of clinical preventive services use in each subgroup using STATA/MP (version 16; StataCorp), adjusted by age, sex, race/ethnicity, education, marital status, self-reported health status, and state.

Use varied across the 10 covered clinical preventive services (Table 1). The weighted prevalence of colon, cervical, and breast cancer screening, pneumococcal and tetanus vaccination, and diabetes screening ranged from 66.0% to 79.2%; the

† The BRFSS questionnaire has three parts: 1) the core component, 2) optional modules, and 3) state-added questions. Every state must ask the core component questions; however, the modules are optional. https://www.cdc.gov/brfss/questionnaires/index.htm

§ https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf

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TABLE 1. Percentage of adults who received recommended clinical preventive services, by health insurance status, family income level, and rurality — Behavioral Risk Factor Surveillance System, United States, 2018

Characteristic	No. who received service, weighted % (95% CI)																			
	Colon cancer screening, age 50–75 yrs		Cervical cancer screening (women), age 21–65 yrs		Breast cancer screening (within 2 yrs) (women), age 50–74 yrs		HIV testing (ever), age 18–65 yrs		Pneumococcal vaccination (ever), age ≥65 yrs		Influenza vaccination (within 1 yr), age ≥18 yrs		Diabetes screening (within 3 yrs), age 40–70 yrs		HPV vaccination (ever), age 18–26 yrs		Zoster (shingles) vaccination (ever), age ≥50 yrs		Tetanus vaccination (within 10 yrs), age ≥19 yrs	
Total	**147,965**	**68.4 (67.9–68.9)**	**106,362**	**79.2 (78.7–79.6)**	**89,409**	**78.7 (78.2–79.3)**	**113,284**	**45.8 (45.4–46.2)**	**105,829**	**71.0 (70.4–71.6)**	**164,092**	**33.2 (32.9–33.5)**	**48,719**	**68.8 (68.0–69.6)**	**527**	**16.5 (14.1–18.9)**	**6,066**	**26.6 (25.3–27.9)**	**17,390**	**66.0 (64.6–67.4)**
Insurance status																				
Insured	143,667	71.0 (70.6–71.5)	97,791	81.0 (80.6–81.5)	86,525	80.4 (79.8–81.0)	100,248	46.1 (45.7–46.5)	104,463	71.6 (71.0–72.2)	158,376	35.9 (35.6–36.2)	45,840	71.2 (70.4–72.0)	471	19.1 (16.3–21.9)	5,928	28.3 (26.9–29.7)	15,668	69.4 (68.1–70.7)
Uninsured	4,035	34.1 (32.1–36.2)	8,343	66.7 (65.0–68.5)	2,719	54.2 (51.2–57.3)	12,639	44.6 (43.4–45.8)	1,138	43.9 (38.8–49.0)	5,303	13.9 (13.2–14.7)	2,781	49.8 (46.5–53.1)	54	9.8 (5.0–14.6)	122	9.5 (5.9–13.0)	1,666	51.9 (47.7–56.1)
Insured to uninsured prevalence ratio*	2.08†	(1.96–2.21)	1.21†	(1.18–1.25)	1.48†	(1.40–1.57)	1.03§	(1.01–1.06)	1.63†	(1.45–1.83)	2.58†	(2.44–2.72)	1.43†	(1.34–1.53)	1.95§	(1.17–3.25)	2.99†	(2.06–4.35)	1.34†	(1.23–1.45)
Income level																				
Higher income (income >138% FPL)	109,437	71.8 (71.2–72.3)	71,638	81.9 (81.3–82.4)	61,902	80.7 (80.0–81.3)	74,501	45.4 (45.0–45.9)	74,031	73.5 (72.9–74.2)	116,176	35.3 (34.9–35.7)	36,019	70.4 (69.5–71.3)	309	18.8 (15.3–22.2)	4,385	29.2 (27.6–30.8)	11,825	69.0 (67.4–70.5)
Lower income (income ≤138% FPL)	16,938	55.9 (54.6–57.2)	21,394	75.5 (74.4–76.5)	11,966	71.5 (70.0–72.9)	25,887	51.8 (51.0–52.7)	10,647	62.0 (60.2–63.8)	21,172	26.6 (25.9–27.3)	7,263	64.1 (61.8–66.4)	129	15.6 (10.6–20.7)	499	15.5 (12.7–18.2)	2,852	60.5 (57.0–64.1)
Higher to lower income prevalence ratio*	1.28†	(1.25–1.32)	1.08†	(1.07–1.10)	1.13†	(1.10–1.15)	0.88†	(0.86–0.89)	1.19†	(1.15–1.22)	1.33†	(1.29–1.36)	1.10†	(1.06–1.14)	1.20	(0.83–1.74)	1.88†	(1.56–2.27)	1.14†	(1.07–1.21)
Rurality																				
Urban	123,288	68.9 (68.4–69.5)	89,873	79.5 (79.0–79.9)	73,706	79.0 (78.4–79.7)	97,576	46.3 (45.9–46.7)	87,922	71.7 (71.1–72.4)	138,216	33.4 (33.1–33.7)	38,737	68.5 (67.6–69.4)	483	16.8 (14.3–19.4)	5,293	27.0 (25.6–28.5)	14,654	66.1 (64.6–67.6)
Rural	23,073	63.9 (62.6–65.1)	14,351	74.3 (73.0–75.6)	14,302	74.5 (73.0–75.9)	13,139	36.4 (35.2–37.5)	17,379	69.0 (67.5–70.5)	24,229	32.4 (31.6–33.3)	8,361	67.6 (65.7–69.6)	44	13.1 (6.6–19.5)	773	23.2 (20.3–26.1)	2,736	65.3 (61.9–68.7)
Urban to rural prevalence ratio*	1.08†	(1.06–1.10)	1.07†	(1.05–1.09)	1.06†	(1.04–1.08)	1.27†	(1.23–1.31)	1.04†	(1.02–1.06)	1.03§	(1.00–1.06)	1.01	(0.98–1.05)	1.29	(0.77–2.16)	1.17§	(1.02–1.34)	1.01	(0.96–1.07)

Abbreviations: CI = confidence interval; FPL = federal poverty level ; HPV = human papillomavirus.
* Generalized linear modeling was used to identify the prevalence ratio.
† $p<0.01$.
§ $p<0.05$.

prevalence of the other four clinical preventive services were <50%, ranging from 16.5% for HPV vaccination to 45.8% for HIV testing. Being uninsured was associated with lower use of each of the 10 services, with PRs ranging from 1.03 for HIV testing to 2.99 for shingles vaccination. Persons with lower income had a lower prevalence for nine of 10 clinical preventive services compared with those with higher household incomes (eight of nine with $p<0.01$). In contrast, HIV testing utilization was significantly higher among those with lower income. Among those eight services, the PRs for persons with higher versus lower income ranged from 1.08 to 1.88. Persons living in rural areas used each of the recommended clinical preventive services less than those living in urban areas, with PRs for seven of these reaching statistical significance.

Use of clinical preventive services varied by state (Table 2). The variation in use differed substantially by type of service, with breast and cervical cancer screenings having the least cross-state variation among the six services asked by all states. Variation across states was widest for prevalence of HIV testing and pneumococcal vaccination use (3.1-fold and 2.5-fold, respectively).

The highest adjusted use was observed in the insured-higher income-urban group for six of the 10 services (all but HIV testing, diabetes screening, HPV vaccination, and tetanus vaccination). Insurance status was the factor most strongly associated with use of clinical preventive services, followed by income level and rurality, respectively. Uninsured persons used seven of the 10 clinical preventive services less frequently than those with insurance, regardless of income level and rurality. Among those with insurance, use of six of the 10 services was higher among persons with higher incomes, regardless of whether they lived in rural or urban counties (Figure) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/104149) (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/104150).

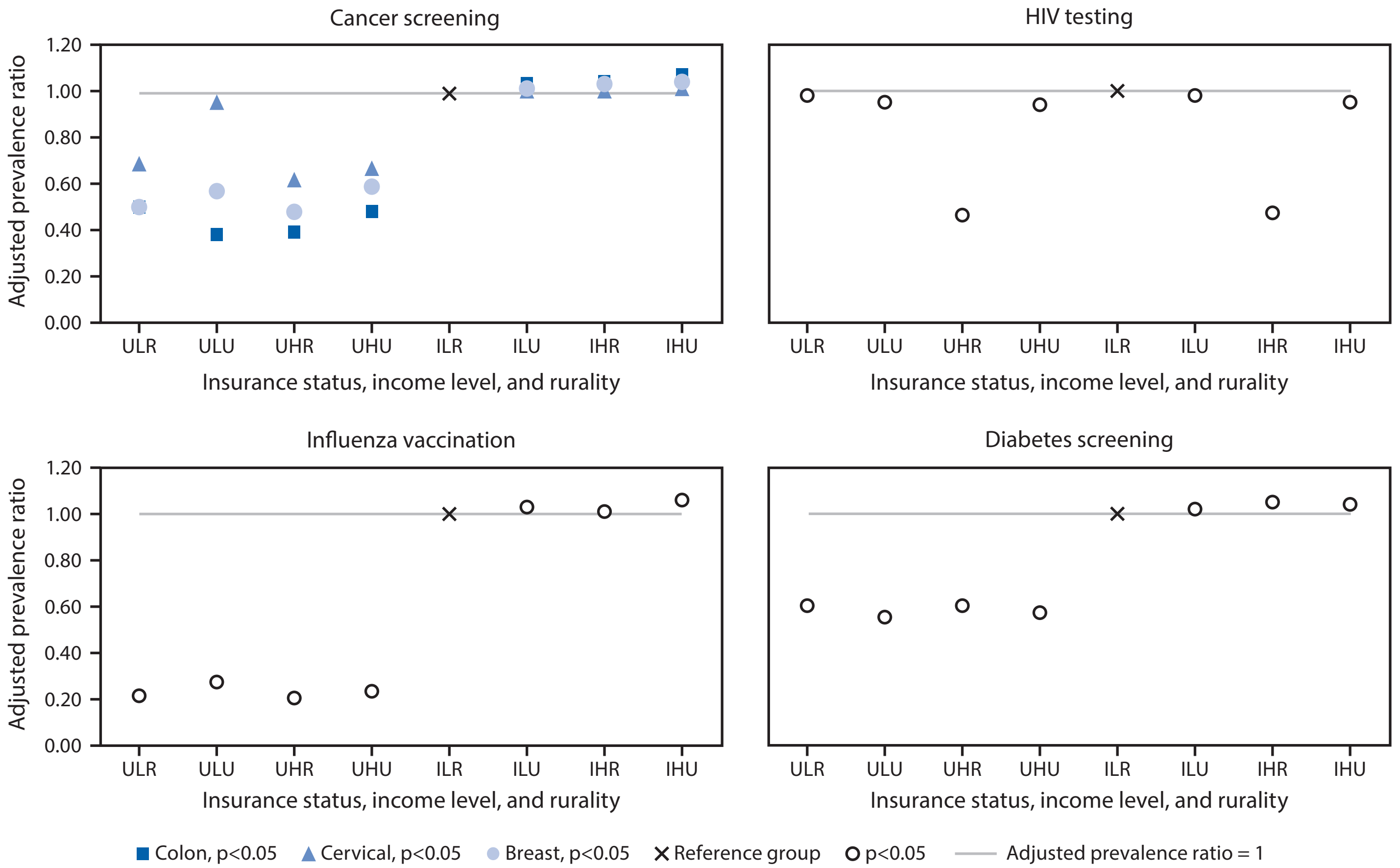
TABLE 2. Percentage of adults who received recommended clinical preventive services, by jurisdiction — Behavioral Risk Factor Surveillance System, United States, 2018*

Jurisdiction	% (95% CI)									
	Colon cancer screening, age 50–75 yrs	Cervical cancer screening (women), age 21–65 yrs	Breast cancer screening (within 2 yrs) (women), age 50–74 yrs	HIV testing (ever), age 18–65 yrs	Pneumococcal vaccination (ever), age ≥65 yrs	Influenza vaccination (within 1 yr), age ≥18 yrs	Diabetes screening (within 3 yrs), age 40–70 yrs	HPV vaccination (ever), age 18–26 yrs	Zoster (shingles) vaccination (ever), age ≥50 yrs	Tetanus vaccination (within 10 yrs), age ≥19 yrs
Alabama	69.8 (67.7–71.9)	79.1 (76.8–81.5)	80.2 (77.8–82.6)	45.8 (43.7–47.8)	71.7 (69.3–74.0)	67.2 (64.6–69.9)	14.6 (10.0–19.1)	NR	NR	NR
Alaska	59.6 (55.8–63.4)	76.3 (72.4–80.3)	67.3 (62.0–72.5)	45.4 (42.2–48.5)	64.2 (59.6–68.8)	33.8 (31.2–36.3)	63.5 (58.9–68.2)	NR	NR	NR
Arizona	65.8 (63.3–68.3)	76.1 (73.3–78.9)	73.1 (70.0–76.3)	45.5 (43.2–47.8)	73.7 (71.2–76.3)	30.6 (28.9–32.2)	67.9 (64.3–71.5)	NR	NR	NR
Arkansas	66.0 (63.5–68.5)	75.5 (72.8–78.3)	72.5 (69.6–75.4)	44.4 (41.8–47.0)	74.6 (72.3–76.8)	31.1 (29.2–33.0)	NR	NR	NR	NR
California	70.1 (68.2–72.0)	78.9 (77.1–80.7)	81.2 (78.8–83.5)	49.0 (47.6–50.5)	68.7 (65.8–71.6)	32.4 (31.2–33.6)	NR	NR	NR	NR
Colorado	67.8 (66.0–69.5)	76.6 (74.7–78.6)	71.1 (68.8–73.4)	41.5 (40.0–43.1)	77.1 (75.2–79.0)	36.6 (35.3–37.8)	NR	NR	NR	NR
Connecticut	74.0 (72.4–75.5)	84.5 (82.7–86.2)	82.7 (80.8–84.6)	45.8 (44.1–47.5)	71.2 (69.3–73.2)	35.0 (33.7–36.2)	NR	25.6 (20.5–30.7)	NR	NR
Delaware	72.0 (69.8–74.2)	82.4 (79.9–84.9)	83.8 (81.4–86.3)	48.6 (46.2–50.9)	72.6 (69.9–75.3)	38.2 (36.3–40.0)	NR	NR	NR	NR
DC	72.3 (69.9–74.8)	83.7 (80.8–86.5)	79.6 (76.7–82.4)	76.7 (74.4–78.9)	70.8 (68.0–73.7)	44.2 (42.1–46.3)	72.0 (68.5–75.4)	NR	NR	NR
Florida	69.6 (67.4–71.8)	79.4 (77.1–81.6)	81.2 (79.0–83.4)	52.8 (50.8–54.9)	67.2 (64.7–69.8)	30.7 (29.2–32.1)	70.6 (67.3–73.8)	NR	NR	NR
Georgia	67.4 (65.5–69.2)	80.5 (78.8–82.2)	79.8 (77.8–81.8)	52.0 (50.4–53.6)	71.0 (68.8–73.2)	29.8 (28.6–30.9)	69.4 (67.1–71.7)	NR	NR	NR
Guam	39.7 (34.6–44.8)	68.0 (62.5–73.4)	74.5 (68.0–80.9)	35.2 (31.4–39.0)	41.5 (33.6–49.5)	24.3 (21.1–27.5)	65.4 (59.1–71.8)	NR	NR	NR
Hawaii	74.3 (72.3–76.2)	83.1 (81.1–85.0)	86.9 (85.0–88.8)	35.9 (34.1–37.7)	65.4 (62.4–68.4)	33.7 (32.2–35.2)	66.5 (63.8–69.3)	16.7 (12.4–21.0)	NR	NR
Idaho	66.6 (63.6–69.6)	68.1 (64.4–71.8)	68.0 (63.9–72.1)	35.4 (32.7–38.1)	70.4 (67.3–73.6)	32.1 (30.1–34.1)	62.2 (57.9–66.4)	NR	NR	NR
Illinois	65.8 (63.4–68.2)	78.5 (76.2–80.8)	78.4 (75.4–81.5)	38.7 (36.8–40.7)	68.7 (65.7–71.7)	32.2 (30.6–33.7)	NR	NR	NR	NR
Indiana	67.1 (65.2–69.0)	78.7 (76.6–80.8)	76.4 (74.2–78.6)	41.2 (39.3–43.1)	71.8 (69.8–73.9)	28.5 (27.1–29.8)	69.6 (67.1–72.1)	NR	NR	NR
Iowa	70.9 (69.3–72.4)	79.5 (77.7–81.3)	80.7 (78.8–82.5)	30.6 (29.2–31.9)	76.1 (74.3–77.9)	40.6 (39.4–41.8)	NR	NR	NR	NR
Kansas	66.5 (65.0–68.1)	74.4 (72.5–76.3)	74.2 (72.3–76.1)	34.5 (33.0–35.9)	75.9 (74.3–77.5)	36.0 (34.9–37.2)	NR	NR	NR	NR
Kentucky	68.9 (66.4–71.4)	77.0 (74.6–79.4)	77.5 (74.7–80.4)	39.3 (37.2–41.5)	72.5 (69.6–75.4)	36.0 (34.3–37.6)	69.7 (66.7–72.7)	NR	NR	NR
Louisiana	68.5 (65.9–71.1)	82.0 (79.6–84.4)	82.9 (80.4–85.5)	48.6 (46.2–50.9)	67.9 (64.4–71.3)	26.4 (24.7–28.1)	NR	NR	NR	NR
Maine	74.9 (73.2–76.5)	82.4 (80.5–84.4)	80.8 (78.9–82.8)	39.5 (37.5–41.5)	76.7 (75.1–78.4)	32.4 (31.0–33.8)	72.3 (70.1–74.5)	NR	NR	NR
Maryland	71.5 (70.1–72.9)	81.8 (80.2–83.5)	81.1 (79.5–82.7)	55.4 (54.0–56.9)	75.3 (73.6–76.9)	39.5 (38.3–40.6)	72.9 (71.1–74.6)	NR	NR	NR
Massachusetts	75.9 (73.9–77.9)	82.9 (80.8–85.0)	86.2 (84.0–88.3)	44.6 (42.6–46.5)	72.4 (69.7–75.1)	37.1 (35.6–38.6)	NR	NR	NR	NR
Michigan	73.8 (72.2–75.4)	82.7 (81.0–84.3)	80.1 (78.1–82.1)	45.8 (44.3–47.3)	73.8 (71.7–75.9)	32.3 (31.2–33.5)	NR	NR	NR	NR
Minnesota	72.5 (71.2–73.7)	81.0 (79.7–82.3)	82.2 (80.7–83.6)	35.1 (34.0–36.2)	72.5 (71.0–74.1)	39.7 (38.8–40.6)	NR	NR	NR	NR
Mississippi	62.0 (59.7–64.4)	80.4 (78.2–82.5)	71.0 (68.2–73.9)	47.3 (45.1–49.4)	68.6 (65.9–71.3)	32.7 (31.1–34.3)	64.1 (61.2–66.9)	15.7 (10.9–20.6)	NR	57.2 (55.4–59.1)
Missouri	69.2 (66.9–71.5)	77.5 (74.8–80.3)	75.3 (72.4–78.1)	39.4 (37.2–41.7)	73.9 (71.6–76.3)	36.5 (34.8–38.2)	70.3 (67.3–73.4)	17.1 (11.7–22.5)	27.0 (25.2–28.8)	71.2 (69.3–73.0)
Montana	63.3 (60.8–65.8)	73.5 (70.4–76.5)	73.7 (70.5–77.0)	37.4 (35.2–39.6)	73.4 (70.6–76.2)	35.7 (33.9–37.4)	NR	NR	NR	NR
Nebraska	68.1 (66.5–69.7)	78.0 (76.2–79.7)	75.2 (73.2–77.3)	29.6 (28.2–31.0)	76.4 (74.8–78.1)	39.4 (38.1–40.6)	NR	NR	NR	NR
Nevada	59.9 (56.0–63.9)	77.4 (73.6–81.2)	72.3 (67.9–76.8)	47.2 (44.1–50.3)	68.1 (63.5–72.7)	32.6 (30.1–35.0)	NR	NR	NR	NR
New Hampshire	74.1 (72.1–76.1)	82.9 (80.5–85.2)	82.8 (80.6–85.1)	42.0 (39.7–44.4)	78.5 (76.4–80.6)	33.3 (31.6–35.0)	NR	NR	NR	NR
New Jersey	66.6 (62.3–70.9)	78.8 (74.4–83.2)	80.8 (76.1–85.5)	49.8 (46.3–53.3)	67.8 (61.5–74.1)	38.1 (35.3–41.0)	78.4 (73.8–83.0)	18.8 (10.5–27.1)	NR	NR
New Mexico	63.8 (61.5–66.1)	77.1 (74.7–79.4)	71.6 (68.8–74.5)	38.4 (36.4–40.4)	70.9 (68.1–73.8)	34.3 (32.7–35.9)	71.4 (68.6–74.3)	NR	NR	NR
New York	68.9 (67.5–70.4)	81.5 (80.1–82.9)	82.1 (80.4–83.9)	57.0 (55.8–58.1)	63.8 (61.6–66.0)	28.0 (27.1–28.9)	65.2 (63.4–67.0)	NR	NR	NR
North Carolina	71.0 (68.5–73.5)	80.3 (78.0–82.7)	79.3 (76.1–82.5)	52.1 (49.9–54.2)	76.2 (73.0–79.5)	41.7 (39.9–43.5)	72.0 (68.8–75.2)	NR	NR	NR
North Dakota	66.5 (64.3–68.7)	75.0 (71.9–78.1)	78.9 (76.2–81.6)	33.6 (31.4–35.8)	75.0 (72.8–77.2)	40.0 (38.2–41.9)	65.3 (62.4–68.2)	NR	NR	NR
Ohio	66.6 (64.9–68.3)	79.0 (77.1–80.8)	77.4 (75.4–79.3)	39.6 (38.0–41.3)	74.1 (72.3–75.9)	35.2 (33.9–36.4)	NR	NR	NR	NR
Oklahoma	62.1 (59.7–64.5)	73.5 (71.0–76.1)	74.2 (71.4–77.0)	36.4 (34.2–38.5)	74.8 (72.4–77.2)	38.1 (36.5–39.8)	NR	NR	NR	NR
Oregon	71.7 (69.5–73.9)	78.0 (75.7–80.3)	77.9 (75.3–80.6)	45.7 (43.8–47.6)	77.1 (74.4–79.9)	30.6 (29.1–32.1)	67.7 (64.8–70.5)	NR	NR	NR
Pennsylvania	71.3 (69.1–73.5)	77.3 (74.8–79.8)	78.6 (75.8–81.5)	41.4 (39.4–43.3)	74.7 (71.9–77.5)	40.3 (38.7–41.9)	NR	NR	NR	NR
Puerto Rico	55.7 (53.2–58.3)	81.6 (79.5–83.7)	83.5 (81.0–86.0)	61.5 (59.4–63.6)	31.1 (28.0–34.2)	25.8 (24.2–27.3)	85.5 (83.3–87.7)	NR	NR	NR
Rhode Island	75.1 (72.9–77.3)	83.9 (81.5–86.4)	87.0 (85.0–89.0)	48.4 (46.0–50.8)	74.6 (72.1–77.1)	37.1 (35.2–38.9)	NR	NR	NR	NR
South Carolina	70.3 (68.7–71.9)	78.7 (76.8–80.6)	77.2 (75.2–79.1)	44.3 (42.6–46.0)	73.4 (71.7–75.1)	35.5 (34.3–36.8)	69.7 (67.4–71.9)	NR	NR	NR
South Dakota	68.4 (65.6–71.2)	72.9 (68.9–76.9)	81.7 (78.6–84.8)	32.0 (29.4–34.6)	76.5 (73.7–79.4)	35.3 (33.2–37.4)	63.7 (59.9–67.4)	NR	NR	NR
Tennessee	68.3 (65.7–70.8)	78.9 (76.2–81.7)	76.3 (73.1–79.5)	42.5 (40.1–44.9)	74.2 (71.3–77.0)	28.6 (26.9–30.3)	69.0 (65.7–72.2)	19.8 (12.3–27.2)	24.6 (22.5–26.8)	NR
Texas	59.3 (55.9–62.8)	78.2 (75.5–81.0)	74.9 (70.4–79.5)	47.1 (44.8–49.5)	71.1 (67.2–74.9)	26.4 (24.6–28.1)	61.6 (57.2–65.9)	13.7 (9.3–18.1)	25.7 (23.2–28.2)	62.7 (60.3–65.1)
Utah	69.5 (67.7–71.3)	73.0 (71.2–74.9)	72.3 (69.8–74.8)	24.7 (23.5–25.9)	73.7 (71.6–75.9)	32.3 (31.2–33.5)	NR	NR	NR	NR
Vermont	71.2 (69.2–73.1)	78.4 (75.8–81.0)	76.4 (73.9–78.9)	44.1 (41.8–46.3)	74.5 (72.2–76.9)	37.2 (35.4–38.9)	NR	NR	NR	NR
Virginia	69.3 (67.5–71.1)	83.6 (81.9–85.3)	81.1 (79.1–83.1)	47.3 (45.6–49.0)	73.6 (71.5–75.7)	38.9 (37.6–40.3)	71.3 (69.1–73.6)	NR	30.0 (28.5–31.5)	73.5 (72.1–74.8)
Washington	70.8 (69.3–72.4)	76.3 (74.6–78.1)	74.8 (72.8–76.8)	44.9 (43.4–46.3)	77.7 (76.2–79.3)	38.4 (37.3–39.5)	67.0 (64.9–69.1)	NR	NR	NR
West Virginia	67.4 (65.3–69.5)	78.0 (75.6–80.4)	75.1 (72.3–77.9)	35.1 (33.0–37.2)	73.0 (70.6–75.4)	42.6 (40.9–44.3)	73.4 (70.7–76.0)	NR	NR	NR
Wisconsin	74.0 (71.6–76.4)	79.5 (76.9–82.0)	77.8 (74.8–80.9)	33.9 (31.6–36.1)	74.7 (71.7–77.7)	29.9 (28.1–31.6)	68.6 (65.6–71.7)	NR	NR	NR
Wyoming	57.7 (55.3–60.1)	73.2 (70.4–76.1)	68.0 (64.9–71.0)	38.0 (35.8–40.3)	69.8 (67.2–72.3)	31.0 (29.4–32.7)	60.2 (57.0–63.3)	NR	NR	NR

Abbreviations: CI = confidence interval; DC = District of Columbia; HPV = human papillomavirus; NR = not reported.

* 50 states, DC, Puerto Rico, and Guam were included in the analysis of cancer screenings, HIV testing, pneumococcal vaccination, and influenza vaccination; 28 states, DC, Puerto Rico, and Guam were included in the analysis of diabetes screening; eight states were included in the analysis of HPV vaccination; and four states were included in the analysis of both zoster (shingles) and tetanus vaccinations.

FIGURE. Adjusted prevalence ratios of use of selected clinical preventive services,* by health insurance status, family income level, and rurality — Behavioral Risk Factor Surveillance System, United States, 2018



Abbreviations: HPV= human papillomavirus; IHR = insured and higher income and rural; IHU = insured and higher income and urban; ILR = insured and lower income and rural; ILU = insured and lower income and urban; UHR = uninsured and higher income and rural; UHU = uninsured and higher income and urban; ULR = uninsured and lower income and rural; ULU = uninsured and lower income and urban.

* Adjusted by age, sex (except for cervical cancer screening and breast cancer screening), race/ethnicity, education level, marital status, self-reported health status, and state. Similar findings were observed in pneumococcal, HPV, zoster (shingles), and tetanus vaccinations (panels available in Supplementary Figure, https://stacks.cdc.gov/view/cdc/104149).

Discussion

In 2018, use of nine recommended clinical preventive services was lower among persons without insurance, those with lower income, and those living in rural communities, whereas use of HIV testing was higher among persons with lower income. Geographic variation in use of clinical preventive services existed across states. These differences varied by type of services, with variation being greatest for HIV testing use. Insurance status had the strongest association with use of clinical preventive services followed by income and rurality.

Use of nearly all recommended clinical preventive services was higher in 2018 than it was during 2011–2012 (*3*,*4*). These results were consistent with previous studies, which showed that the prevalence of use of clinical preventive services was lower among persons who were uninsured, lived in households with lower income, and lived in nonmetropolitan areas (*3*–*5*). Geographic variation was also consistent with previous studies, which suggests that state-level variation could be used to identify state- and locality-specific strategies to increase use of clinical preventive services (*6*,*8*). In addition, policies that address health insurance coverage and benefits or reduce specific barriers to care for persons with lower income or living in rural areas could potentially be effective at increasing use of clinical preventive services. The finding that use of HIV testing was higher among persons of lower income was consistent with previous studies (*2*,*3*) and might reflect the success of a testing strategy that focused HIV screening efforts in communities that are disproportionately comprised of persons of lower income (*9*). Fear and misperceptions about HIV risk and the testing process itself might be additional barriers to increasing HIV testing (*10*).

Summary

What is already known on this topic?

Ongoing federal and state health reform efforts, particularly the Patient Protection and Affordable Care Act, have affected use of clinical preventive services in the United States.

What is added by this report?

Analysis of 2018 Behavioral Risk Factor Surveillance System data indicated use increased for selected recommended clinical preventive services; however, use of nine of the 10 services examined was lower among the uninsured, those with lower income, and those living in rural communities. Among those factors examined, insurance status had the strongest association with use of clinical preventive services, followed by income level and rurality.

What are the implications for public health practice?

Understanding factors influencing use of clinical preventive services can potentially help decision makers better identify policies to increase their use including strategies to increase insurance coverage.

The findings in this report are subject to at least six limitations. First, the analysis was based on self-reported use data, which could be subject to recall and social desirability bias. Second, use of some services as measured by BRFSS was not entirely aligned with the recommendations; BRFSS questions, recommendations, and important distinctions are provided (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/104148). Third, FPL was estimated based on the categorical income value provided by BRFSS rather than a precise estimate of household income. Fourth, whether BRFSS participants received services from in-network providers could not be determined, nor could whether survey participants were enrolled in insurance plans subject to ACA requirements to provide clinical preventive services without cost-sharing be determined (*1*). Therefore, use among the insured group was potentially underestimated compared with a sample comprised entirely of persons with ACA-compliant plans. Fifth, this is a cross-sectional study, and causal relationship cannot be determined even when relevant confounders are adequately controlled. Finally, only a limited number of states participated in BRFSS optional modules for diabetes screening and for HPV, shingles and tetanus vaccinations, and so data might not be nationally representative of prevalence, even though the results were consistent with previous studies (*3*,*4*).

As the health care policy landscape continues to shift, understanding factors associated with use of recommended clinical preventive services could help decision makers better identify policy levers to increase use of clinical preventive services. The ongoing monitoring of trends could improve understanding of how modifiable factors affect use of clinical preventive services, especially during the pandemic, because a decrease in use of routine vaccinations was observed. Although insurance status, income level, rurality, and state of residence appear to be associated with use, examining other barriers could also help better identify strategies to achieve public health goals.

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Community-Associated Outbreak of COVID-19 in a Correctional Facility — Utah, September 2020–January 2021

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Transmission of SARS-CoV-2, the virus that causes COVID-19, is common in congregate settings such as correctional and detention facilities (*1*–*3*). On September 17, 2020, a Utah correctional facility (facility A) received a report of laboratory-confirmed SARS-CoV-2 infection in a dental health care provider (DHCP) who had treated incarcerated persons at facility A on September 14, 2020 while asymptomatic. On September 21, 2020, the roommate of an incarcerated person who had received dental treatment experienced COVID-19–compatible symptoms*; both were housed in block 1 of facility A (one of 16 occupied blocks across eight residential units). Two days later, the roommate received a positive SARS-CoV-2 test result, becoming the first person with a known-associated case of COVID-19 at facility A. During September 23–24, 2020, screening of 10 incarcerated persons who had received treatment from the DHCP identified another two persons with COVID-19, prompting isolation of all three patients in an unoccupied block at the facility. Within block 1, group activities were stopped to limit interaction among staff members and incarcerated persons and prevent further spread. During September 14–24, 2020, six facility A staff members, one of whom had previous close contact† with one of the patients, also reported symptoms. On September 27, 2020, an outbreak was confirmed after specimens from all remaining incarcerated persons in block 1 were tested; an additional 46 cases of COVID-19 were identified, which were reported to the Salt Lake County Health Department and the Utah Department of Health. On September 30, 2020, CDC, in collaboration with both health departments and the correctional facility, initiated an investigation to identify factors associated with the outbreak and implement control measures. As of January 31, 2021, a total of 1,368 cases among 2,632 incarcerated persons (attack rate = 52%) and 88 cases among 550 staff members (attack rate = 16%) were reported in facility A. Among 33 hospitalized incarcerated persons, 11 died. Quarantine and monitoring of potentially exposed persons and implementation of available prevention measures, including vaccination, are important in preventing introduction and spread of SARS-CoV-2 in correctional facilities and other congregate settings (*4*).

* Includes fever or chill, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, or diarrhea.

† Close contact was defined as being within 6 ft of a person with COVID-19 for at least 15 cumulative minutes.

In Utah, the 7-day average daily incidence of confirmed§ COVID-19 cases increased from 12 cases per 100,000 population¶ on September 1, 2020 to a peak of 106 on November 22, 2020.** On March 6, 2020, facility A had implemented symptom and temperature screening at entry for all staff members and SARS-CoV-2 testing at intake for incarcerated persons. Staff members were required to wear a surgical mask or cloth face covering at work; incarcerated persons were issued cloth face coverings and directed to always wear them. On March 27, 2020, personal protective equipment (PPE) stations were installed, and dedicated nursing staff members were placed on call to supervise PPE use, mostly during intake processing. On May 1, 2020, nonessential visits were stopped.

Before September 14, 2020, no known COVID-19 cases had been diagnosed among incarcerated persons at facility A other than 15 cases among incarcerated persons screened at intake and identified by reverse transcription–polymerase chain reaction (RT-PCR) testing while isolated. On September 14, 2020, a visiting DHCP treated 10 incarcerated persons in a dental clinic at facility A (Table 1). At entry screening, the DHCP had a normal temperature and reported no COVID-19–compatible symptoms but experienced symptoms later that evening. On September 15, 2020, the DHCP received SARS-CoV-2 RT-PCR testing and notified the facility of a positive result 2 days later (September 17, 2020). The DHCP was classified as patient DHCP1 (the index patient). By September 24, 2020, COVID-19 was confirmed in three incarcerated persons, and the outbreak subsequently expanded to include 198 incarcerated persons and seven staff members by October 3, 2020.

The outbreak investigation started on September 30, 2020. To better understand factors contributing to the outbreak, investigators interviewed facility dental and medical staff members during September 30–October 9, 2020. Investigators also reviewed case records of staff members who reported onset of COVID-19–compatible symptoms during September 14–September 24, 2020 and who worked in block 1 or in other areas where possible exposure to block 1 incarcerated persons or

§ For this investigation, a confirmed case was defined as receipt of a positive SARS-CoV-2 real time RT-PCR test result.

¶ Estimate based on an average case count during the previous 7 days per 100,000 population.

** The 7-day cumulative number of new COVID-19 cases in Salt Lake County was obtained from the Utah Department of Health and the Salt Lake County Health Department.

TABLE 1. Clinical and exposure characteristics of incarcerated persons (IPs) with COVID-19 (n = 9), a visiting dental health care provider (DHCP1),* and potentially infectious staff members who worked near block 1† areas or patients in correctional facility A — Utah, September 14–September 26, 2020

Patient no. (occupation)	Preexisting conditions and risk factors	Date of symptom onset§	Symptoms reported	Date of positive RT-PCR test result¶	Known exposure (duration)**	Location of potential onward facility exposures††
Visiting staff member case						
DHCP1/S1	Unknown	Sep 14, 2020	Chills, muscle aches, fatigue	Sep 15, 2020	Community contact (unknown)	Dental clinic
IP resident cases associated with nonfacility (visiting) health care provider						
R1 (IP)	Emphysema, history of smoking	Sep 21, 2020	Chills, muscle aches, runny nose, sore throat, cough, headache, fatigue	Sep 23, 2020	Contact to R2 (ongoing)	Block 1
R2 (IP)	Depression, history of smoking	Unknown	Headache	Sep 23, 2020	Contact to S1: surgical tooth extraction (15 mins); roommate of R1	Block 1
R3 (IP)	Asthma, lipidemia, developmental disabilities	Unknown	None	Sep 24, 2020	Contact to S1: biopsy and evaluation (12 mins)	Block 1
Staff member cases with known close contact with block 1 confirmed IP cases						
S2 (officer)	Chronic gastrointestinal	Sep 23, 2020	Subjective fever, chills, sore throat, cough, fatigue, loss of taste, loss of smell	Sep 24, 2020	Contact to IP (R2) during interview (>15 mins cumulative)	Block 1
Staff member cases with possible or indirect contact with block 1 IP cases and staff members with COVID-19						
S3 (maintenance worker)	Type 2 diabetes, cardiovascular disease	Sep 17, 2020	Muscle aches, cough, fatigue	Sep 18, 2020	Community contact (unknown)	Block 2, culinary facility, corridor†
S4 (officer)	None	Sep 18, 2020	Subjective fever, chills, muscle aches, headache, fatigue	Sep 21, 2020	Household contact (ongoing)	Block 2, corridor†
S5 (maintenance worker)	Unknown	Unknown	Unknown	Sep 20, 2020	Contact to S4 (ongoing)	Block 2
S6 (officer)	None	Sep 21, 2020	Fever, subjective fever, chills, muscle aches, runny nose, sore throat, cough, difficulty breathing, nausea, headache, fatigue, abdominal pain, diarrhea	Sep 23, 2020	Unknown (unknown)	Corridor†
S7 (HCP)	None	Sep 24, 2020	Chills, muscle aches, runny nose, sore throat, cough, headache, fatigue, loss of taste, loss of smell	Sep 26, 2020	Household contact with same date of symptom onset (ongoing)	Infirmary

Abbreviations: HCP = health care provider; RT-PCR = real time reverse transcription–polymerase chain reaction; R = resident; S = staff member.

* DHCP1 was the first reported staff member with COVID-19; block 1 cases that occurred among incarcerated persons were associated with exposure to this staff member.

† Block 1 is a residential unit with two-person, closed-door rooms where COVID-19 was identified in IPs; block 2 is a residential unit with single-person, open-door rooms, where COVID-19 was next identified in IPs; blocks 1 and 2 are connected by a corridor (60-ft-long, 12-foot-wide) that staff members use occasionally to travel between blocks 1 and 2.

§ Date of any COVID-19 symptom first reported.

¶ Specimen collection date.

** Where known, exposures involve contact to a confirmed case with an earlier onset date unless otherwise specified.

¶¶ Facility locations include dental clinic, block 1, block 2, corridor between blocks 1 and 2, culinary facility serving blocks 1 and 2, and the infirmary.

staff members might have occurred. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.††

†† 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.

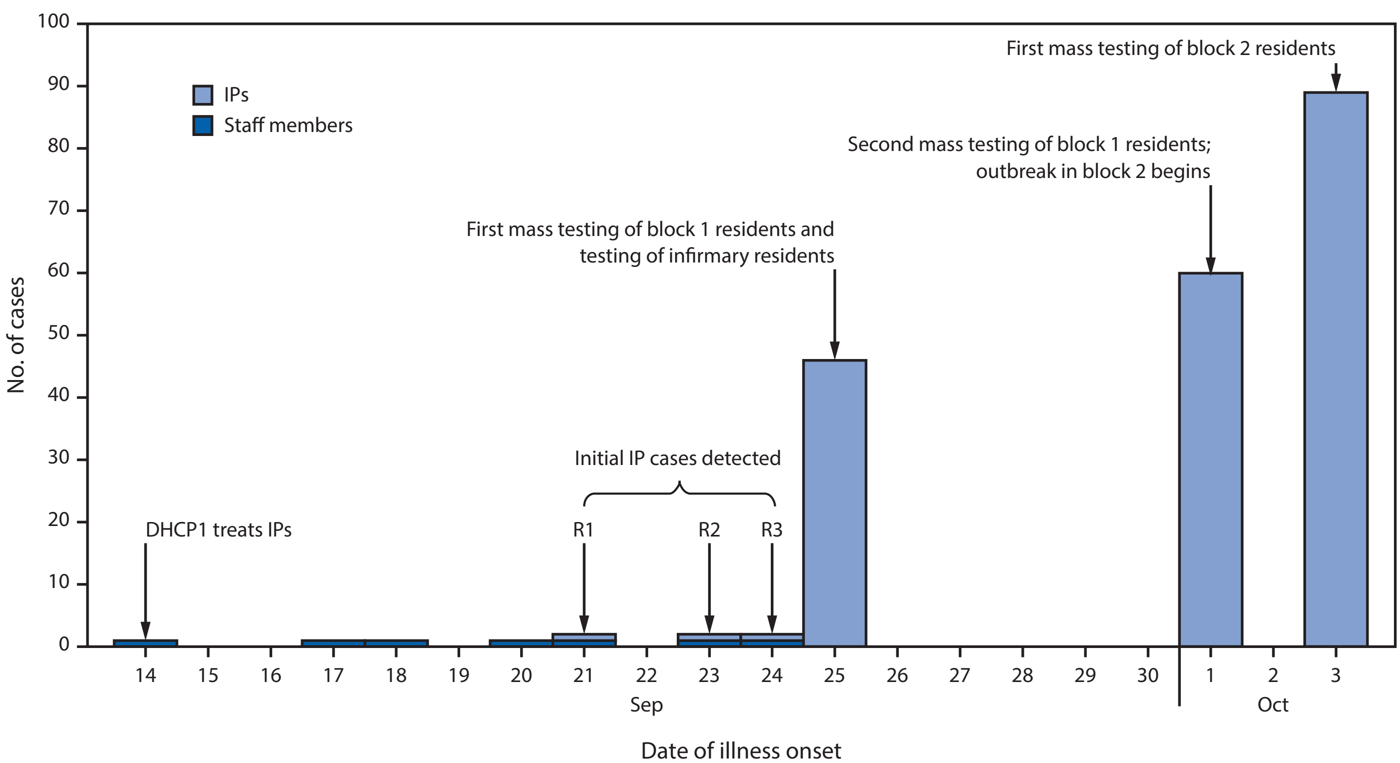
On September 14, 2020, DHCP1 wore a valveless N95 respirator face mask at entry to facility A, during temperature and symptom screening, and in transit to the dental clinic. During treatment, DHCP1 wore the N95 as well as a gown, gloves, and goggles, and changed gowns and gloves after each patient. Among 10 incarcerated persons (residents) who received treatment, six (including a resident who subsequently developed

COVID-19 [patient R2]) had surgical tooth extractions (a 15-minute procedure), one (patient R3) had a combined evaluation and biopsy (12-minute procedure); and three had 10-minute patient evaluations. All 10 incarcerated persons were interviewed for 5 minutes each by one of five facility dental clinic staff members, all of whom wore recommended PPE. On the day of treatment, none of the incarcerated persons was tested for SARS-CoV-2, screened for fever or symptoms, or wore masks or gloves during treatment.

On September 21, 2020, patient R1 (the roommate of patient R2, who had received dental treatment) experienced symptoms and visited the infirmary the next day. On September 23, 2020, patients R1 and R2 both received positive SARS-CoV-2 RT-PCR test results; patient R2 was tested because of his close contact with patient R1, despite being asymptomatic at the time (he retrospectively reported a headache with indeterminate onset) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/104506). Patients R1 and R2 were moved from block 1 to an unoccupied isolation block, and staff members began wearing N95 respirators and eye protection. On September 24, 2020 the nine remaining incarcerated persons treated by DHCP1 were tested. Patient R3, who also lived in block 1, received a positive result and was isolated.

On September 25, 2020, facility medical staff members tested specimens from the remaining 171 block 1 incarcerated persons with unknown SARS-CoV-2 infection status (Figure); 46 (26%) received positive RT-PCR test results. The incarcerated persons with positive results were isolated, and the remaining persons living in block 1 were quarantined; those with negative test results and no known exposures were placed together in rooms in block 1, and those with known exposure were quarantined in single-occupant rooms in another unoccupied area. On October 1, 2020, specimens collected from incarcerated persons who lived in block 1 and who had received a negative result on September 25, 2020 were tested; 57 (46%) of 127 received a positive result. Among 174 incarcerated persons living in block 1, a cumulative total of 106 (61%) had received a positive result by October 1, 2020; through January 31, 2021, a total of 117 cases occurred among block 1 incarcerated persons. No hospitalizations or deaths among block 1 cases

FIGURE. Number of COVID-19 cases (N = 205) among incarcerated persons* (IPs) (n = 198) and staff members† (n = 7) associated with initial outbreak at correctional facility A,§ by date of illness onset¶ — Utah, September 14–October 3, 2020



Abbreviations: DHCP1 = dental health care provider; R = resident.

* IPs included R1: confirmed case in a resident IP treated by DHCP1; R2: confirmed case in roommate of patient R1 (resident IP index case); and R3: second confirmed case in IP treated by DHCP1.

† DHCP1 is the first case in a staff member at correctional facility A.

§ Block 1 is the first residential unit at correctional facility A where COVID-19 was identified in IPs; block 2 is the second residential unit where COVID-19 was identified in IPs; block 1 and block 2 are connected by a corridor.

¶ Where date of illness onset was unknown or when symptoms data were not available, date of specimen collection with first positive test result is used.

were reported, but several patients (including patient R2) were treated in the facility infirmary. Facility A medical staff members indicated that symptoms of incarcerated persons were not consistently recorded because of workload constraints as well as patients' hesitancy to report symptoms to avoid being moved; among 11 patients with data available, six reported symptoms. On October 1, 2020, two additional incarcerated persons with COVID-19–compatible symptoms who lived permanently in a long-term care setting within the infirmary, also received positive SARS-CoV-2 RT-PCR test results.

Block 2 is connected to block 1 by a corridor (60-ft long, 12-ft wide) through which staff members occasionally travel. Among 174 incarcerated persons in block 2, three with COVID-19–compatible symptoms were moved to the isolation area on October 1, 2020 after receiving positive test results. On October 3, 2020, RT-PCR testing of specimens from the 171 remaining block 2 incarcerated persons identified an additional 89 cases (Figure) (Table 2). Among the 92 (53%) incarcerated persons in block 2 with positive results by October 3, 2020 additional information was available for 20 (22%), including five who were symptomatic, one of whom was hospitalized on October 12, 2020 and died on November 14, 2020. As of October 3, 2020, a total of 198 cases among incarcerated persons had been reported in the facility. By January 31, 2021, the outbreak had spread to six of eight residential units (consisting of 14 of 16 blocks); 1,368 cases had been reported and the median attack rate in all affected blocks, including blocks 1 and 2, was 69% (range = 7%–96%) and the overall attack rate in facility A was 52%. Among blocks with cases, the attack rate was higher in dormitory-style or open-cell blocks (76%) compared with single or paired closed-door cells (64%).

Investigations of six cases in staff members occurring during the period from the potential introduction of infection into facility A to the detection of COVID-19 cases in the first three incarcerated persons suggested likely acquisition at work for two (Table 1); staff member patient S2 reported close contact with an infected incarcerated person and staff member patient S5 reported ongoing contact with staff member patient S4. Four staff members (patients S3, S4, S6, and S7) reported only community exposures. Epidemiologic data suggest that cases in patients S3–S7 contributed to the block 2 outbreak (Table 1); however, SARS-CoV-2 might have been introduced into block 1 by infected but asymptomatic or untested staff members. These six staff members (S2–S7) stopped reporting to work after receiving positive test results or learning of their exposure to a person with confirmed COVID-19 (Supplementary Figure, https://stacks.cdc.gov/view/cdc/104506). Cumulatively, as of January 31, 2020, 88 (16%) cases among 550 staff members were reported in facility A.

TABLE 2. Total* COVID-19 cases, hospitalizations, and deaths among incarcerated persons (IPs) and staff members, blocks 1 and 2† in correctional facility A — Utah, September 14, 2020–January 31, 2021

Case characteristics among IPs and staff members	Facility A	Block 1	Block 2
IPs			
Total no. of residents	**2,632**	**174**	**174**
No. of COVID-19 cases (% attack rate§), initial outbreak¶	198 (8)	106 (61)	92 (53)
No. of COVID-19 cases (% attack rate§), total	1,368 (52)	117 (67)	165 (95)
No. of hospitalizations (hospitalization rate **)	31 (22.6)	0 (—)	1 (6.1)
No. of deaths (death rate††)	11 (6.5)	0 (—)	1 (6.1)
Staff members			
Total no. of staff members	**550**	**N/A**	**N/A**
No. of COVID-19 cases (% attack rate§), initial outbreak¶	7 (1)	N/A	N/A
No. COVID-19 cases (% attack rate§), total	88 (16)	N/A	N/A
No. of hospitalizations (hospitalization rate**)	0 (—)	0 (—)	0 (—)
No. of deaths (death rate††)	0 (—)	0 (—)	0 (—)

Abbreviation: N/A = not available

* Estimated total number of residents as of October 1, 2020; daily counts fluctuated based on intake and release of IP and hiring, termination, or leave among staff members. Staff member total counts, case counts, and attack rates for individual blocks were not available because staff members move among blocks.

† Block 1 is a residential area with two-person, closed-door rooms, where COVID-19 was first identified in IPs; block 2 is a residential area in the same residential unit with single-person, open-door rooms, where COVID-19 was next identified in IPs. Blocks 1 and 2 are connected by a 60-foot-long, 12-foot-wide corridor that staff use occasionally to travel between blocks 1 and 2.

§ Attack rate is the number of cases as a proportion of the total number of IPs or staff members. After November 24, 2021, facility A used rapid antigen tests to determine cases in emergency situations.

¶ The initial outbreak was defined as September 14–October 3, 2021, and consisted of cases detected in IPs during two mass testing days in block 1 (September 25 and October 1), selective testing of two infirmary residents (October 1), one mass testing day in block 2 (October 3), and seven cases in staff members potentially associated with the outbreak.

** Hospitalizations per 1,000 cases.

†† Deaths per 1,000 cases.

After 46 cases were detected with mass testing in block 1 on September 27, 2020, facility A notified the Salt Lake County Health Department and the Utah Department of Health. A team from both departments, with technical assistance from CDC, implemented twice-weekly calls with the facility to review infection control guidance, including protocols for cohorting, quarantine and isolation of incarcerated persons and repeated mass testing to identify new cases. The entire facility was placed under a quarantine restriction to limit mobility of staff members among residential units. The state mobile testing team supported mass testing of incarcerated persons and staff member testing events. As of March 2, 2021, the outbreak was ongoing; 1,545 cases (1,452 [94%] among incarcerated persons) have been reported, as well as 31 hospitalizations and 12 deaths among incarcerated persons with COVID-19.

Discussion

SARS-CoV-2 might have been introduced into correctional facility A by DHCP1 or other staff members with community-acquired infection. The detection of 46 cases just 11 days after the first potential introduction by DHCP1 suggests that infection spread quickly. Infection might also have spread through undetected chains of transmission from staff members working in block 1 to other areas, especially because N95 respirators and eye protection were not usually worn before September 23, 2020.

The possibility of transmission from staff members to incarcerated persons at facility A indicates a need for serial testing for both staff members and incarcerated persons (*1*), as well as careful attention to infection control guidance (*5*), including in health care settings (*6*), where dental treatment is provided (*7*), and in correctional settings (*4*). Screening of nonfacility HCPs with rapid antigen tests, testing incarcerated persons 5–7 days after receiving treatment from nonfacility HCPs, or stopping nonemergency procedures requiring nonfacility staff members could all be considered to reduce introduction and transmission of SARS-CoV-2.

Ten incarcerated persons were exposed to the index patient (DHCP1) on the date of the index patient's symptom onset and were not immediately quarantined or isolated; two of 10 appeared to be infected by DHCP1. The interval between patient R2's exposure to R1 (his roommate) and R1's symptom onset (September 14–21, 2020), suggests a mean 3.5-day incubation for these cases, consistent with previous estimates (*8*). Although only surgical tooth extractions resulted in 15-minute (the longest) exposures to DHCP1, other procedures that require manipulation or prolonged close contact with a patient's eyes, nose, or mouth might pose a higher risk for transmission during a shorter time frame (*4*). A COVID-19 outbreak among nursing home residents after receiving dental treatment was also reported in New York (*9*).

The findings in this report are subject to at least four limitations. First, it was not possible to determine whether the N95 mask worn by the index patient was fit-tested or working properly, or whether transmission occurred by touching patients' mucous membranes with contaminated gloves. Poor fit of an N95 respirator can limit its efficacy in preventing the wearer from acquiring or spreading infection (*10*). Second, given the increasing community transmission of SARS-CoV-2 when the outbreak began, SARS-CoV-2 might have been introduced undetected from another essential service provider. Third, inconsistent monitoring and reporting of symptoms could have affected the order in which cases among incarcerated persons were detected. Finally, because whole genome sequencing was not performed, linkages between infections were not ascertained definitively.

Patients exposed to HCPs who are found to be infected with SARS-CoV-2 should quarantine after exposure and be monitored closely (*4*). Because SARS-CoV-2 can spread quickly in correctional and detention facilities (*1–3*), particularly in areas with elevated community transmission, control measures are needed to prevent introductions (*4*). Control measures could include regular testing of staff members, rapid testing at entry for visiting HCP, and halting of nonemergency medical procedures requiring outside staff members, as well as universal masking, maintaining physical distancing when possible, and paying attention to hand hygiene. Vaccination of incarcerated persons might help prevent or limit the spread of infection in these facilities.

Summary

What is already known about this topic?

SARS-CoV-2 transmission is common in congregate settings including correctional and detention facilities.

What is added by this report?

Incarcerated persons in a Utah correctional facility were likely exposed to SARS-COV-2 by community-associated sources of introduction, including a visiting dental health care provider. An outbreak in the facility was first detected in the residential block where two residents received treatment; the outbreak spread rapidly, eventually affecting 1,368 (52%) of 2,632 residents (with 31 hospitalizations and 12 deaths) and an estimated 88 (16%) of 550 staff members.

What are the implications for public health practice?

Quarantining and monitoring potentially exposed persons are important in preventing the introduction and spread of SARS-CoV-2 infection in correctional facilities and other congregate settings. Vaccination of incarcerated persons might help prevent or limit the spread of infection in these facilities.

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Willingness to Receive a COVID-19 Vaccination Among Incarcerated or Detained Persons in Correctional and Detention Facilities — Four States, September–December 2020

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Incarcerated and detained persons are at increased risk for acquiring COVID-19. However, little is known about their willingness to receive a COVID-19 vaccination. During September–December 2020, residents in three prisons and 13 jails in four states were surveyed regarding their willingness to receive a COVID-19 vaccination and their reasons for COVID-19 vaccination hesitancy or refusal. Among 5,110 participants, 2,294 (44.9%) said they would receive a COVID-19 vaccination, 498 (9.8%) said they would hesitate to receive it, and 2,318 (45.4%) said they would refuse to receive it. Willingness to receive a COVID-19 vaccination was lowest among Black/African American (Black) (36.7%; 510 of 1,390) persons, participants aged 18–29 years (38.5%; 583 of 1,516), and those who lived in jails versus prisons (43.7%; 1,850 of 4,232). Common reasons reported for COVID-19 vaccine hesitancy were waiting for more information (54.8%) and efficacy or safety concerns (31.0%). The most common reason for COVID-19 vaccination refusal was distrust of health care, correctional, or government personnel or institutions (20.1%). Public health interventions to improve vaccine confidence and trust are needed to increase vaccination acceptance by incarcerated or detained persons.

Correctional and detention facilities are at increased risk for COVID-19 outbreaks because of several factors, including difficulty maintaining physical distancing, limited space for isolation or quarantine, poor ventilation, and limited resources for testing and personal protective equipment (*1*). Members of racial and ethnic minority groups and persons with unstable housing, substance use disorders, and mental illness are disproportionately incarcerated and more likely to have chronic diseases resulting from disparities in social determinants of health (*2*). The higher prevalence of medical conditions associated with severe COVID-19 illness, delays in timely diagnosis, and inadequate treatment might all contribute to the increased risk for death from COVID-19 among incarcerated or detained persons (*3*). Recognizing this, some jurisdictions have prioritized incarcerated or detained persons for COVID-19 vaccination.* Data pertaining to willingness of residents to be vaccinated while incarcerated or detained are scarce, and routine vaccination coverage is low in these settings (*4*).

To assess attitudes related to receipt of COVID-19 vaccination, a survey was conducted in three prisons and 10 small-to-medium–sized jails in Washington and one medium-to-large–sized jail each in California, Florida, and Texas, which agreed to participate in an evaluation of willingness of their residents to receive a COVID-19 vaccination.† The survey was conducted during September 22–December 12, 2020, with 96% of the interviews occurring during November 20–December 12. Interviews were conducted by health care providers, health service administrators, or corrections staff members, depending on the facility and staff member availability. Interviewers attempted to interview all residents within a facility, except those who were in special housing units, quarantine, or medical isolation. Interviews were conducted one-on-one or in small groups in outdoor spaces, communal lounges, or individual cells. Participation was voluntary, and participants could stop the interview at any time. The survey participation rate was 64.2% (range = 20.0%–94.0%).§

Interviewers informed participants that correctional and detention facilities were planning for COVID-19 vaccination. Participants were asked "When a vaccine for COVID-19 is approved, will you sign-up to get it?" (willingness). Possible responses were "yes," "no," or "maybe." Participants who answered "no" (refusal) or "maybe" (hesitancy) were then asked to provide a reason for vaccine refusal or hesitancy; responses were open-ended. The primary reason reported for vaccination hesitancy or refusal was coded into one of seven categories: 1) having concerns about efficacy or safety; 2) awaiting more information or to see others vaccinated; 3) distrust of health care, correctional, or governmental personnel or institutions; 4) not perceiving themselves at risk for COVID-19 or perceiving vaccination as unnecessary; 5) being against vaccination in general; 6) believing in a virus- or vaccine-related conspiracy to harm incarcerated or detained persons; or 7) other reasons.

* Some jurisdictions have specifically prioritized staff members, residents of correctional or detention facilities, or both in their COVID-19 vaccination plans. https://www.cdc.gov/vaccines/covid-19/covid19-vaccination-guidance.html

† Prisons usually hold persons with sentences >1 year and jails hold persons pretrial or with sentences ≤1 year.

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

Willingness to receive a COVID-19 vaccination was compared by incarcerated or detained persons' sex, age, and race/ethnicity and facility type and location. Categories of reasons for vaccine refusal or hesitancy were compared by willingness to receive a vaccination. Multivariable logistic regression was used to compare willingness to receive a vaccination ("yes") and vaccine hesitancy or refusal ("maybe"/"no") by demographic characteristics, facility type, and location. Analyses were conducted using SAS (version 9.4; SAS Institute) and R software (version 4.0.3; the R Foundation). The University of Washington Institutional Review Board determined that this was an evaluation to inform educational needs and not human subjects research. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.¶

¶ The denominator for the response rate was resident census of each facility, which included persons in restricted areas who were not approached for interview. Because not all facility residents were approached, the response rate was at least 64.2% (5,110 participants among a cumulative census of 7,955).

Among 5,110 total participants, a total of 2,294 (44.9%) responded that they would receive, 498 (9.7%) that they would hesitate to receive, and 2,318 (45.4%) that they would refuse a COVID-19 vaccination (Table 1). Willingness to receive a vaccination was similar among men (45.0%) and women (44.4%), but a higher percentage of women than men indicated they would hesitate to receive a COVID-19 vaccination (14.9% versus 8.7%; p<0.001 for "yes" versus "maybe" by sex). Willingness to receive a COVID-19 vaccination increased with age from 38.5% among participants aged 18–29 years to 61.8% among those aged 60–83 years (p<0.001). Willingness to receive a vaccination was lowest among Black participants (36.7%) and highest among Hispanic/Latino (Hispanic) (52.5%) and American Indian/Alaska Native (48.4%) participants (p<0.001 for group). Willingness to receive a COVID-19 vaccination was higher among participants in prisons than among those in jails (50.6% versus 43.7%; p<0.001). Lower willingness to receive a vaccination persisted in multivariable analyses among participants who were younger, were Black,

TABLE 1. Willingness to receive a COVID-19 vaccination among incarcerated or detained persons, by demographics and facility — four states, September–December 2020

Characteristic (no. with available information)	Willingness to receive a COVID-19 vaccination when it is authorized, no. of persons (%)				Willingness to be vaccinated,* odds ratio (95% CI)	
	All persons	Yes	Maybe	No	Unadjusted†	Adjusted§
Total no. of persons	**5,110 (100)**	**2,294 (44.9)**	**498 (9.7)**	**2,318 (45.4)**	—	—
Sex¶ (5,107)						
Men	4,209 (82.4)	1,895 (45.0)	364 (8.7)	1,950 (46.3)	Referent	Referent
Women	898 (17.6)	399 (44.4)	134 (14.9)	365 (40.7)	0.98 (0.85–1.13)	1.04 (0.86–1.24)
Age group, yrs¶ (5,070)						
18–29	1,516 (29.9)	583 (38.5)	136 (9.0)	797 (52.6)	Referent	Referent
30–39	1,589 (31.3)	653 (41.1)	181 (11.4)	755 (47.5)	1.12 (0.97–1.29)	1.09 (0.94–1.26)
40–49	1,011 (19.9)	496 (49.1)	111 (11.0)	404 (40.0)	1.54 (1.31–1.81)	1.46 (1.24–1.73)
50–59	661 (13.0)	367 (55.5)	51 (7.7)	243 (36.8)	2.00 (1.66–2.40)	1.92 (1.58–2.32)
60–83	293 (5.8)	181 (61.8)	18 (6.1)	94 (32.1)	2.59 (1.99–3.35)	2.62 (2.01–3.43)
Race/Ethnicity¶ (4,979)						
White	2,085 (41.9)	915 (43.9)	251 (12.0)	919 (44.1)	Referent	Referent
Black/African American	1,390 (28.0)	510 (36.7)	105 (7.6)	775 (55.8)	0.74 (0.65–0.85)	0.74 (0.63–0.86)
Hispanic/Latino	1,013 (20.4)	532 (52.5)	75 (7.4)	406 (40.1)	1.41 (1.22–1.64)	1.34 (1.14–1.58)
American Indian/ Alaska Native	221 (4.4)	107 (48.4)	19 (8.6)	95 (43.0)	1.20 (0.91–1.58)	1.36 (1.02–1.80)
Other	270 (5.4)	128 (47.4)	43 (15.9)	99 (36.7)	1.15 (0.89–1.49)	0.93 (0.71–1.21)
Facility type¶, (5,110)**						
Jail	4,232 (82.8)	1,850 (43.7)	345 (8.2)	2,037 (48.1)	Referent	Referent
Prison	878 (17.2)	444 (50.6)	153 (17.4)	281 (32.0)	1.32 (1.14–1.52)	1.23 (1.01–1.51)
Facility location¶ (5,110)						
Washington	2,514 (49.2)	1,081 (43.0)	349 (13.9)	1,084 (43.1)	Referent	Referent
Florida	2,015 (39.4)	856 (42.5)	67 (3.3)	1,092 (54.2)	0.98 (0.87–1.10)	1.17 (0.99–1.36)
California	449 (8.8)	297 (66.2)	35 (7.8)	117 (26.1)	2.59 (2.10–3.20)	2.96 (2.35–3.72)
Texas	132 (2.6)	60 (45.5)	47 (35.6)	25 (18.9)	1.11 (0.78–1.57)	1.41 (0.98–2.04)

Abbreviation: CI = confidence interval.
* Bivariate and multivariable regression compared willingness to receive a vaccination ("yes") and vaccine hesitancy or refusal ("maybe"/"no").
† Separate bivariate logistic regression models were constructed to examine the association between participant's willingness to receive a COVID-19 vaccination by sex, age, race/ethnicity, facility type, and location.
§ A multivariable logistic regression model was constructed to examine the association between participant's willingness to receive a COVID-19 vaccination, by sex, age, race/ethnicity, facility type, and location, adjusting for all characteristics listed in the table.
¶ p<0.001 comparing "yes," "maybe," and "no" vaccination willingness and characteristic (by chi-square test).
** Prisons usually hold persons with sentences >1 year and jails hold persons pretrial or with sentences ≤1 year.

lived in jails, and were not in California. When stratified by sex and race/ethnicity, willingness to receive a vaccination was highest among Hispanic men (54.9%) and lowest among Hispanic women (35.8%) and Black men (36.0%) (Table 2).

Among 2,816 participants who indicated they would hesitate to receive or would refuse a COVID-19 vaccination, 2,281 (81.0%) provided a primary reason. Among 458 participants who would hesitate to receive a COVID-19 vaccination, 251 (54.8%) said they were awaiting more information or to see others vaccinated, and 142 (31.0%) had concerns about efficacy or safety (Table 3). Among 1,823 participants who would refuse a COVID-19 vaccination, 366 (20.1%) cited distrust of health care, correctional, or governmental personnel or institutions; 358 (19.6%) had concerns about efficacy or safety; and 344 (18.9%) did not perceive themselves to be at risk for COVID-19 or thought vaccination was unnecessary.

Discussion

Among incarcerated or detained persons, willingness to receive a COVID-19 vaccination was lower in this analysis compared with findings from national surveys of the general population over the same period (45% versus 56%–67%) (*5*,*6*). This survey identified significantly lower prevalences of willingness to receive a vaccination among persons who were younger or Black, consistent with similar surveys in the general population. Lower willingness to receive a COVID-19 vaccination among Black participants is not unexpected given historical mistreatment and higher rates of distrust of health care, correctional, and governmental institutions** (*7*). This finding is particularly concerning because this group is at higher risk for severe illness and death from COVID-19 and overrepresented in the criminal justice system (*8*).

More than three fourths of participants who reported they were hesitant to receive a COVID-19 vaccination indicated that they had concerns about efficacy or safety or were waiting to see others vaccinated. This finding highlights the need for access to COVID-19 vaccination information that is culturally relevant and appropriate for persons of all health literacy levels, and that is conveyed via multiple formats and languages

** Long-standing systemic health and social inequities have put many persons from racial and ethnic minority groups at increased risk for becoming ill and dying from COVID-19. Inequities in the social determinants of health have historically prevented these groups from having the same opportunities for economic, physical, and emotional health. These inequities are highlighted by the factors that contribute to increased risk for COVID-19 exposure, severe illness from COVID-19, death, and unintended consequences of COVID-19 mitigation strategies. https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/index.html

TABLE 3. Primary reasons for COVID-19 vaccination hesitancy or refusal among incarcerated or detained persons, by vaccination willingness — four states,* September–December 2020

	Willingness to receive a COVID-19 vaccination when it is authorized,§ no. of persons (%)		
Primary reason for refusal or hesitancy†	All respondents (N = 2,281)	Maybe (hesitancy) (n = 458)	No (refusal) (n = 1,823)
Efficacy or safety concerns	500 (21.9)	142 (31.0)	358 (19.6)
Awaiting more information or to see others vaccinated	493 (21.6)	251 (54.8)	242 (13.3)
Distrust of health care, correctional, or governmental personnel or institutions	379 (16.6)	13 (2.8)	366 (20.1)
Not perceiving themselves at risk for COVID-19 or perceiving vaccination as unnecessary	353 (15.5)	9 (2.0)	344 (18.9)
Against vaccination in general	253 (11.1)	5 (1.1)	248 (13.6)
Believing in a virus- or vaccine-related conspiracy to harm incarcerated or detained persons	104 (4.6)	4 (0.9)	100 (5.5)
Other	199 (8.7)	34 (7.4)	165 (9.1)

* California, Florida, Texas, and Washington.
† Participants were then asked to provide a reason for vaccination refusal or hesitancy with open-ended responses that were coded into one of seven primary reasons.
§ p<0.001 comparing the distribution of reasons between "maybe" and "no" vaccination willingness (by chi-square test).

TABLE 2. Willingness to receive a COVID-19 vaccination among incarcerated or detained persons, by sex and race/ethnicity — four states,* September–December 2020

		Willingness to receive a COVID-19 vaccination when it is authorized, no. of persons (%)					
		Men† (n = 4,081)			Women§ (n = 894)		
Race/Ethnicity	All persons	Yes	Maybe	No	Yes	Maybe	No
Total	**4,975 (100)**	**1,795 (44.0)**	**359 (8.8)**	**1,927 (47.2)**	**396 (44.3)**	**134 (15.0)**	**364 (40.7)**
White	2,084 (41.9)	687 (43.4)	172 (10.1)	724 (45.7)	227 (45.3)	79 (15.8)	195 (38.9)
Black/African American	1,390 (27.9)	453 (36.0)	89 (7.1)	717 (57.0)	57 (43.5)	16 (12.2)	58 (44.3)
Hispanic/Latino	1,011 (20.3)	489 (54.9)	54 (6.1)	348 (39.1)	43 (35.8)	21 (17.5)	56 (46.7)
American Indian/Alaska Native	221 (4.4)	64 (46.0)	11 (7.9)	64 (46.0)	43 (52.4)	8 (9.8)	31 (37.8)
Other	269 (5.4)	102 (48.1)	33 (15.8)	74 (35.4)	26 (43.3)	10 (16.7)	24 (40.0)

* California, Florida, Texas, and Washington.
† p<0.001 comparing "yes," "maybe," and "no" vaccination willingness and race/ethnicity among men (by chi-square test).
§ p<0.001 comparing "yes," "maybe," and "no" vaccination willingness and race/ethnicity among women (by chi-square test).

including video messages, handouts, posters, presentations, peer interactions, and discussions with experts. In addition, opportunities to observe peers, family members, and trusted influencers having positive vaccination experiences could increase vaccine confidence. Nearly one in five participants who would refuse vaccination did not perceive themselves to be at risk for COVID-19 and thought vaccination was unnecessary. Interventions to increase COVID-19 risk perception and highlight the facility and community protective benefits of vaccination might further increase vaccination acceptance. Participants who would refuse vaccination distrusted service providers or the government (20%), were against vaccination in general (14%), or believed a COVID-19 vaccination was a conspiracy to harm them (6%). These reasons were much more prevalent among incarcerated or detained persons than the prevalence that has been reported among the general population (*7*), suggesting that overcoming systemic distrust will be necessary to increase willingness to receive a vaccination among a segment of this population. Interventions to improve vaccine confidence should not be punitive or overly generous to avoid being perceived as coercive, which might worsen trust.

The findings in this report are subject to at least three limitations. First, the correctional and detention facilities were selected based on voluntary participation and are likely not representative of facilities or their residents nationwide. Second, the survey was largely conducted before Emergency Use Authorization of the first COVID-19 vaccine on December 11, 2020; willingness to be vaccinated might have changed given the rapid evolution of the pandemic and vaccine rollout. Finally, stated willingness to receive a COVID-19 vaccination is an imperfect measure of whether a person will accept a vaccination when it is actually offered (*9*). Persons might be influenced by a variety of peer, environmental, and situational factors that support or hinder receipt of vaccination.

This report underscores the urgent need for interventions that are culturally relevant and appropriate for various health literacy levels to increase vaccine confidence among incarcerated or detained persons. Incarcerated or detained persons might have inherent higher distrust of governmental systems based on their interactions with law enforcement or the justice system or their experiences with institutional racism, emphasizing the need for trusted messengers to directly appeal to these persons. Low vaccine confidence contributes to low vaccination coverage and risks further exacerbating preexisting inequities in COVID-19 outcomes by incarceration or detention status, age, and race/ethnicity. In addition, correctional or detention facilities staff members and residents frequently cycle between the facility and the community. COVID-19 outbreaks in these settings can contribute to community transmission, which intensifies the importance of preventing outbreaks in this setting with vaccination (*10*). It is critically important for public health and criminal justice professionals to promote health equity by addressing vaccine hesitancy and improving vaccine confidence and acceptance among this disproportionately affected population.

Summary

What is already known about this topic?

Persons living in correctional or detention facilities are at increased risk for COVID-19. Certain jurisdictions have prioritized COVID-19 vaccination of incarcerated or detained persons.

What is added by this report?

Among incarcerated or detained participants at correctional and detention facilities in four states who were surveyed before authorization of COVID-19 vaccines for emergency use, 45% were willing to be vaccinated. Willingness to be vaccinated was lower among participants who were younger, identified as Black/African American, and lived in jails.

What are the implications for public health practice?

COVID-19 outbreaks among incarcerated or detained persons can exacerbate inequities in COVID-19 outcomes and contribute to community transmission. Interventions are needed to improve vaccine confidence among incarcerated or detained persons.

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Rapid Spread of SARS-CoV-2 in a State Prison After Introduction by Newly Transferred Incarcerated Persons — Wisconsin, August 14–October 22, 2020

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SARS-CoV-2, the virus that causes COVID-19, can spread rapidly in prisons and can be introduced by staff members and newly transferred incarcerated persons (*1*,*2*). On September 28, 2020, the Wisconsin Department of Health Services (DHS) contacted CDC to report a COVID-19 outbreak in a state prison (prison A). During October 6–20, a CDC team investigated the outbreak, which began with 12 cases detected from specimens collected during August 17–24 from incarcerated persons housed within the same unit, 10 of whom were transferred together on August 13 and under quarantine following prison intake procedures (intake quarantine). Potentially exposed persons within the unit began a 14-day group quarantine on August 25. However, quarantine was not restarted after quarantined persons were potentially exposed to incarcerated persons with COVID-19 who were moved to the unit. During the subsequent 8 weeks (August 14–October 22), 869 (79.4%) of 1,095 incarcerated persons and 69 (22.6%) of 305 staff members at prison A received positive test results for SARS-CoV-2. Whole genome sequencing (WGS) of specimens from 172 cases among incarcerated persons showed that all clustered in the same lineage; this finding, along with others, demonstrated that facility spread originated with the transferred cohort. To effectively implement a cohorted quarantine, which is a harm reduction strategy for correctional settings with limited space, CDC's interim guidance recommendation is to serial test cohorts, restarting the 14-day quarantine period when a new case is identified (*3*). Implementing more effective intake quarantine procedures and available mitigation measures, including vaccination, among incarcerated persons is important to controlling transmission in prisons. Understanding and addressing the challenges faced by correctional facilities to implement medical isolation and quarantine can help reduce and prevent outbreaks.

Investigation and Findings

Prison A is a medium-security state prison in Wisconsin with 300–350 staff members and a maximum capacity of 1,192 men housed in 15 units. Except for one unit (a restrictive housing unit with locked cells), all units have shared lavatories and common areas, including one 150-person dormitory-style unit with conjoined sleeping and common areas. Before the outbreak, prison A implemented multiple mitigation measures, including mandatory mask wearing for staff members and incarcerated persons.[†] During August 17–19, 2020, members of a group of incarcerated men transferred from a Wisconsin central intake facility on August 13 were tested for SARS-CoV-2 by real-time reverse transcription–polymerase chain reaction (RT-PCR)[§] in accordance with routine intake procedures[¶]; six received positive test results and were immediately isolated. Before testing, the new intake group was housed with other incarcerated persons, most of whom were recent transfers, in the intake unit. On August 24, testing of incarcerated persons in the intake unit identified six additional cases in incarcerated persons, who were immediately isolated. On August 25, intake processing was suspended, the intake unit was locked down,[**] and the remaining persons in the unit started a 14-day group quarantine. After receiving the test results from facilitywide testing on September 1, incarcerated persons with COVID-19 were moved to the intake unit, which potentially exposed quarantined persons to SARS-CoV-2. The 14-day quarantine that started on August 25 was not restarted after the potential exposure to persons with COVID-19. Mass (facilitywide) and targeted (selected units) testing was conducted on September 1, 14, and 23–24, and detected rapid spread; the percentage of

* These authors contributed equally to this report.

† As of July 2020, the following mitigation measures were implemented at prison A: 1) mandatory mask wearing for staff members and incarcerated persons when outside their cells or away from their sleeping areas; 2) prevention of large gatherings by limiting the number of incarcerated persons who could congregate in common recreation areas and modifying schooling and other programming sessions; 3) preventive or wellness screenings led by health services staff members (daily for incarcerated persons in quarantine and semiroutinely for other incarcerated persons across the facility to identify susceptible incarcerated persons who were not actively reporting symptoms to their unit officers); 4) symptom screening and temperature checks of staff members and other essential visitors on entry into the facility; 5) suspension of in-person visits to incarcerated persons; and 6) modification of daily operations to reduce close contact between incarcerated persons within the intake unit.

§ https://www.fda.gov/media/137450/download

¶ Five of the six newly transferred incarcerated persons with COVID-19 were tested on August 17 (postintake day 4), and one was tested on August 19 (postintake day 6) after initially refusing testing on August 17. Routine intake procedures dictate that newly transferred incarcerated persons are tested on postintake days 4 or 5.

** Movement of incarcerated persons into or out of the unit was restricted. All incarcerated persons under quarantine within the unit were isolated in their cells except for telephone calls, meals, and bathroom or shower use.

positive test results among incarcerated persons was 2.4% on September 1 and increased to 46.2% on September 23.

After September 14 test results identified 86 cases of COVID-19 among incarcerated persons, the facility implemented a modified lockdown, restricting movement of incarcerated persons across units and shutting down common areas; however, staff members continued to rotate throughout the facility because of staffing shortages and scheduling policies. By September 22, the facility was unable to medically isolate or quarantine incarcerated persons because of limited space. On September 28, the Wisconsin DHS and Wisconsin Department of Corrections contacted CDC to request assistance in investigating the outbreak.

A COVID-19 case was defined as a positive SARS-CoV-2 test result[††] received by any incarcerated person or staff member at prison A during August 14–October 22, 2020. Voluntary testing was offered to incarcerated persons during mass or targeted testing, routine intake screening (on postintake days 4 or 5), or when symptoms were reported. Staff members were tested at the first two mass testing events and were instructed to report receipt of positive test results from outside testing. Epidemiologic data were extracted from prison-managed documents and the Wisconsin Electronic Disease Surveillance System. Attack rates were calculated using population estimates communicated by prison A. A heat map was created to show the percentage of new cases across units and testing events, assuming maximum capacity. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[§§]

On September 1, a total of 8 days after cases were identified on the intake unit, facilitywide testing identified cases in six of 15 units (Supplementary Table, https://stacks.cdc.gov/view/cdc/104507). Twenty-two days later (September 23), cases were identified across all 15 units, with infections in three units progressing from zero cases to attack rates ranging from 66.2% to 84.6% during that period. During August 14–October 22, a total of 869 (79.4%) of 1,095 incarcerated persons (median age = 36 years, range = 18–83 years) and 69 (22.6%) of 305 staff members (median age = 44 years, range = 23–77 years) received positive SARS-CoV-2 test results (Figure 1). Among 869 incarcerated persons with COVID-19, 118 (14%) were infected in the dormitory-style unit (unit 15). Six incarcerated persons were hospitalized (median age = 58 years, range = 33–69 years), one of whom, a man aged 56 years, died. Mass or targeted testing identified 95.4% (829 of 869) of cases in incarcerated persons and 42.0% (29 of 69) of cases in staff members. In the 14 days before reporting onset of COVID-19 symptoms or receiving positive SARS-CoV-2 test results, 71 (8.2%) incarcerated persons transferred units, and 27 (39.1%) staff members were assigned to more than one unit.

[††] All cases were identified with laboratory-confirmed RT-PCR testing, except three cases among staff members who received antigen tests elsewhere.

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

Whole Genome Sequencing

All 409 of 869 (47.1%) nasal swab specimens from incarcerated persons sent to the Wisconsin State Laboratory of Hygiene for testing were retained for WGS, and 172 (42%) of these, representing 20% of cases among incarcerated persons across 13 of 15 units, were successfully sequenced. These included specimens from cases identified from intake testing (12 of 12), symptomatic testing (11 of 22), and mass or targeted testing on September 14 (66 of 86), October 6–7 (60 of 153), and October 19 (23 of 34). No specimens from staff members were available for sequencing because the testing laboratory had discarded them.

Sequences were compared with those from specimens obtained from persons in the central intake facility, the location of persons with the initial cases before their transfer to prison A, and others across Wisconsin (Figure 2). Sequences from specimens collected at prison A showed a genetic relationship with 29 sequences collected from a concurrent outbreak in the central intake facility (cluster A). Specimens from prison A (clusters A and B) were more closely related to each other than to other sequences outside of these outbreaks (cluster C).

Public Health Response

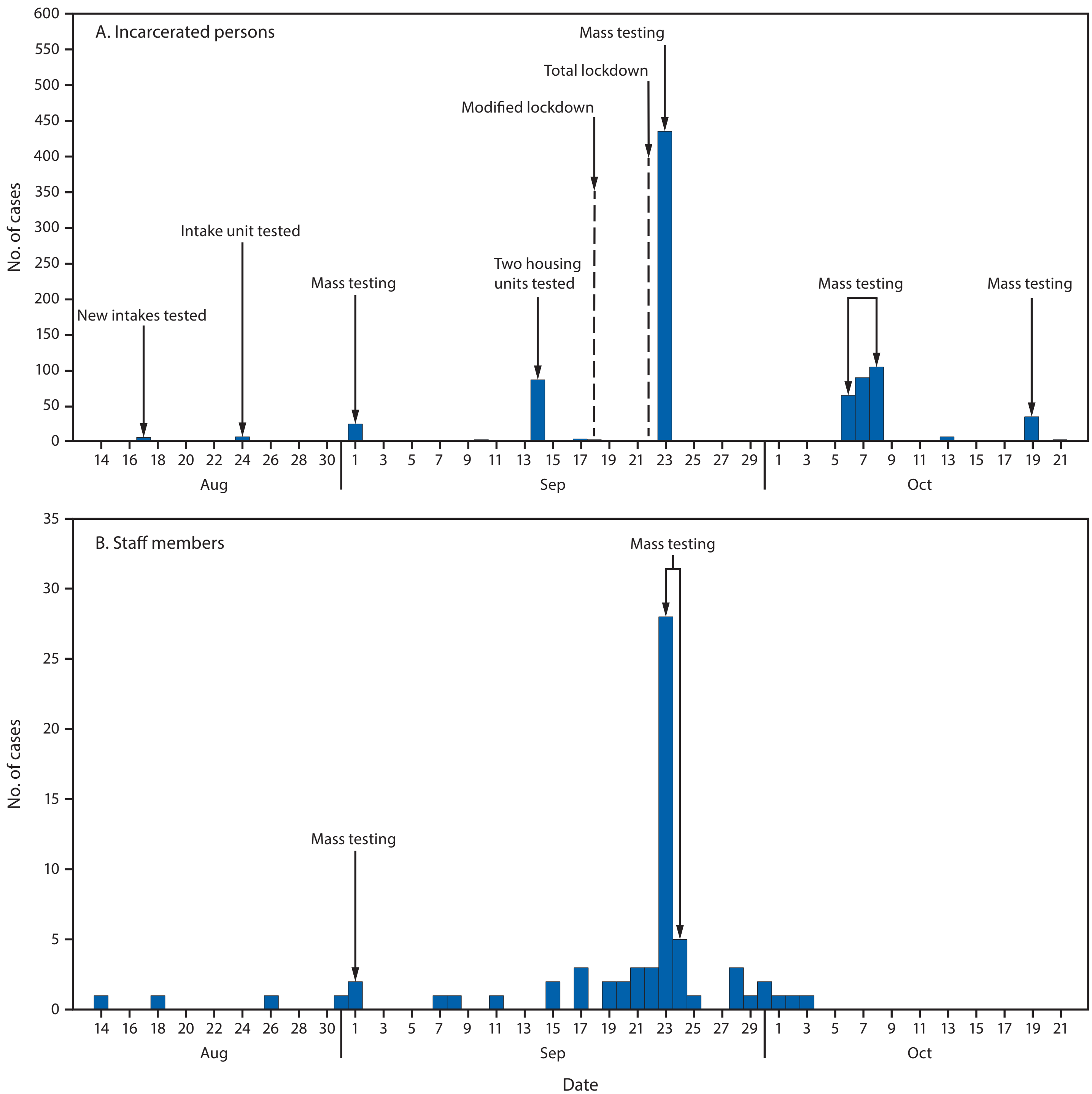
On October 16, CDC and Wisconsin DHS recommended that prison A house incarcerated persons with active infection separately from susceptible incarcerated persons[¶¶] and avoid housing susceptible incarcerated persons in the dormitory-style unit. Prison A began immediately implementing these recommendations. The facility was advised to retest quarantined cohorts every 3–7 days and restart the 14-day quarantine period whenever a new case was identified. However, testing capacity was insufficient to implement serial testing of quarantined cohorts. Case counts decreased substantially after the investigation period; no cases were reported after January 15, 2021.

Discussion

Investigation findings demonstrate that SARS-CoV-2 spread rapidly in prison A, infecting 79% of incarcerated persons and 23% of staff members in 2 months. Factors that likely facilitated transmission include the described intake quarantine

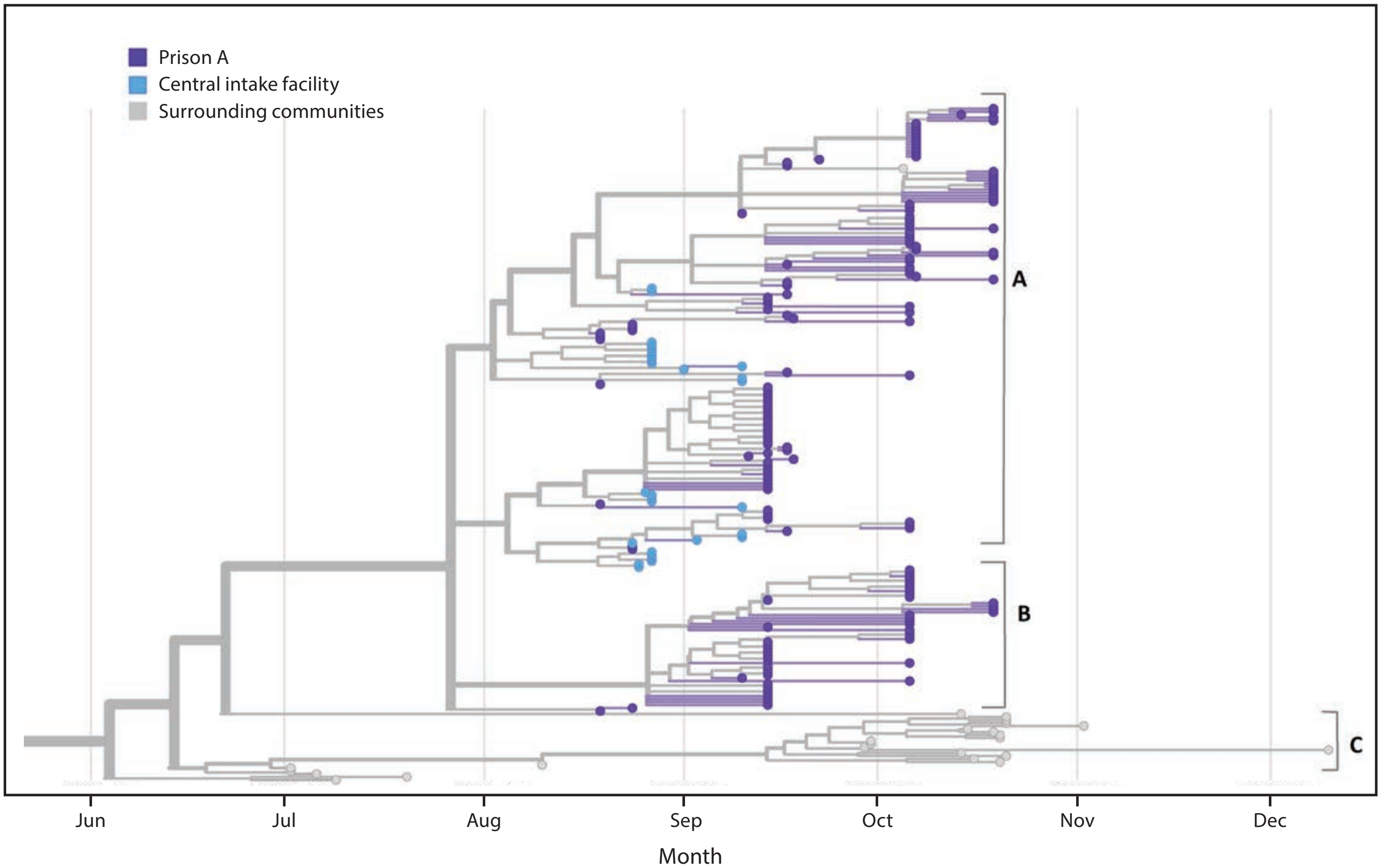
[¶¶] Susceptible persons were defined as those who had never received a positive SARS-CoV-2 test result or whose date of infection onset was at least 90 days earlier. https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html

FIGURE 1. Number of COVID-19 cases among incarcerated persons (A) (n = 869) and staff members (B) (n = 69), by testing date — prison A, Wisconsin, August 14–October 22, 2020*



* Modified lockdown refers to prison A's policy change that restricted movement of incarcerated persons within the facility and shut down all areas except for food services. Total lockdown refers to prison A's policy change that restricted outdoor recreation and limited movement within housing units by modifying daily operations to allow incarcerated persons to leave their cells only in small groups during assigned time slots for shower and telephone time. Meals were delivered and eaten within cells.

FIGURE 2. Phylogenetic tree* showing genetic distance between available SARS-CoV-2 specimens† from prison A,§ a central intake facility, and the surrounding communities — Wisconsin, June–December 2020



* Includes 230 of 1,345 sequences produced by Wisconsin State Laboratory of Hygiene during June–December 2020 using the ARTIC sequencing approach (https://artic.network/ncov-2019) on both the Illumina MiSeq and Oxford Nanopore MinION platforms. Consensus sequences generated using the StaPH-B ToolKit Monroe workflow v1.2.5 (https://github.com/StaPH-B/staphb_toolkit). Phylogenetic inference and visualization performed using Nextstrain Augur v9.0.0 (https://github.com/nextstrain/augur) and Nextstrain Auspice v2.18.4 (https://github.com/nextstrain/auspice).

† Clusters A and B refer to sequences from specimens collected at prison A. Cluster A refers to sequences from specimens collected at prison A that showed a genetic relationship with 29 sequences collected from a concurrent outbreak at the central intake facility. Cluster C refers to sequences from specimens collected outside of the outbreaks at the central intake facility and at prison A.

§ No specimens from staff members were available for sequencing because the testing laboratory had discarded them.

procedures, crowded housing units, and movement of incarcerated persons and staff members among units.

WGS detected one cluster of cases originating in a group of newly transferred incarcerated persons, with all subsequent cases clustering closely together. CDC's interim guidance recommendation is to quarantine incarcerated persons at intake and immediately isolate symptomatic persons and persons who receive positive test results (*3*). If incarcerated persons are quarantined in a group, retesting the cohort is recommended every 3–7 days; if any person in the cohort receives a positive test result, the 14-day quarantine period should restart for the remaining cohort (*4*).

Incarcerated persons quarantined at intake were tested only on days 4 or 5 after entry because of resource and staffing constraints. Antigen testing offers a feasible option for repeat testing of persons in cohorted quarantine or during an outbreak, when widespread use of nucleic acid amplification tests is infeasible; however, confirmation from such tests might be needed (e.g., for asymptomatic persons with a known exposure or symptomatic persons who receive negative antigen test results) (*5*).

Because of ongoing within-facility movement of staff members and incarcerated persons, staff members and incarcerated persons both might have contributed to the prolonged outbreak. Assignment of staff members to specific units and routine testing of staff members might reduce within-facility and community transmission (*1*,*6*,*7*); however, sufficient staffing and testing resources would be needed. Other prevention measures such as movement restriction during an outbreak should be considered for staff members and incarcerated

Summary

What is already known about this topic?

SARS-CoV-2 can spread rapidly in prisons and can be introduced by staff members and newly transferred persons.

What is added by this report?

After early detection of SARS-CoV-2 in six newly transferred persons during intake quarantine in a Wisconsin prison, 79.4% of incarcerated persons and 22.6% of staff members contracted SARS-CoV-2 during August 14–October 22, 2020. Whole genome sequencing from 172 incarcerated persons with COVID-19 determined that all specimens clustered in the same lineage.

What are the implications for public health practice?

Insufficient quarantine after intake can lead to rapid, widespread SARS-CoV-2 transmission, even after early detection of initial cases. Understanding and addressing the challenges faced by correctional facilities to implement medical isolation and quarantine can help reduce and prevent outbreaks.

persons. Prioritization of vaccination of incarcerated persons and staff members could play an important role in preventing outbreaks in prisons (*8*).

The findings in this report are subject to at least four limitations. First, sociodemographic or clinical comparisons between persons who did and did not have COVID-19 could not be made because data were available only for infected persons. Second, cases in staff members were likely underreported because facilitywide testing and test result reporting were not mandated. Third, maximum capacity was used to calculate the percentage of new cases detected by unit because the number of persons in each unit over time was unavailable. Finally, only 20% of specimens from incarcerated persons with COVID-19 and no specimens from staff cases were sequenced, limiting understanding of staff member and prison-to-community transmission.

SARS-CoV-2 transmission is difficult to control in congregate living facilities (*2*,*9*). Investigation findings highlight challenges in implementing quarantine guidance and structural factors that contribute to rapid spread, including limited testing resources and space for quarantine and medical isolation. Adjustments to prison capacity, organization, and intake and quarantine processes might be necessary to protect staff members and incarcerated persons from COVID-19 outbreaks and to prevent community transmission (*10*). This investigation demonstrates the importance of identifying and addressing barriers to adherence to public health guidance on COVID-19 management in correctional settings. In addition, because vaccination of staff members alone likely would have been insufficient to prevent the outbreak described in this report, incarcerated persons and correctional facility staff members should both be vaccinated as early as possible to help prevent outbreaks and the associated morbidity and mortality of incarcerated persons and staff members (*8*).

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Counties with High COVID-19 Incidence and Relatively Large Racial and Ethnic Minority Populations — United States, April 1–December 22, 2020

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Long-standing systemic social, economic, and environmental inequities in the United States have put many communities of color (racial and ethnic minority groups) at increased risk for exposure to and infection with SARS-CoV-2, the virus that causes COVID-19, as well as more severe COVID-19–related outcomes (*1*–*3*). Because race and ethnicity are missing for a proportion of reported COVID-19 cases, counties with substantial missing information often are excluded from analyses of disparities (*4*). Thus, as a complement to these case-based analyses, population-based studies can help direct public health interventions. Using data from the 50 states and the District of Columbia (DC), CDC identified counties where five racial and ethnic minority groups (Hispanic or Latino [Hispanic], non-Hispanic Black or African American [Black], non-Hispanic Asian [Asian], non-Hispanic American Indian or Alaska Native [AI/AN], and non-Hispanic Native Hawaiian or other Pacific Islander [NH/PI]) might have experienced high COVID-19 impact during April 1–December 22, 2020. These counties had high 2-week COVID-19 incidences (>100 new cases per 100,000 persons in the total population) and percentages of persons in five racial and ethnic groups that were larger than the national percentages (denoted as "large"). During April 1–14, a total of 359 (11.4%) of 3,142 U.S. counties reported high COVID-19 incidence, including 28.7% of counties with large percentages of Asian persons and 27.9% of counties with large percentages of Black persons. During August 5–18, high COVID-19 incidence was reported by 2,034 (64.7%) counties, including 92.4% of counties with large percentages of Black persons and 74.5% of counties with large percentages of Hispanic persons. During December 9–22, high COVID-19 incidence was reported by 3,114 (99.1%) counties, including >95% of those with large percentages of persons in each of the five racial and ethnic minority groups. The findings of this population-based analysis complement those of case-based analyses. In jurisdictions with substantial missing race and ethnicity information, this method could be applied to smaller geographic areas, to identify communities of color that might be experiencing high potential COVID-19 impact. As areas with high rates of new infection change over time, public health efforts can be tailored to the needs of communities of color as the pandemic evolves and integrated with longer-term plans to improve health equity.

To assess potential COVID-19 impact on racial and ethnic minority groups, CDC examined two population-based measures: incidence of COVID-19 at the county level during three successive 2-week periods during April 1–December 22, 2020, and the percentage of the county population accounted for by each racial and ethnic minority group. Two-week COVID-19 incidence was calculated as numbers of cases (*5*) per 100,000 persons collected from state and local health department websites*; counties with >100 new cases per 100,000 persons during the 2-week period were considered to have high incidence.

The percentage of county population represented by five racial and ethnic minority groups was calculated using 2019 U.S. Census population estimates.† Counties whose percentage of racial and ethnic minority persons exceeded the 2019 national percentage were considered to have relatively large populations of the respective racial and ethnic minority group. For the Hispanic, Black, Asian, AI/AN, and NH/PI groups, these were percentages in excess of 18.5%, 12.5%, 5.8%, 0.7%, and 0.2%, respectively. Whereas the term "population" is used to describe all persons within a reported race and ethnicity category, the diversity of backgrounds and experiences that exists within these broad groups is recognized.

Counties were considered to have high potential COVID-19 impact during the 2-week period for a racial and ethnic minority group if they had both high COVID-19 incidence and a large population of the respective group. Counties were considered to have relatively low potential COVID-19 impact during the 2-week period for a racial and ethnic minority group if they had a large population of the respective group and low COVID-19 incidence or had a small population of the respective group, regardless of COVID-19 incidence. To illustrate where counties with high potential COVID-19 impact were located for each racial and ethnic minority group, maps were created for three time periods, representing the beginning (April 1–14), middle (August 5–18), and end (December 9–22) of the analysis period (Supplementary Figures 1–3, https://stacks.cdc.gov/view/cdc/104229). In these maps, high COVID-19 incidence was further categorized as >100 to ≤500 and >500 new cases

* Aggregate county-level case counts were downloaded through HHS Protect (accessed January 26, 2021).

† https://www.census.gov/programs-surveys/popest.html

per 100,000 persons. Large population of the respective racial and ethnic minority group was further categorized as >national percentage to ≤upper cutpoint and >upper cutpoint, where the upper cutpoint was determined using Jenks natural breaks.§ The four U.S. Census regions were used to describe groups of counties for interpretation.¶

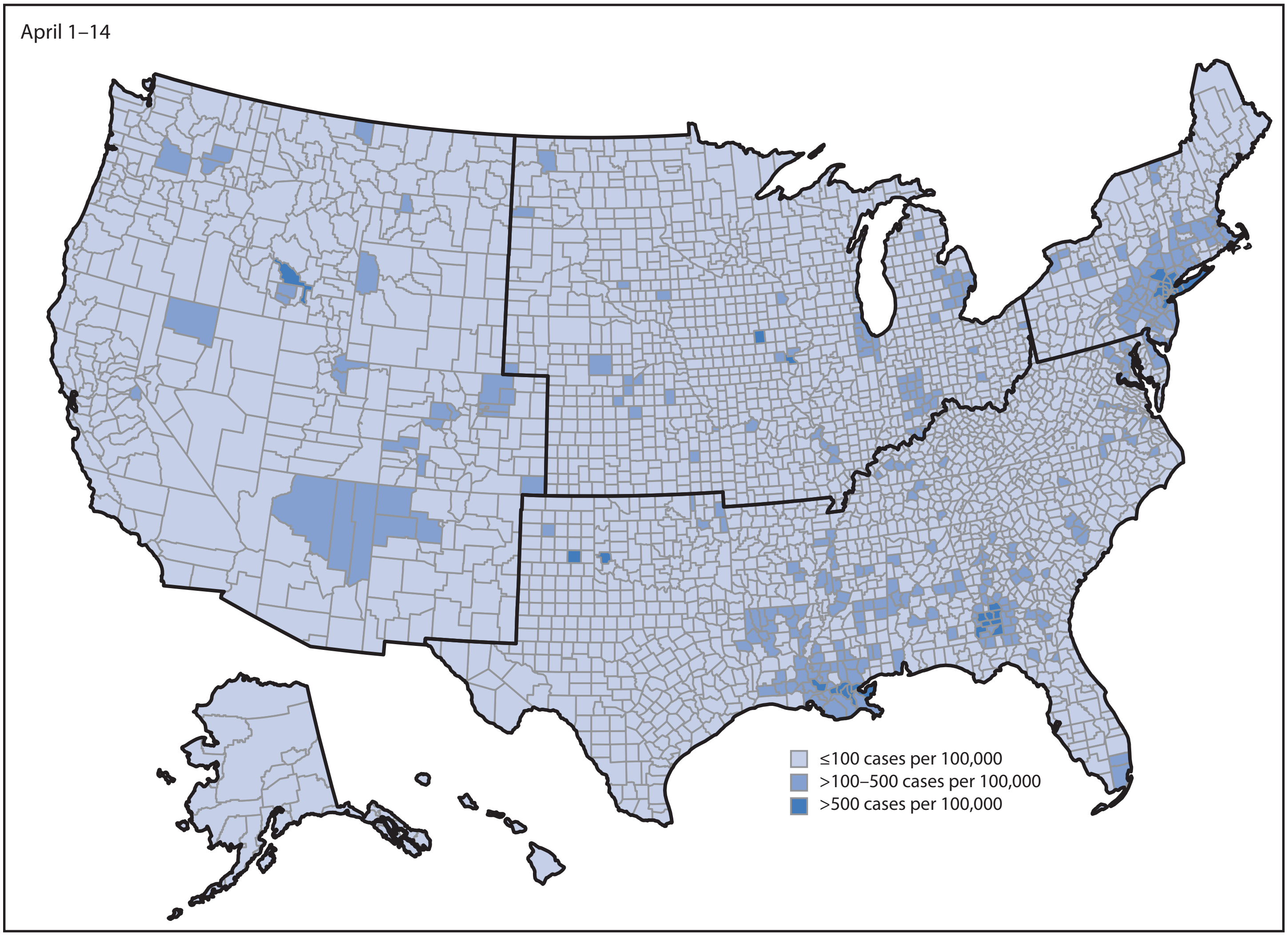
During April 1–14, high COVID-19 incidence was reported by 359 (11.4%) counties, most of which were in the Northeast and South (Figure 1). High COVID-19 incidence was reported by 28.7%, 27.9%, 12.5%, 5.1%, and 0.6% of counties with large Asian, Black, Hispanic, AI/AN, and NH/PI populations, respectively, during this period (Table) (Figure 2) (Supplementary Figure 1, https://stacks.cdc.gov/view/cdc/104229).

As the geographic distribution of counties reporting high COVID-19 incidence changed regionally throughout the course of the U.S. pandemic, the potential COVID-19 impact on each racial and ethnic minority group also changed. During August 5–18, high COVID-19 incidence was reported by 2,034 (64.7%) counties, most of which were in the South (Figure 1). High COVID-19 incidence was reported by 92.4%, 74.5%, 65.9%, 64.7%, and 51.7% of counties with large Black, Hispanic, NH/PI, Asian, and AI/AN populations, respectively, during this period (Table) (Figure 2) (Supplementary Figure 2, https://stacks.cdc.gov/view/cdc/104229). During December 9–22, when 3,114 (99.1%) counties reported high COVID-19 incidence, >95%

§ https://pro.arcgis.com/en/pro-app/help/mapping/layer-properties/data-classification-methods.htm

¶ https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

FIGURE 1. Counties with high COVID-19 incidence,* by county for April 1–14, August 5–18, and December 9–22 — United States,† April 1–December 22, 2020



See footnotes on page 486.

of counties with large populations of each racial and ethnic minority group reported high COVID-19 incidence (Table) (Figure 2) (Supplementary Figure 3, https://stacks.cdc.gov/view/cdc/104229).

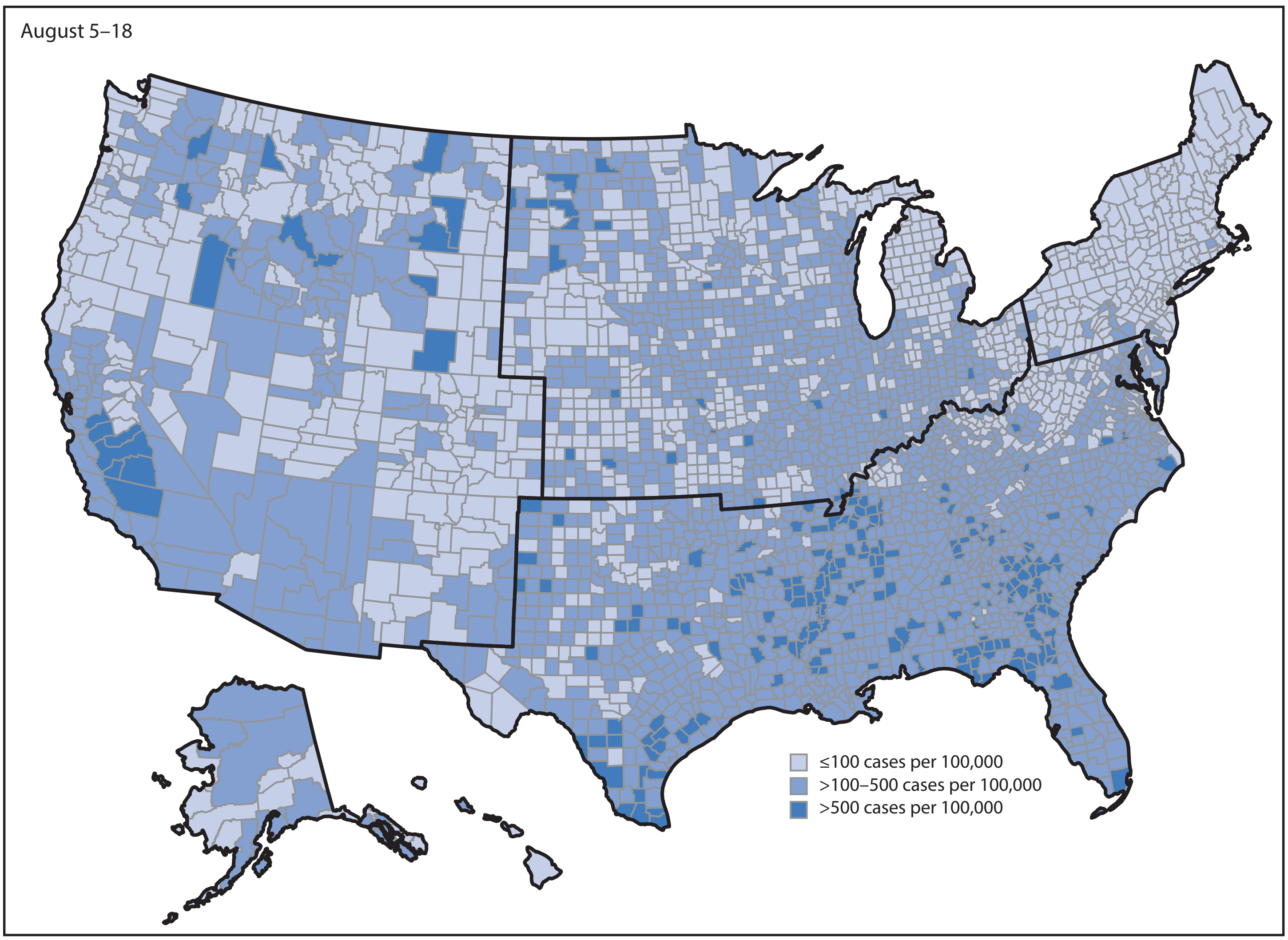
Discussion

Analysis of data from all 50 states and DC during April–December 2020 demonstrates how relative potential COVID-19 impact among racial and ethnic minority groups has changed during the U.S. COVID-19 epidemic. During the early weeks of April, a larger percentage of high-incidence counties was reported among those with large Asian populations and large Black populations, whereas during the early weeks of August, a larger percentage of high-incidence counties was reported among those with large Black populations and large Hispanic populations. By mid-December, high COVID-19 incidence was reported in nearly all counties.

As SARS-CoV-2 has spread throughout the United States, racial and ethnic minority populations have been profoundly affected. Previous CDC reports found that racial and ethnic minority groups were disproportionately represented among COVID-19 cases in counties with high or rapidly increasing incidence, and that these groups experienced higher COVID-19–associated hospitalization and death rates (*4,6–8*). Inequities in social, economic, and environmental conditions among racial and ethnic minority groups lead to disparities in health risks and outcomes (*9*), including those related to COVID-19.

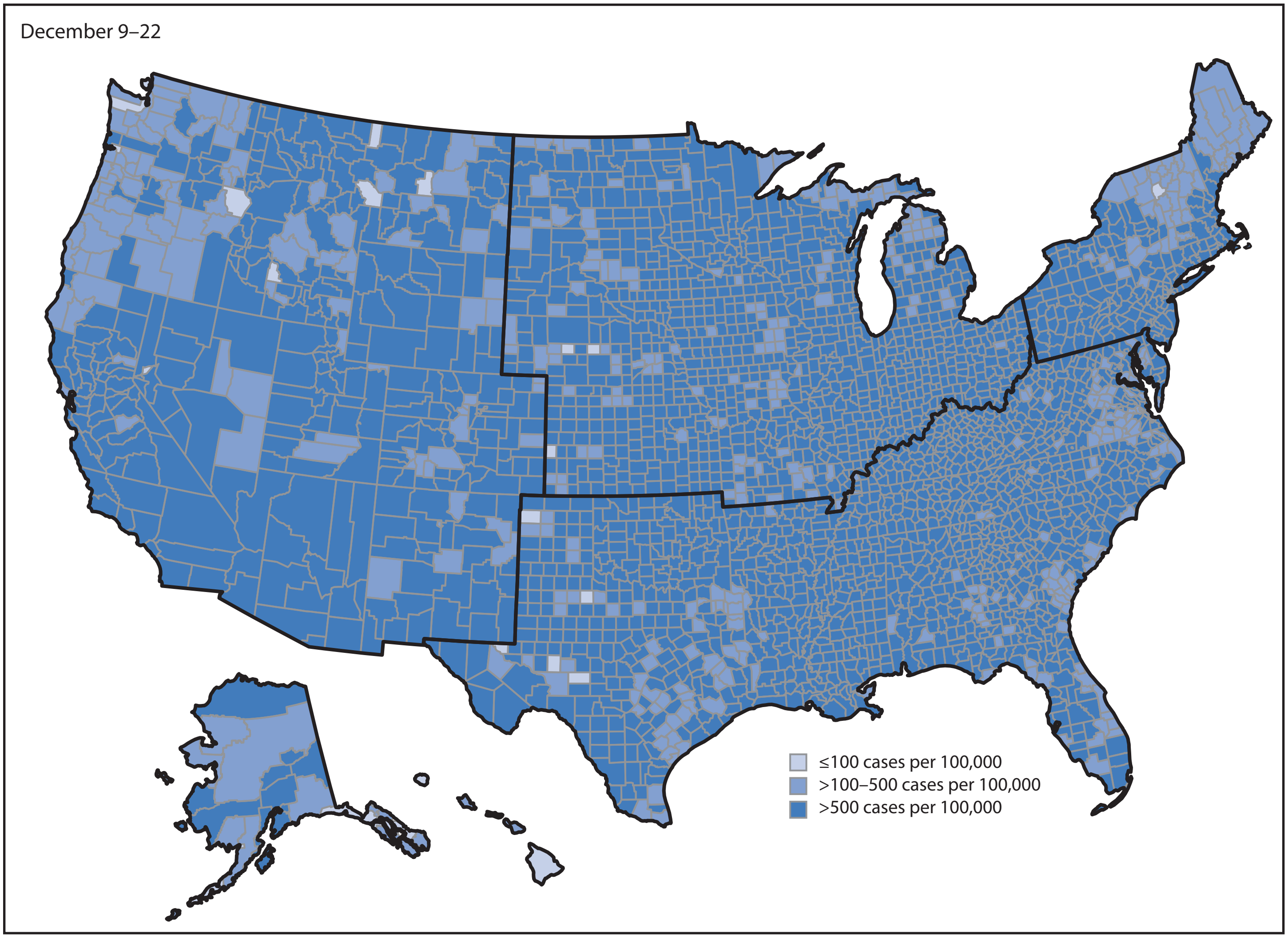
This analysis and its population-based approach complements case-based analyses of racial and ethnic disparities.

FIGURE 1. (*Continued*) Counties with high COVID-19 incidence,* by county for April 1–14, August 5–18, and December 9–22 — United States,† April 1–December 22, 2020



See footnotes on page 486.

FIGURE 1. (*Continued*) **Counties with high COVID-19 incidence,* by county for April 1–14, August 5–18, and December 9–22 — United States,† April 1–December 22, 2020**



* >100 new cases per 100,000 persons in the 2-week period.
† U.S. Census regions are outlined in black.

CDC continues to work with local and state health departments to improve reporting of race and ethnicity data for individual cases. Although case-based analyses might more directly assess these disparities, population-based approaches can illustrate the potential impact of COVID-19 across all racial and ethnic minority groups and across regions. This approach can also be used to examine potential disparities in other COVID-19–associated outcomes and behaviors, including vaccination administration.

State health departments can apply the approach taken in this study to analyze data for smaller geographic areas and identify when and where racial and ethnic minority groups might be experiencing high potential COVID-19 impact within their jurisdictions. Findings can be supplemented with analyses of indicators of social determinants of health, including occupation, health care access and utilization, income and wealth gaps, and housing stability and quality (*10*), to inform development of community engagement strategies that increase COVID-19 knowledge, testing, contact tracing, preventive care, vaccination administration, and disease management in populations at increased risk for COVID-19. In addition to examining counties with large racial and ethnic minority populations and high COVID-19 incidence, examining counties with large populations but low COVID-19 incidence might reveal lessons for effectively preventing the spread of COVID-19.

The findings in this report are subject to at least three limitations. First, counties might have large populations of more than one racial and ethnic minority group; therefore, comparisons across groups should be interpreted with caution.

TABLE. Percentage of counties with high COVID-19 incidence* and large population percentages of five racial and ethnic minority groups† — United States, April 1–14, August 5–18, and December 9–22, 2020

COVID-19 incidence* (% county population)†	No. (%) of counties		
	Apr 1–14	**Aug 5–18**	**Dec 9–22**
Counties with large Hispanic or Latino populations (>18.5%)	439 (100)	439 (100)	439 (100)
>500 cases per 100,000 (>46.0%–96.4%)	1 (0.2)	27 (6.2)	101 (23.0)
>100–500 cases per 100,000 (>46.0–96.4%)	5 (1.1)	68 (15.5)	16 (3.6)
>500 cases per 100,000 (>18.5–46.0%)	15 (3.4)	23 (5.2)	270 (61.5)
>100–500 cases per 100,000 (>18.5–46.0%)	34 (7.7)	209 (47.6)	48 (10.9)
Counties with large Black, non-Hispanic populations (>12.5%)	681 (100)	681 (100)	681 (100)
>500 cases per 100,000 (>37.0–85.9%)	12 (1.8)	53 (7.8)	184 (27.0)
>100–500 cases per 100,000 (>37.0–85.9%)	73 (10.7)	156 (22.9)	30 (4.4)
>500 cases per 100,000 (>12.5–37.0%)	10 (1.5)	75 (11.0)	394 (57.9)
>100–500 cases per 100,000 (>12.5–37.0%)	95 (14.0)	345 (50.7)	73 (10.7)
Counties with large Asian, non-Hispanic populations (>5.8%)	136 (100)	136 (100)	136 (100)
>500 cases per 100,000 (>17.7–42.8%)	2 (1.5)	1 (0.7)	10 (7.4)
>100–500 cases per 100,000 (>17.7–42.8%)	1 (0.7)	10 (7.4)	8 (5.9)
>500 cases per 100,000 (>5.8–17.7%)	10 (7.4)	3 (2.2)	85 (62.5)
>100–500 cases per 100,000 (>5.8–17.7%)	26 (19.1)	74 (54.4)	28 (20.6)
Counties with large AI/AN, non-Hispanic populations (>0.7%)	826 (100)	826 (100)	826 (100)
>500 cases per 100,000 (>30.3%–90.4%)	0	5 (0.6)	33 (4.0)
>100–500 cases per 100,000 (>30.3%–90.4%)	5 (0.6)	21 (2.5)	7 (0.8)
>500 cases per 100,000 (>0.7%–30.3%)	3 (0.4)	37 (4.5)	602 (72.9)
>100–500 cases per 100,000 (>0.7%–30.3%)	34 (4.1)	364 (44.1)	171 (20.7)
Counties with large NH/PI, non-Hispanic populations (>0.2%)	173 (100)	173 (100)	173 (100)
>500 cases per 100,000 (>11.8%–48.8%)	0	0	0
>100–500 cases per 100,000 (>11.8%–48.8%)	0	0	0
>500 cases per 100,000 (>0.2%–11.8%)	0	8 (4.6)	118 (68.2)
>100–500 cases per 100,000 (>0.2%–11.8%)	1 (0.6)	106 (61.3)	47 (27.2)

Abbreviations: AI/AN = American Indian or Alaska Native; NH/PI = Native Hawaiian or other Pacific Islander.

* >100 new cases per 100,000 persons in the 2-week period. High COVID-19 incidence was further categorized as >100 to ≤500 new cases per 100,000 persons and >500 new cases per 100,000 persons.

† Percentage of racial and ethnic minority group populations in the county higher than the national percentages: 12.5% (non-Hispanic Black), 18.5% (Hispanic/Latino), 5.8% (non-Hispanic Asian), 0.7% (non-Hispanic AI/AN), and 0.2% (non-Hispanic NH/PI). Large population was further categorized as >national percentage to ≤upper cutpoint and >upper cutpoint, where the upper cutpoint was determined using Jenks natural breaks.

Second, a large racial and ethnic minority population within a county with high COVID-19 incidence does not necessarily mean that a disproportionate number of cases occurred among persons in that group. Analyses using case-level race and ethnicity data may be better suited to directly assess the disproportionate impact of COVID-19 on persons of color. Finally, the category indicating high 2-week COVID-19 incidence (>100 per 100,000) is conservative. The range for county-level incidence might be greater during periods of peak incidence (i.e., December) than during other periods.

CDC continues to collect data from local and state health departments to assess and monitor COVID-19 disparities and develop new ways to communicate data to the public and other partners.** These COVID-19 data†† can be examined by race and ethnicity and by the social determinants of health associated with these disparities to inform cross-sector programs

Summary

What is already known about this topic?

Long-standing systemic health and social inequities have placed many racial and ethnic minority groups at increased risk for COVID-19.

What is added by this report?

During April 1–14, 11.4% of counties reported high COVID-19 incidence, including 28.7% and 27.9% of counties with large Asian and Black populations, respectively. During August 5–18, this percentage was 64.7%, including 92.4% and 74.5% of counties with large Black and Hispanic populations, respectively. By December 9–22, 99.1% of counties reported high incidence.

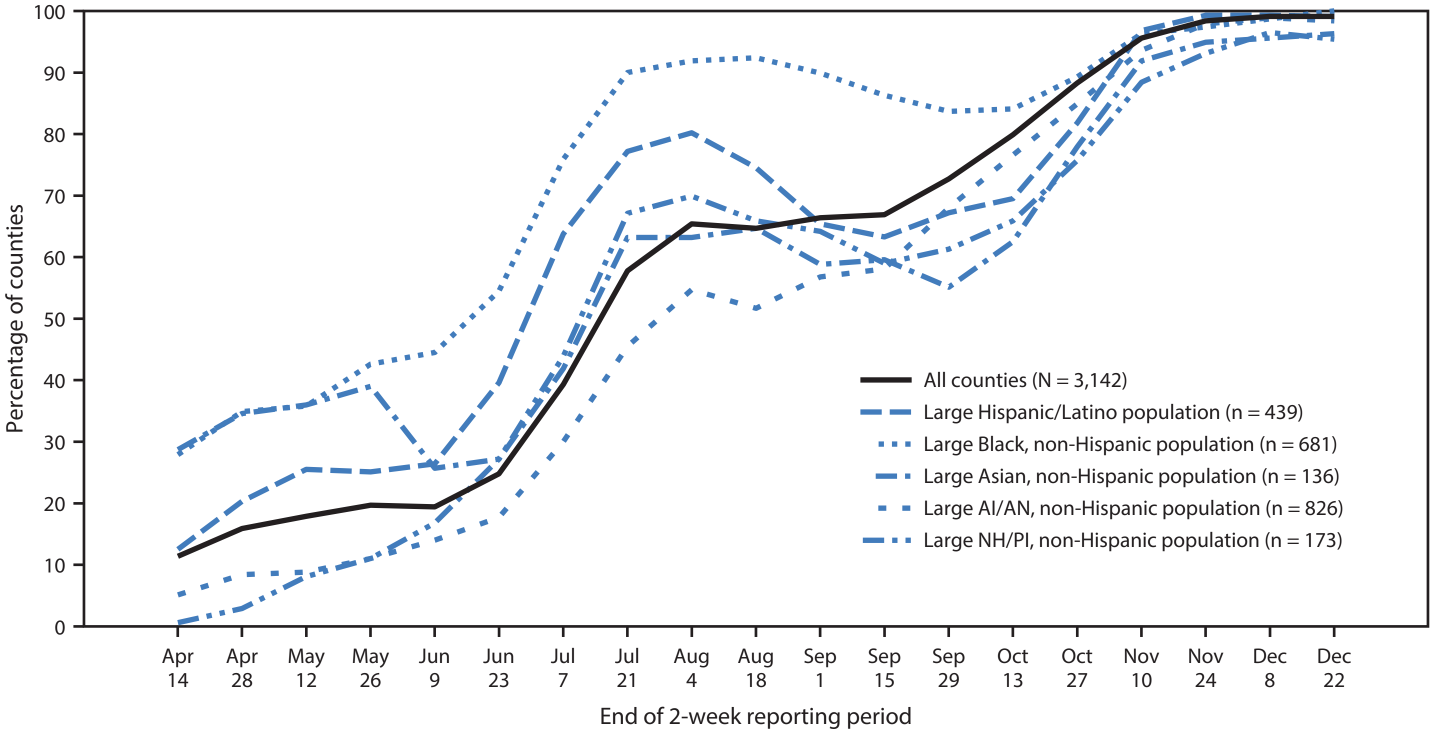
What are the implications for public health practice?

As the COVID-19 pandemic evolves, public health efforts can be tailored to the needs of communities of color that may be experiencing high COVID-19 impact and integrated with longer-term plans to improve health equity.

** https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/what-we-can-do.html

†† https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/index.html

FIGURE 2. Percentage of counties with high COVID-19 incidence* among U.S. counties with large population percentages of five racial and ethnic minority groups† — United States, April 1–December 22, 2020



Abbreviations: AI/AN = American Indian/Alaska Native; NH/PI = Native Hawaiian or other Pacific Islander.
* >100 new cases per 100,000 persons in the 2-week period.
† Percentage of racial and ethnic minority group populations in the county higher than the national percentages: 12.5% (non-Hispanic Black), 18.5% (Hispanic/Latino), 5.8% (non-Hispanic Asian), 0.7% (non-Hispanic AI/AN), and 0.2% (non-Hispanic NH/PI).

and practices based on the CDC COVID-19 Response Health Equity Strategy.§§ Examining COVID-19 incidence in conjunction with race and ethnicity at the county level can identify areas where racial and ethnic minority groups might be experiencing high potential COVID-19 impact. CDC, as well as federal, state, and local partners, can use this approach throughout the COVID-19 response to direct public health activities intended to reach these areas. Current prevention measures, including correct and consistent use of masks, frequent handwashing, physical distancing,¶¶ avoiding crowds, limiting nonessential travel, and efforts to expand programs for vaccination, testing, screening, case investigation, case isolation, contact tracing and treatment can be integrated with longer-term community plans to alleviate long-standing health and social inequalities*** and improve health equity.

§§ https://www.cdc.gov/coronavirus/2019-ncov/downloads/community/CDC-Strategy.pdf
¶¶ https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
*** https://www.cdc.gov/minorityhealth/chdir/index.html

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Symptoms of Anxiety or Depressive Disorder and Use of Mental Health Care Among Adults During the COVID-19 Pandemic — United States, August 2020–February 2021

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On March 26, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The spread of disease and increase in deaths during large outbreaks of transmissible diseases is often associated with fear and grief (*1*). Social restrictions, limits on operating nonessential businesses, and other measures to reduce pandemic-related mortality and morbidity can lead to isolation and unemployment or underemployment, further increasing the risk for mental health problems (*2*). To rapidly monitor changes in mental health status and access to care during the COVID-19 pandemic, CDC partnered with the U.S. Census Bureau to conduct the Household Pulse Survey (HPS). This report describes trends in the percentage of adults with symptoms of an anxiety disorder or a depressive disorder and those who sought mental health services. During August 19, 2020–February 1, 2021, the percentage of adults with symptoms of an anxiety or a depressive disorder during the past 7 days increased significantly (from 36.4% to 41.5%), as did the percentage reporting that they needed but did not receive mental health counseling or therapy during the past 4 weeks (from 9.2% to 11.7%). Increases were largest among adults aged 18–29 years and among those with less than a high school education. HPS data can be used in near real time to evaluate the impact of strategies that address mental health status and care of adults during the COVID-19 pandemic and to guide interventions for groups that are disproportionately affected.

HPS is a rapid-response online survey using a probability-based sample design to measure the social and economic impact of the COVID-19 pandemic on U.S. households (*3*). This experimental data product* was developed by the U.S. Census Bureau in partnership with CDC's National Center for Health Statistics (NCHS) and several other federal statistical agencies. The sample is drawn from the U.S. Census Bureau's Master Address File.† E-mail addresses and mobile telephone numbers associated with randomly selected housing units are used to invite participants. Analytic files include self-reported data from one adult aged ≥18 years at each address. Data collection began on April 23, 2020, and is ongoing (phase 1 = April 23–July 21, 2020; phase 2 = August 19–October 26, 2020; phase 3 = October 28, 2020–present, with a break during December 22, 2020–January 5, 2021). HPS response rates averaged 2.9%, 9.3%, and 6.5% during phase 1, phase 2, and phase 3 (through February 1, 2021), respectively.

Questions on mental health symptoms were based on the validated four-item Patient Health Questionnaire (PHQ-4) for depression and anxiety and included how often, during the past 7 days, respondents had been bothered by 1) feeling nervous, anxious, or on edge; 2) not being able to stop or control worrying; 3) having little interest or pleasure in doing things; and 4) feeling down, depressed, or hopeless. Adults who had symptoms that generally occurred more than one half of the days or nearly every day were classified as having symptoms, consistent with published scoring recommendations§ (*4*). Questions about mental health care use included whether, during the past 4 weeks, respondents had 1) taken prescription medication for their mental health, 2) received counseling or therapy from a mental health professional, or 3) needed but did not receive counseling or therapy from a mental health professional (i.e., had an unmet mental health need).

Because of methodological differences between phases 1 and 2, trend analyses were limited to phases 2 and 3.¶ Estimates** are presented for each 2-week data collection period for August 19, 2020–February 1, 2021 (unweighted sample size = 431,656 for

* U.S. Census Bureau experimental data products are statistical products created using new data sources or previously untested methodologies. The analysis in this report was based on publicly available deidentified data files provided by the U.S. Census Bureau. https://www.census.gov/data/experimental-data-products.html

† The Master Address File is the U.S. Census Bureau's official inventory of known living quarters in the United States, maintained to facilitate the decennial census. E-mail addresses, mobile telephone numbers, or both were appended for 81% of addresses. Housing units linked to one or more e-mail addresses or mobile telephone numbers are randomly selected to participate.

§ These items are adapted from the validated PHQ-4 for depression and anxiety, which includes the two-item versions of the Generalized Anxiety Disorder (GAD-2, items 1 and 2) scale and the two-item PHQ (PHQ-2, items 3 and 4). Because phase 1 of HPS was conducted weekly, the recall period for these questions was modified from a 2-week to a 1-week period for this survey. For each survey response, answers were assigned a numerical value: not at all (0), several days (1), more than one half of the days (2), and nearly every day (3). The two responses for anxiety symptoms were summed, and adults who had scale scores of ≥3 were classified as having symptoms of an anxiety disorder. The two responses for depressive symptoms were summed, and adults who had scale scores of ≥3 were classified as having symptoms of a depressive disorder. These two composite indicators were used to create the third composite indicator of symptoms of an anxiety disorder, a depressive disorder, or both. This scoring approach is the same as recommended by the developers of PHQ-2 and GAD-2.

¶ Methodological differences between phase 1 and phase 2 complicate examination of trends across the two phases. These differences include a change in the data collection period from 6 days to 13 days, additional reminders sent to nonrespondents in phase 2, and elimination of a longitudinal component that was present in phase 1. Therefore, trends are only examined for phases 2 and 3. Sample sizes for the mental health questions averaged 86,000 completed surveys biweekly in phase 2 and 60,000 biweekly in phase 3 through February 1, 2021.

** All estimates shown met the NCHS Data Presentation Standards for Proportions (https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf).

phase 2 and 358,977 for phase 3, total = 790,633). Trends were assessed using joinpoint regression.[††] In addition, changes in estimates of symptoms of an anxiety or a depressive disorder and the two mental health care measures were compared between August 19–31, 2020, and January 20–February 1, 2021, according to selected respondent characteristics. SAS-callable SUDAAN (version 11.0; RTI International) was used to conduct these analyses. Estimates were weighted to adjust for nonresponse and number of adults in the household and to match U.S. Census Bureau estimates of the population by age, sex, race/ethnicity, and educational attainment.

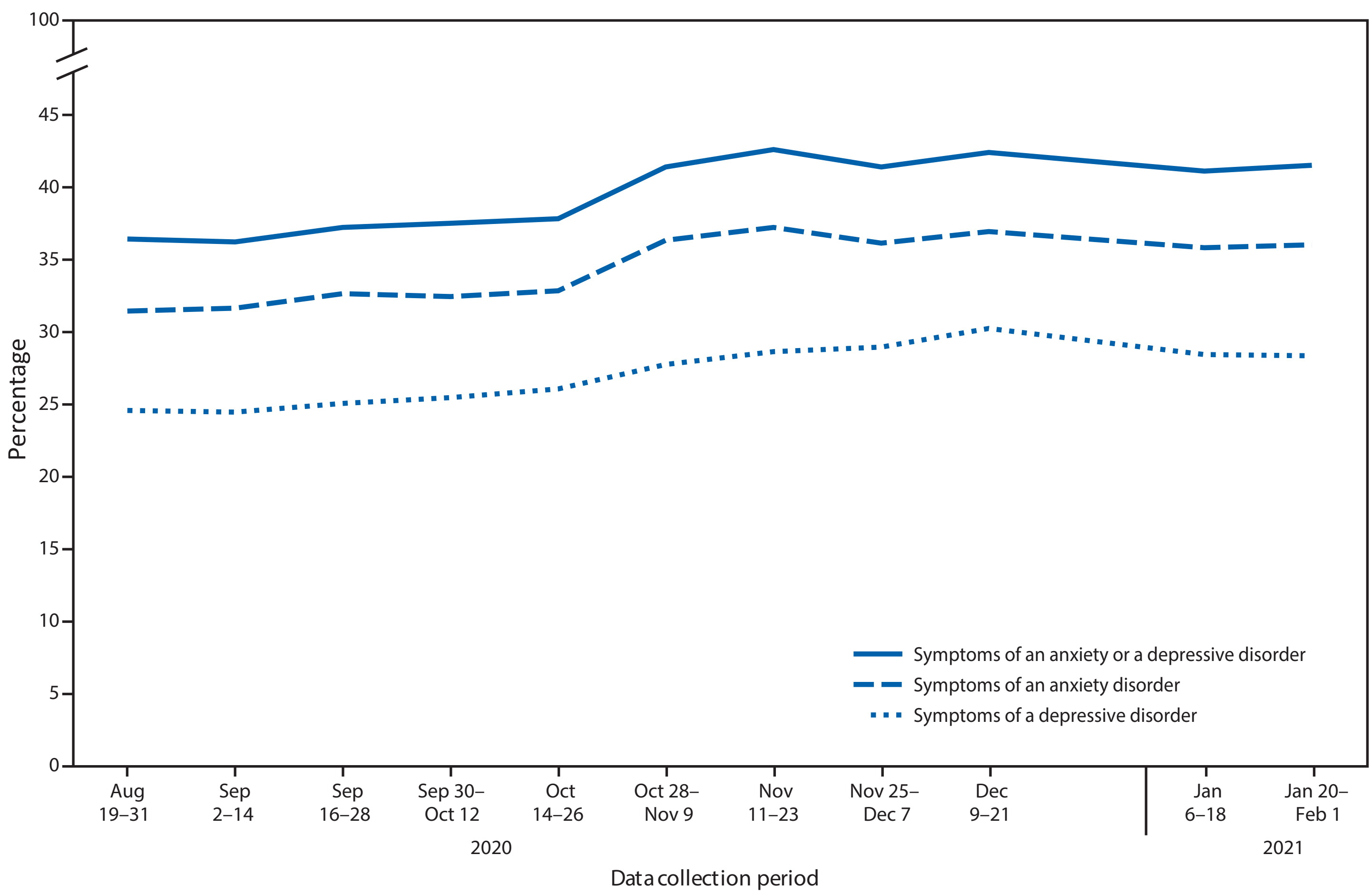
During August 19–31, 2020, through December 9–21, 2020, significant increases were observed in the percentages of adults who reported experiencing symptoms of an anxiety disorder (from 31.4% to 36.9%), depressive disorder (from 24.5% to 30.2%), and at least one of these disorders (from 36.4% to 42.4%) (Figure 1). Estimates for all three mental health indicators through January 2021 were similar to those in December 2020.

During August 19–31, 2020, through November 25–December 7, 2020, a significant increase was observed in the percentage of adults who reported taking prescription medication or receiving counseling for their mental health (from 22.4% to 25.0%) (Figure 2). Similarly, during August 19–31, 2020, through December 9–21, 2020, a significant increase was observed in the percentage of adults who reported needing but not receiving counseling or therapy for their mental health (from 9.2% to 12.4%). Estimates through January 2021 were similar to those in December 2020.

During August 19–31, 2020, through January 20–February 1, 2021, symptoms of an anxiety or a depressive disorder increased significantly from 36.4% to 41.5% (Table). Significant increases were observed for all demographic

[††] Joinpoint regression characterizes trends as joined linear segments (https://surveillance.cancer.gov/joinpoint/). A joinpoint is the period at which two segments with different slopes meet. Joinpoint software uses statistical criteria to determine the fewest number of segments necessary to characterize a trend and the periods when segments begin and end. The models were specified to include a minimum of one joinpoint.

FIGURE 1. Percentage of adults aged ≥18 years with symptoms of anxiety disorder, depressive disorder, or anxiety or depressive disorder during past 7 days, by data collection period — Household Pulse Survey, United States, August 19, 2020–February 1, 2021*



* Household Pulse Survey data collection included a 1-day break between the conclusion of one data collection period and the start of the next, as well as a 2-week break during December 22, 2020–January 5, 2021.

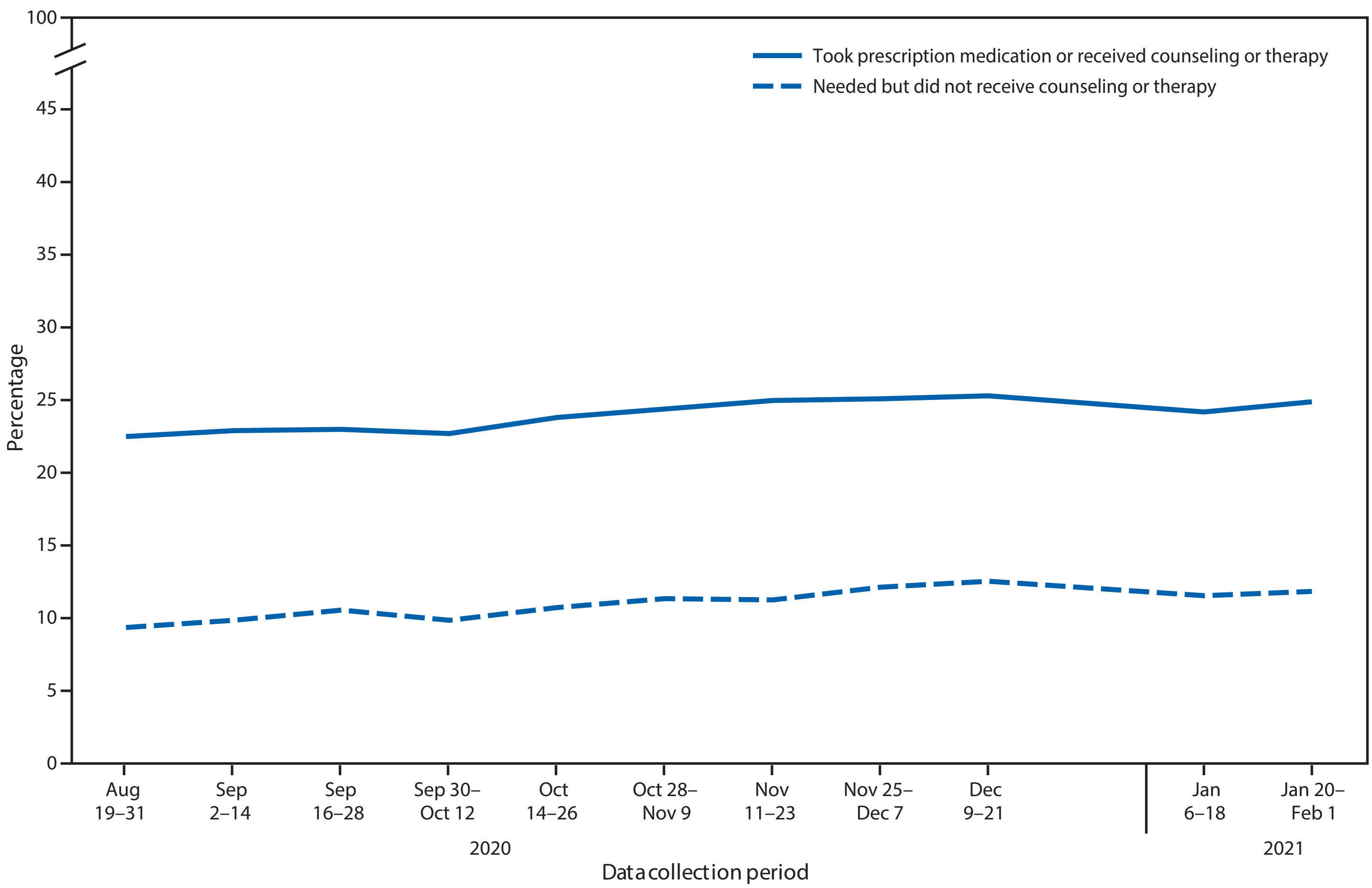
subgroups presented, except adults aged ≥80 years and non-Hispanic adults reporting races other than White, Black, or Asian. The largest increases (8.0 and 7.8 percentage points) were among those aged 18–29 years and those with less than a high school education, respectively. During this time, mental health care treatment increased significantly from 22.4% to 24.8%. Significant increases were observed for adults aged 18–29, 30–39, and 60–69 years; men and women; non-Hispanic White and non-Hispanic Black adults; adults with at least a high school education; and adults who had not experienced symptoms of an anxiety or a depressive disorder during the past 7 days.

Unmet mental health needs also increased significantly from 9.2% to 11.7%. Subgroups with significant increases included adults aged 18–29, 30–39, and 50–59 years; men and women; Hispanic, non-Hispanic White, and non-Hispanic Black adults; adults at all education levels; and adults regardless of whether they experienced symptoms of an anxiety or a depressive disorder or both during the past 7 days. The largest increases in unmet mental health needs (7.2 percentage points and 4.3 percentage points) were among adults aged 18–29 years and those with less than a high school education, respectively. During January 20, 2021–February 1, 2021, 23.8% of persons with symptoms of an anxiety or a depressive disorder had unmet mental health needs, and this percentage increased by 2.8 percentage points from August 2020 to February 2021.

Discussion

The percentage of adults who had symptoms of an anxiety or a depressive disorder during the past 7 days and those with unmet mental health needs during the past 4 weeks increased significantly from August 2020 to February 2021, with the largest increases among those aged 18–29 years and those with less than a high school education. During January 20, 2021–February 1, 2021, more than two in five adults aged ≥18 years experienced symptoms of an anxiety or a depressive disorder

FIGURE 2. Percentage of adults aged ≥18 years who took prescription medication for mental health or received counseling or therapy during past 4 weeks and percentage who needed but did not receive counseling or therapy during past 4 weeks, by data collection period — Household Pulse Survey, United States, August 19, 2020–February 1, 2021*



* Household Pulse Survey data collection included a 1-day break between the conclusion of one data collection period and the start of the next, as well as a 2-week break during December 22, 2020–January 5, 2021.

TABLE. Weighted* percentage of adults aged ≥18 years with symptoms of anxiety or depressive disorder during past 7 days, percentage who took prescription medication for mental health or received counseling or therapy during past 4 weeks, and percentage who needed but did not receive counseling or therapy during past 4 weeks, by selected characteristics — Household Pulse Survey, United States, August 19, 2020–February 1, 2021

	% (95% CI)					
	Symptoms of anxiety or depressive disorder during past 7 days		Took prescription medication for mental health or received counseling or therapy during past 4 weeks		Needed but did not receive counseling or therapy during past 4 weeks	
Characteristic	**Aug 19–31, 2020**	**Jan 20–Feb 1, 2021**	**Aug 19–31, 2020**	**Jan 20–Feb 1, 2021**	**Aug 19–31, 2020**	**Jan 20–Feb 1, 2021**
Total	**36.4 (35.9–36.9)**	**41.5 (40.7–42.2)†**	**22.4 (22.0–22.9)**	**24.8 (24.2–25.4)†**	**9.2 (8.8–9.6)**	**11.7 (11.1–12.2)†**
Age group, yrs						
18–29	49.0 (47.5–50.5)	57.0 (54.2–59.8)†	23.3 (21.5–25.2)	26.9 (24.9–29.0)†	15.6 (14.5–16.7)	22.8 (20.3–25.4)†
30–39	42.5 (40.8–44.1)	45.9 (44.5–47.3)†	23.1 (22.1–24.1)	27.1 (25.8–28.4)†	12.9 (11.9–13.9)	16.1 (14.8–17.5)†
40–49	37.6 (36.3–39.0)	41.1 (38.9–43.2)†	23.6 (22.8–24.5)	25.0 (23.7–26.3)	10.0 (9.3–10.7)	11.0 (10.0–11.9)
50–59	34.9 (33.6–36.3)	41.2 (39.8–42.6)†	23.9 (22.8–25.1)	25.4 (24.0–26.9)	7.7 (6.9–8.5)	9.5 (8.6–10.4)†
60–69	29.3 (28.0–30.6)	33.4 (31.6–35.4)†	21.2 (20.2–22.2)	23.3 (22.0–24.6)†	5.3 (4.8–5.9)	5.4 (4.8–6.0)
70–79	23.2 (21.6–25.0)	26.3 (24.6–28.0)†	19.6 (18.1–21.1)	19.8 (18.3–21.3)	2.9 (2.2–3.6)	3.1 (2.4–3.9)
≥80	19.4 (16.3–22.9)	22.5 (18.5–27.0)	14.8 (12.0–17.9)	17.3 (14.1–21.0)	1.4 (0.9–2.0)	2.3 (1.3–3.7)
Sex						
Male	31.8 (30.8–32.8)	38.0 (36.9–39.1)†	16.3 (15.6–17.1)	19.1 (18.1–20.1)†	6.8 (6.2–7.3)	9.1 (8.3–9.8)†
Female	40.7 (39.9–41.5)	44.8 (43.8–45.8)†	28.0 (27.3–28.7)	30.0 (29.3–30.7)†	11.4 (10.9–11.9)	14.1 (13.4–14.8)†
Race/Ethnicity						
Hispanic or Latino	40.2 (38.0–42.3)	47.1 (44.7–49.4)†	17.2 (15.8–18.6)	19.5 (17.3–21.9)	9.6 (8.6–10.6)	12.8 (10.9–14.9)†
White, non-Hispanic	35.4 (34.8–35.9)	39.8 (38.9–40.7)†	25.6 (25.0–26.1)	28.1 (27.3–28.8)†	9.1 (8.7–9.5)	11.7 (11.2–12.1)†
Black, non-Hispanic	37.7 (35.7–39.8)	44.5 (41.6–47.5)†	15.6 (14.2–17.1)	18.7 (16.7–20.8)†	9.3 (8.3–10.3)	12.2 (10.4–14.1)†
Asian, non-Hispanic	30.5 (28.2–32.8)	37.4 (33.4–41.5)†	11.1 (9.7–12.5)	12.9 (10.7–15.4)	4.8 (3.9–5.8)	5.8 (4.5–7.3)
Other/Multiple races, non-Hispanic	43.1 (40.2–46.1)	44.8 (41.0–48.6)	25.0 (22.3–27.9)	23.8 (20.9–26.9)	14.2 (12.1–16.4)	13.8 (11.4–16.5)
Education level						
Less than high school diploma	41.8 (38.4–45.2)	49.6 (45.7–53.5)†	20.0 (17.3–22.9)	20.6 (17.5–24.0)	7.0 (5.4–8.8)	11.3 (8.8–14.2)†
High school diploma or GED certificate	36.3 (35.0–37.7)	41.1 (39.3–42.9)†	20.1 (19.1–21.2)	22.2 (20.9–23.4)†	7.0 (6.3–7.8)	8.7 (7.4–10.2)†
Some college or associate's degree	39.4 (38.5–40.3)	46.4 (45.2–47.6)†	23.5 (22.7–24.4)	27.7 (26.8–28.7)†	11.2 (10.6–11.9)	14.9 (13.9–15.9)†
Bachelor's degree or higher	32.4 (31.7–33.0)	35.5 (34.7–36.3)†	24.0 (23.4–24.6)	25.4 (24.6–26.1)†	9.7 (9.2–10.1)	11.4 (10.9–12.0)†
Symptoms of anxiety or depressive disorder during past 7 days						
Did not experience symptoms	NA	NA	13.9 (13.4–14.4)	15.6 (14.9–16.4)†	2.4 (2.2–2.7)	3.1 (2.8–3.5)†
Experienced symptoms	NA	NA	37.5 (36.5–38.5)	37.7 (36.6–38.8)	21.0 (20.2–21.8)	23.8 (22.8–24.9)†

Abbreviations: CI = confidence interval; GED = general educational development; NA = not applicable.

* Estimates were weighted to adjust for nonresponse and number of adults in the household and to match U.S. Census Bureau estimates of the population by age, sex, race/ethnicity, and educational attainment.

† Significant difference between percentages at two time points (August 19–31, 2020, versus January 20–February 1, 2021) based on two-sided significance tests at the 0.05 level.

during the past 7 days. One in four adults who experienced these symptoms reported that they needed but did not receive counseling or therapy for their mental health.

These findings are consistent with results from surveys conducted early in the COVID-19 pandemic (March–June 2020) that showed an increased prevalence of mental health symptoms, especially among young adults (*5–7*). The more recent results indicate an increasing prevalence over time later in 2020, which remained increased in early 2021. The trends in symptoms of an anxiety or a depressive disorder from HPS have been shown to be consistent with trends in the weekly number of reported COVID-19 cases, and it has been theorized that increases in these mental health indicators correspond with pandemic trends (*8*).

The findings in this report are subject to at least four limitations. First, these data are based on self-report and were not confirmed by health professionals. Questions about mental health symptoms might be predictive of but do not necessarily reflect a clinical diagnosis. In addition, the predictive validity of the scales used in this report have not been confirmed when adapted from a 2-week to a 1-week time frame. Second, HPS did not assess the cause of these symptoms; therefore, a direct association with COVID-19 events could not be determined with certainty. Third, changes in mental health symptoms from the summer to the winter months might reflect symptoms associated with seasonal affective disorder (*9*). However, data from the 2019 National Health Interview Survey (NHIS),[§§] measured using the unmodified PHQ-4, did not demonstrate statistically significant changes from August to December 2019 for symptoms of an anxiety disorder (8.1% to 8.6%); a depressive disorder (7.0% to 6.7%); or an anxiety disorder, a depressive

[§§] NHIS is an annual household survey of the noninstitutionalized U.S. civilian population. In 2019, NHIS included the eight-item PHQ (PHQ-8) depression scale and seven-item GAD (GAD-7) scale as part of its sample adult interview.

Summary

What is already known about this topic?

Large disease outbreaks have been associated with mental health problems.

What is added by this report?

During August 2020–February 2021, the percentage of adults with recent symptoms of an anxiety or a depressive disorder increased from 36.4% to 41.5%, and the percentage of those reporting an unmet mental health care need increased from 9.2% to 11.7%. Increases were largest among adults aged 18–29 years and those with less than a high school education.

What are the implications for public health practice?

Trends in mental health can be used to evaluate the impact of strategies addressing adult mental health status and care during the pandemic and to guide interventions for disproportionately affected groups.

disorder, or both (11.0% to 11.3%) (*10*). Finally, these estimates are intended to represent all adults aged ≥18 years living in housing units in the United States. However, representativeness might be limited by the indirect exclusion of persons without Internet access and by low response rates. Some households were not eligible to participate because the U.S. Census Bureau was unable to match a mobile telephone number or e-mail address. The sampling weights that were applied to all analyses were likely to have reduced some of the potential bias. Nevertheless, these data might not fully meet the U.S. Census Bureau's quality standards and as such, the bureau labeled these data as experimental.

Despite these limitations, the survey's timeliness and relevance are strengths of HPS. The U.S. Census Bureau releases data tables to the public 9 days after the close of each data collection period.[¶¶] Simultaneously, NCHS updates online visualizations of trends in key health indicators.[***]

Several measures have been initiated to address increased mental health risks associated with COVID-19,[†††] and a previous report outlines additional strategies, including expanded use of telehealth, to address mental health conditions during the pandemic (*6*). Continued near real-time monitoring of mental health trends by demographic characteristics is critical during the COVID-19 pandemic. These trends might be used to evaluate the impact of strategies that address mental health status and care of adults during the pandemic and to guide interventions for groups that are disproportionately affected.

¶¶ The U.S. Census Bureau releases data files to the public within 4 weeks after the close of each data collection period. https://www.census.gov/programs-surveys/household-pulse-survey/data.html

*** https://www.cdc.gov/nchs/covid19/health-care-access-and-mental-health.htm

††† https://howrightnow.org/; https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/managing-stress-anxiety.html; https://www.samhsa.gov/find-help/disaster-distress-helpline

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Interim Estimates of Vaccine Effectiveness of BNT162b2 and mRNA-1273 COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Health Care Personnel, First Responders, and Other Essential and Frontline Workers — Eight U.S. Locations, December 2020–March 2021

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Messenger RNA (mRNA) BNT162b2 (Pfizer-BioNTech) and mRNA-1273 (Moderna) COVID-19 vaccines have been shown to be effective in preventing symptomatic COVID-19 in randomized placebo-controlled Phase III trials (*1*,*2*); however, the benefits of these vaccines for preventing asymptomatic and symptomatic SARS-CoV-2 (the virus that causes COVID-19) infection, particularly when administered in real-world conditions, is less well understood. Using prospective cohorts of health care personnel, first responders, and other essential and frontline workers* in eight U.S. locations during December 14, 2020–March 13, 2021, CDC routinely tested for SARS-CoV-2 infections every week regardless of symptom status and at the onset of symptoms consistent with COVID-19–associated illness. Among 3,950 participants with no previous laboratory documentation of SARS-CoV-2 infection, 2,479 (62.8%) received both recommended mRNA doses and 477 (12.1%) received only one dose of mRNA vaccine.† Among unvaccinated participants, 1.38 SARS-CoV-2 infections were confirmed by reverse transcription–polymerase chain reaction (RT-PCR) per 1,000 person-days.§ In contrast, among fully immunized (≥14 days after second dose) persons, 0.04 infections per 1,000 person-days were reported, and among partially immunized (≥14 days after first dose and before second dose) persons, 0.19 infections per 1,000 person-days were reported. Estimated mRNA vaccine effectiveness for prevention of infection, adjusted for study site, was 90% for full immunization and 80% for partial immunization. These findings indicate that authorized mRNA COVID-19 vaccines are effective for preventing SARS-CoV-2 infection, regardless of symptom status, among working-age adults in real-world conditions. COVID-19 vaccination is recommended for all eligible persons.

HEROES-RECOVER¶ is a network of longitudinal cohorts in eight locations (Phoenix, Tucson, and other areas in Arizona; Miami, Florida; Duluth, Minnesota; Portland, Oregon; Temple, Texas; and Salt Lake City, Utah) that share a common protocol and methods.** Enrollment in this longitudinal study started in July 2020 and included health care personnel, first responders, and other essential and frontline workers who provided written consent. The current vaccine effectiveness analytic study period began on the first day of vaccine administration at study sites (December 14–18, 2020) and ended March 13, 2021. Active surveillance for symptoms consistent with COVID-19–associated illness (defined as fever, chills, cough, shortness of breath, sore throat, diarrhea, muscle aches, or loss of smell or taste) occurred through weekly text messages, e-mails, and direct participant or medical record reports. Participants self-collected a midturbinate nasal swab weekly, regardless of COVID-19–associated illness symptom status and collected an additional nasal swab and saliva specimen at the onset of COVID-19–associated illness. Specimens shipped on cold packs were tested by RT-PCR assay at Marshfield Clinic Laboratory (Marshfield, Wisconsin) to determine SARS-CoV-2 infections (PCR-confirmed infection). Receipt

* Occupational categories: primary health care personnel (physicians, physician assistants, nurse practitioners, and dentists), other allied health care personnel (nurses, therapists, technicians, medical assistants, orderlies, and all other persons providing clinical support in inpatient or outpatient settings), first responders (firefighters, law enforcement, corrections, and emergency medical technicians), other essential and frontline workers (workers in hospitality, delivery, and retail; teachers; and all other occupations that require contact within 3 feet of the public, customers, or coworkers as a routine part of their job).

† An additional five participants received the Janssen COVID-19 vaccine (Johnson & Johnson), resulting in 2,961 vaccinated participants.

§ Person-days is an estimate of the time-at-risk (to SARS-CoV-2 infection) that each participant contributed to the study.

¶ Arizona Healthcare, Emergency Response and Other Essential Workers Surveillance Study (HEROES); Research on the Epidemiology of SARS-CoV-2 in Essential Response Personnel (RECOVER).

** https://preprints.jmir.org/preprint/28925 of COVID-19 vaccines was documented by multiple methods: by self-report in electronic surveys, by telephone interviews, and through direct upload of vaccine card images at all sites; records were also extracted from electronic medical records at the Minnesota, Oregon, Texas, and Utah sites. Among 5,077 participants, those with laboratory documentation of SARS-CoV-2 infection before enrollment starting in July 2020 (608) or identified as part of longitudinal surveillance up until the first day of vaccine administration (240) were excluded. Another 279 were excluded because of low participation (i.e., failed to complete surveillance for ≥20% of study weeks and did not contribute COVID-19–associated illness specimens). Overall, 3,950 participants in the vaccine effectiveness analytic sample were analyzed.

Hazard ratios were estimated by the Andersen-Gill extension of the Cox proportional hazards model, which accounted for time-varying vaccination status. Hazard ratios of unvaccinated person-days to partial immunization person-days (≥14 days after first dose and before second dose) and to full immunization person-days (≥14 days after second dose) were calculated separately. The 13 person-days between vaccine administration and partial or full immunization were considered excluded at-risk person-time because immunity was considered to be indeterminate. Unadjusted vaccine effectiveness was calculated as 100% × (1–hazard ratio). An adjusted vaccine effectiveness model included study site as a covariate. All analyses were conducted with SAS (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[††]

Approximately one half of the participants (52.6%) were from the Arizona study sites (Table 1). Participants included physicians and other clinical leads (primary health care personnel) (21.1%), nurses and other allied health care personnel (33.8%), first responders (21.6%), and other essential and frontline workers (23.5%). The majority of participants were female (62.1%), aged 18–49 years (71.9%), White (86.3%), and non-Hispanic (82.9%) and had no chronic medical conditions (68.9%). Over the 13-week study period, adherence to weekly surveillance reporting and specimen collection was high (median = 100%; interquartile range = 82%–100%).

Most (75.0%) of the participants received one or more doses of vaccine during the study period (Table 1); 477 (12.1%) received their first dose and had not received their second dose by the end of the study period, and 2,479 (62.8%) received both recommended mRNA vaccine doses. Most (60.5%) were vaccinated with their first dose during December 14–31, 2020. Both mRNA vaccine products were administered to participants in all locations but differed in the timing of their availability; 62.7% of vaccinated participants received Pfizer-BioNTech vaccine and 29.6% received Moderna vaccine. The remaining mRNA vaccines (7.7%) are pending product verification. Receipt of at least one vaccine dose was significantly higher among participants who were female, White, non-Hispanic, health care personnel, or living in Minnesota or Oregon; vaccine coverage was lowest in Florida (Table 1).

SARS-CoV-2 infection was diagnosed by RT-PCR in 205 (5.2%) participants; PCR-confirmed infection was significantly higher among participants who were male, Hispanic, first responders, or living in Arizona, Florida, and Texas (Table 1). The majority of PCR-confirmed infections were identified by weekly specimens (58.0%), whereas 42.0% were identified from specimens collected at the onset of COVID-19–associated illness. Nonetheless, the majority (87.3%) of PCR-confirmed infections were associated with symptoms consistent with COVID-19–associated illness. The remaining PCR-confirmed infections were associated with other symptoms not part of the COVID-19–associated illness definition (e.g., headache, fatigue, and rhinorrhea) (2.0%) or no symptoms (10.7%). Only 22.9% of PCR-confirmed infections were medically attended, including two hospitalizations; no deaths occurred.

During the 116,657 person-days when participants were unvaccinated, 161 PCR-confirmed infections were identified (incidence rate = 1.38/1,000 person-days). During the 13 days after first-dose or second-dose vaccination when immune status was considered indeterminate (67,483 person-days), 33 PCR-confirmed infections were identified and excluded from the outcome. Two sources of partially immunized person-days were reported. Five PCR-confirmed infections were reported during 15,868 person-days ≥14 days after their first dose among those who did not receive their second dose during the study period; three PCR-confirmed infections were reported during 25,988 person-days ≥14 days after the first dose and through receipt of the second dose. Taken together, this represents eight PCR-confirmed infections that occurred during 41,856 person-days with partial immunization (≥14 days after first dose and before second dose; incidence rate = 0.19/1,000 person-days). Three PCR-confirmed infections occurred during 78,902 person-days with full immunization (≥14 days after second dose; incidence rate = 0.04/1,000 person-days). Estimated adjusted vaccine effectiveness of full immunization was 90% (95% confidence interval [CI] = 68%–97%); vaccine effectiveness of partial immunization was 80% (95% CI = 59%–90%) (Table 2). In sensitivity analyses, inclusion of other covariates (sex, age, ethnicity, and occupation) were entered individually in

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

TABLE 1. Characteristics of health care personnel, first responders, and other essential and frontline workers with reverse transcription–polymerase chain reaction (RT-PCR)–confirmed SARS-CoV-2 infections and percentage receiving one or more doses of a messenger RNA (mRNA) COVID-19 vaccine — eight U.S. locations, December 14, 2020–March 13, 2021

Characteristic	No. (column %) of participants	SARS-CoV-2 infection		Unvaccinated	Vaccinated with ≥1 dose*	
		No. (row %)	p-value†	No. (row %)	No. (row %)	p-value†
Total	**3,950 (100)**	**205 (5.2)**	—	**989 (25.0)**	**2,961 (75.0)**	—
Cohort location						
Phoenix, Arizona	555 (14.1)	39 (7.0§)	<0.001	147 (26.5)	408 (73.5)	<0.001
Tucson, Arizona	1,199 (30.4)	79 (6.6§)		325 (27.1)	874 (72.9)	
Other, Arizona	320 (8.1)	16 (5.0§)		88 (27.5)	232 (72.5)	
Miami, Florida	221 (5.6)	19 (8.6§)		118 (53.4)	103 (46.6¶)	
Duluth, Minnesota	448 (11.3)	12 (2.7)		47 (10.5)	401 (89.5¶)	
Portland, Oregon	468 (11.8)	4 (0.9)		61 (13.0)	407 (87.0¶)	
Temple, Texas	289 (7.3)	18 (6.2§)		71 (24.6)	218 (75.4)	
Salt Lake City, Utah	450 (11.4)	18 (4.0)		132 (29.3)	318 (70.7)	
Sex						
Female**	2,453 (62.1)	109 (4.4)	0.007	529 (21.6)	1,924 (78.4)	<0.001
Male	1,497 (37.9)	96 (6.4)		460 (30.7)	1,037 (69.3)	
Age group, yrs						
18–49	2,839 (71.9)	146 (5.1)	0.83	735 (25.9)	2,104 (74.1)	0.48
≥50	1,111 (28.1)	59 (5.3)		254 (22.9)	857 (77.1)	
Race						
White	3,408 (86.3)	178 (5.2)	0.92	814 (23.9)	2,594 (76.1)	<0.001
Other	542 (13.7)	27 (5.0)		175 (32.3)	367 (67.7)	
Ethnicity						
Hispanic/Latino	674 (17.1)	57 (8.5)	<0.001	236 (35.0)	438 (65.0)	<0.001
Other	3,276 (82.9)	148 (4.5)		753 (23.0)	2,523 (77.0)	
Occupation††						
Primary health care personnel	835 (21.1)	16 (1.9)	<0.001	65 (7.8)	770 (92.2)	<0.001
Other allied health care personnel	1,335 (33.8)	67 (5.0)		242 (18.1)	1,093 (81.9)	
First responder	852 (21.6)	75 (8.8)		308 (36.2)	544 (63.8)	
Other essential and frontline worker	928 (23.5)	47 (5.1)		374 (40.3)	554 (59.7)	
Chronic condition						
None§§	2,723 (68.9)	141 (5.2)	0.92	711 (26.1)	2,012 (73.9)	0.11
≥1	1,227 (31.1)	64 (5.2)		278 (22.7)	949 (77.3)	

* Total vaccinated includes 477 participants who received one mRNA vaccine dose, 2,479 who received two mRNA vaccine doses, and five who received a single dose of the Janssen COVID-19 vaccine (Johnson & Johnson); these five participants contribute unvaccinated person-days until their vaccination date and then no longer contribute to the analysis.

† P-values (comparing the percentage of SARS-CoV-2 infections by sociodemographic and health categories and comparing the percentage vaccinated by these categories) calculated using Pearson's chi-square test (cells with ≥5 observations) or Fisher's exact test (cells with <5 observations).

§ Sites identified had statistically higher percentages of participants with RT-PCR-confirmed SARS-CoV-2 infections than the other sites (chi-square = 31.0, p-value <0.001).

¶ The Minnesota and Oregon sites had the statistically highest percentage vaccinated with at least one vaccine dose. Florida had the lowest (chi-square = 62.1, p-value <0.001).

** 10 participants were missing biologic sex and were imputed as the more common category (female).

†† Occupational categories: primary health care personnel (physicians, physician assistants, nurse practitioners, and dentists), other allied health care personnel (nurses, therapists, technicians, medical assistants, orderlies, and all other persons providing clinical support in inpatient or outpatient settings), first responders (firefighters, law enforcement, corrections, and emergency medical technicians), other essential and frontline workers (workers in hospitality, delivery, and retail; teachers; and all other occupations that require contact within 3 feet of the public, customers, or coworkers as a routine part of their job).

§§ 133 participants who did not respond to the self-report question were imputed as "none."

the vaccine effectiveness model; the change in vaccine effectiveness point estimates were <3%.

Discussion

Prospective cohorts of health care personnel, first responders, and other essential and frontline workers over 13 weeks in eight U.S. locations confirmed that authorized mRNA COVID-19 vaccines (Pfizer-BioNTech's BNT162b2 and Moderna's mRNA-1273) are highly effective in real-world conditions. Vaccine effectiveness of full immunization with two doses of mRNA vaccines was 90% (95% CI = 68%–97%) against RT-PCR–confirmed SARS-CoV-2 infection. These findings are consistent with those from the mRNA vaccines' Phase III trials (*1*,*2*) and recent observational studies of the mRNA vaccine effectiveness against severe COVID-19 (*3*). The findings complement and expand upon these preceding reports by demonstrating that the vaccines can also reduce the risk for infection regardless of COVID-19–associated illness symptom status (*4*,*5*). Reducing the risk for transmissible infection, which can occur among persons with asymptomatic

TABLE 2. Person-days, SARS-CoV-2 infections, and vaccine effectiveness among health care personnel, first responders, and other essential and frontline workers, by messenger RNA immunization status — eight U.S. locations, December 14, 2020–March 13, 2021

		SARS-CoV-2 infections		Unadjusted vaccine effectiveness*	Adjusted vaccine effectiveness*,†
COVID-19 immunization status	Person-days	No.	Incidence rate per 1,000 person-days	% (95% CI)	% (95% CI)
Unvaccinated	116,657	161	1.38	N/A	N/A
Partially immunized	41,856	8	0.19	82 (62–91)	80 (59–90)
≥14 days after receiving first dose only§	15,868	5	0.32		
≥14 days after first dose through receipt of second dose	25,988	3	0.12		
Fully immunized					
≥14 days after second dose	78,902	3	0.04	91 (73–97)	90 (68–97)

Abbreviations: CI = confidence interval; N/A = not applicable.
* Vaccine effectiveness was estimated using a Cox proportional hazards model accounting for time-varying immunization status.
† Hazard ratio is adjusted for study site.
§ Participants received first dose but had not received second dose by the end of the study period.

infection or among persons several days before symptoms onset (*6*), is especially important among health care personnel, first responders, and other essential and frontline workers given their potential to transmit the virus through frequent close contact with patients and the public.

Partial immunization (≥14 days after first dose but before second dose) provided preventive benefits with vaccine effectiveness of 80%. This finding is similar to an analysis of Phase III trial results (*1*,*2*,*7*) and two other recent estimates of vaccine effectiveness for partial immunization with Pfizer-BioNTech vaccine among health care personnel, including a vaccine effectiveness (≥21 days after first dose) of 72% (95% CI = 58%–86%) against PCR-confirmed infection identified by routine testing in the United Kingdom (*4*) and a vaccine effectiveness (>14 days after first dose) of 60% (95% CI = 38%–74%) against PCR-confirmed infection identified by records review in Israel (*5*). This finding is also consistent with early descriptive findings of SARS-CoV-2 employee and clinical testing results by mRNA vaccination status in the United States (*8*,*9*).

The findings in this report are subject to at least three limitations. First, vaccine effectiveness point estimates should be interpreted with caution given the moderately wide CIs attributable in part to the limited number of postimmunization PCR-confirmed infections observed. Second, this also precluded making product-specific vaccine effectiveness estimates and limited the ability to adjust for potential confounders; however, effects were largely unchanged when study site was included in an adjusted vaccine effectiveness model and when adjusted for sex, age, ethnicity, and occupation separately in sensitivity analyses. Finally, self-collection of specimens and delays in shipments could reduce sensitivity of virus detection by PCR (*10*); if this disproportionately affected those who received the vaccine (e.g., because of possible vaccine attenuation of virus shedding), vaccine effectiveness would be overestimated.

Summary

What is already known about this topic?

Messenger RNA (mRNA) COVID-19 vaccines have been shown to be effective in preventing symptomatic SARS-CoV-2 infection in randomized placebo-controlled Phase III trials.

What is added by this report?

Prospective cohorts of 3,950 health care personnel, first responders, and other essential and frontline workers completed weekly SARS-CoV-2 testing for 13 consecutive weeks. Under real-world conditions, mRNA vaccine effectiveness of full immunization (≥14 days after second dose) was 90% against SARS-CoV-2 infections regardless of symptom status; vaccine effectiveness of partial immunization (≥14 days after first dose but before second dose) was 80%.

What are the implications for public health practice?

Authorized mRNA COVID-19 vaccines are effective for preventing SARS-CoV-2 infection in real-world conditions. COVID-19 vaccination is recommended for all eligible persons.

The scientific rigor of these findings is enhanced by its prospective design and the participants' very high adherence to weekly specimen collection. As the study progresses, viruses will be genetically characterized to examine the viral features of breakthrough infections. Given that there is uncertainty related to the number of days required to develop immunity postvaccination (*3*–*5*,*7*), future research examining vaccine effectiveness at different intervals is warranted.

These interim vaccine effectiveness findings for both Pfizer-BioNTech's and Moderna's mRNA vaccines in real-world conditions complement and expand upon the vaccine effectiveness estimates from other recent studies (*3*–*5*) and demonstrate that current vaccination efforts are resulting in substantial preventive benefits among working-age adults. They reinforce CDC's recommendation of full 2-dose immunization with mRNA vaccines. COVID-19 vaccination is recommended for all eligible persons, which currently varies by location in the United States.

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Erratum

Vol. 70, No. 3

In the report "Vaccination Coverage with Selected Vaccines and Exemption Rates Among Children in Kindergarten — United States, 2019–20 School Year," on page 77, in the Table, for the row for Kansas, in the columns labeled "MMR 2 doses," "DTaP 5 doses," and "Varicella 2 doses," the percentages should have been **90.0%**, **89.7%**, and **89.1%**, respectively.

Erratum

Vol. 70, No. 12

In the report "Declines in Prevalence of Human Papillomavirus Vaccine-Type Infection Among Females after Introduction of Vaccine — United States, 2003–2018," on page 417, Table 1 contained alignment errors. The corrected table is as follows:

TABLE 1. Prevalence of human papillomavirus (HPV) infection among females aged 14–34 years, by age group and survey years — National Health and Nutrition Examination Survey, United States, 2003–2018*

Age group (yrs) and HPV types	Prevaccine era 2003–2006	2007–2010	2011–2014	2015–2018	Comparison of 2015–2018 with 2003–2006	
	% (95% CI)				PR (95% CI)	aPR (95% CI)[†]
14–19	n = 1,363	n = 740	n = 797	n = 666	—	—
4vHPV[§]	11.5 (9.1–14.4)	5.0 (3.8–6.6)	3.3 (1.9–5.8)	1.1 (0.5–2.4)[¶]	**0.10 (0.05–0.21)**	**0.12 (0.06–0.26)**
Additional five types in 9vHPV**	8.4 (6.6–10.6)	6.1 (4.4–8.5)	5.3 (3.4–8.4)	2.3 (1.3–4.1)	0.28 (0.15–0.51)	0.35 (0.18–0.65)
Non-4vHPV[††]	31.2 (27.9–34.8)	25.3 (21.4–29.5)	25.5 (21.3–30.2)	20.9 (16.9–25.6)	0.67 (0.53–0.84)	0.72 (0.57–0.92)
Non-9vHPV[§§]	29.0 (26.0–32.2)	24.4 (20.8–28.4)	24.7 (20.6–29.4)	20.6 (16.6–25.3)	0.71 (0.57–0.90)	0.77 (0.61–0.98)
20–24	n = 432	n = 445	n = 442	n = 368	—	—
4vHPV[§]	18.5 (14.9–22.8)	19.9 (15.4–25.3)	7.2 (4.7–11.1)	3.3 (1.7–6.3)[¶]	**0.18 (0.09–0.35)**	**0.19 (0.09–0.40)**
Additional five types in 9vHPV**	16.5 (11.3–23.4)	13.8 (10.2–18.2)	13.2 (8.8–19.4)	10.2 (7.2–14.4)	0.62 (0.38–1.02)	0.62 (0.38–1.01)
Non-4vHPV[††]	50.7 (43.4–58.0)	57.4 (51.3–63.3)	55.8 (49.9–61.6)	49.9 (42.3–57.5)	0.98 (0.80–1.21)	0.97 (0.80–1.18)
Non-9vHPV[§§]	47.6 (40.7–54.6)	54.9 (48.9–60.8)	53.4 (47.8–58.8)	47.1 (39.7–54.7)	0.99 (0.80–1.22)	0.97 (0.79–1.18)
25–29	n = 403	n = 414	n = 395	n = 430	—	—
4vHPV[§]	11.8 (8.8–15.6)	13.1 (10.0–17.2)	8.8 (6.3–12.1)	9.1 (5.8–14.0)	**0.77 (0.46–1.29)**	**0.85 (0.50–1.46)**
Additional five types in 9vHPV**	10.8 (7.3–15.7)	13.1 (9.7–17.3)	13.9 (10.5–18.1)	11.6 (8.1–16.3)	1.07 (0.64–1.79)	0.99 (0.58–1.67)
Non-4vHPV[††]	43.8 (38.9–48.9)	48.6 (43.7–53.6)	43.7 (37.7–49.9)	45.2 (39.2–51.4)	1.03 (0.87–1.23)	1.05 (0.86–1.27)
Non-9vHPV[§§]	39.8 (34.8–45.0)	44.7 (40.0–49.4)	42.0 (36.2–48.0)	42.1 (36.6–47.9)	1.06 (0.88–1.27)	1.07 (0.88–1.31)
30–34	n = 389	n = 433	n = 433	n = 413	—	—
4vHPV[§]	9.5 (6.7–13.2)	8.9 (6.5–11.9)	7.1 (5.1–9.9)	6.2 (4.0–9.5)	**0.65 (0.38–1.11)**	**0.67 (0.37–1.21)**
Additional five types in 9vHPV**	9.8 (7.1–13.5)	6.8 (4.7–9.9)	6.9 (4.6–10.0)	6.9 (4.4–10.8)	0.70 (0.41–1.21)	0.68 (0.37–1.27)
Non-4vHPV[††]	44.5 (39.1–50.1)	37.8 (31.6–44.5)	39.2 (33.6–45.0)	34.7 (29.1–40.8)	0.78 (0.63–0.96)	0.82 (0.67–1.00)
Non-9vHPV[§§]	40.4 (35.0–46.0)	36.1 (30.3–42.3)	38.2 (32.7–44.0)	31.9 (26.6–37.6)	0.79 (0.64–0.98)	0.83 (0.67–1.03)

Abbreviations: 4vHPV = quadrivalent HPV vaccine; 9vHPV = 9-valent HPV vaccine; aPR = adjusted prevalence ratio; CI = confidence interval; PR = prevalence ratio.

* All analyses were weighted using the National Health and Nutrition Examination Survey examination sample weights.

† Adjustments for aPR: females aged 14–19 years, race/ethnicity and ever had sex; females aged 20–24, 25–29, and 30–34 years, race/ethnicity and number of lifetime sex partners (fewer than three or three or more).

§ HPV 6, 11, 16, or 18.

¶ Relative standard error >30% and ≤50%, considered unstable.

** HPV 31, 33, 45, 52, or 58.

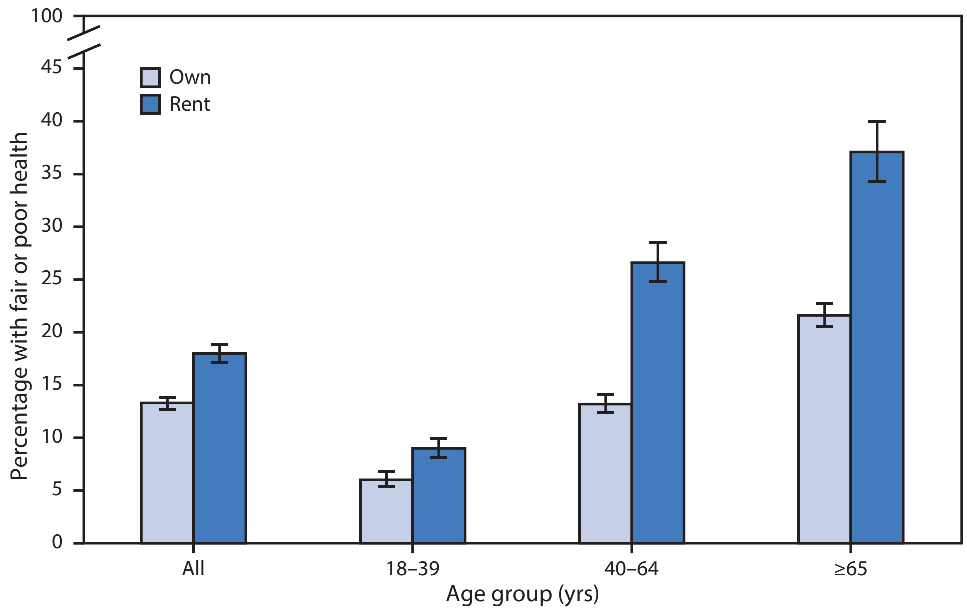
†† Thirty-three HPV types detected using linear array that are not HPV 6, 11, 16, or 18.

§§ Twenty-eight HPV types detected using linear array that are not HPV 6, 11, 16, 18, 31, 33, 45, 52, or 58.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults with Fair or Poor Health,† by Home Ownership Status§ and Age Group — National Health Interview Survey, United States, 2019¶



* With 95% confidence intervals indicated with error bars.
† Based on a response to the question "Would you say your health in general is excellent, very good, good, fair, or poor?"
§ Based on a response to the question "Is this house/apartment owned or rented by you [you or someone in your family]?"
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2019, 18.0% of renters assessed their health as fair or poor, compared with 13.3% of homeowners. For each age group, renters were more likely than homeowners to report fair or poor health: 9.0% versus 6.0% among adults aged 18–39 years, 26.6% versus 13.2% among those aged 40–64 years, and 37.1% versus 21.6% among those aged ≥65 years. For both renters and homeowners, the percentage of adults with fair or poor health increased with increasing age.

Source: National Health Interview Survey, 2019. https://www.cdc.gov/nchs/nhis.htm

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