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Care Outcomes Among Black or African American Persons with Diagnosed HIV in Rural, Urban, and Metropolitan Statistical Areas — 42 U.S. Jurisdictions, 2018

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During 2018, Black or African American (Black) persons accounted for 43% of all diagnoses of human immunodeficiency virus (HIV) infection in the United States (*1*). Among Black persons with diagnosed HIV infection in 41 states and the District of Columbia for whom complete laboratory reporting* was available, the percentages of Black persons linked to care within 1 month of diagnosis (77.1%) and with viral suppression within 6 months of diagnosis (62.9%) during 2018 were lower than the Ending the HIV Epidemic initiative objectives of 95% for linkage to care and viral suppression goals (*2*). Access to HIV-related care and treatment services varies by residence area (*3*–*5*). Identifying urban-rural differences in HIV care outcomes is crucial for addressing HIV-related disparities among Black persons with HIV infection. CDC used National HIV Surveillance System† (NHSS) data to describe HIV care outcomes among Black persons with diagnosed HIV infection during 2018 by population area of residence§ (area). During 2018, Black persons in rural areas received a higher percentage of late-stage diagnoses (25.2%) than did those in urban (21.9%) and metropolitan (19.0%) areas. Linkage to care within 1 month of diagnosis was similar across all areas, whereas viral suppression within 6 months of diagnosis was highest in metropolitan areas (63.8%). The Ending the HIV Epidemic initiative supports scalable, coordinated, and innovative efforts to increase HIV diagnosis, treatment, and prevention among populations disproportionately affected by or who are at higher risk for HIV infection (*6*), especially during syndemics (e.g. with coronavirus disease 2019).

CDC analyzed data reported to NHSS for Black persons aged ≥13 years who received a diagnosis of HIV during 2018 in

* CDC has established three criteria for complete laboratory reporting: 1) the jurisdiction's laws or regulations require reporting of all CD4 and viral load results to the state or local health department; 2) laboratories that perform HIV-related testing for the area must have reported a minimum of 95% of HIV-related test results to the state or local health department; and 3) by December 31, 2019, the jurisdiction had reported to CDC ≥95% of all CD4 and viral load results received during January 2017–September 2019. https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html

† The National HIV Surveillance System is the primary source for monitoring HIV trends in the United States. Through that system, CDC funds and assists state and local health departments for collecting data regarding HIV infection cases. Health departments provide deidentified data to CDC.

§ Area of residence at HIV diagnosis was categorized as rural (<50,000 population), urban (50,000–499,999 population), or metropolitan (≥500,000 population) according to the Office of Management and Budget 2010 standards for delineating metropolitan and micropolitan statistical areas (http://www.federalregister.gov/documents/201006/28/2010-15605/2010-standards-for-delineating-metropolitan-and-micropolitan-statistical-areas).

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41 states¶ and the District of Columbia, jurisdictions in which laboratory reporting was complete as of December 31, 2019. Stage of disease** at diagnosis was classified using the 2014 surveillance case definition for HIV infection based on age-specific CD4 counts or percentages of total lymphocytes (*2*,*7*). Linkage to care within 1 month of diagnosis was measured by documentation of one or more CD4 counts or percentage of viral load test results within 1 month after diagnosis. Viral suppression within 6 months of HIV diagnosis was defined as a viral load of <200 HIV RNA copies/mL within 6 months of HIV diagnosis. Data were statistically adjusted by using multiple imputation techniques to account for missing HIV transmission categories (*8*). Analyses were conducted using SAS (version 9.4; SAS Institute).

Among 14,502 Black persons who received a diagnosis of HIV infection during 2018, a total of 897 (6.2%) lived in a rural area, 1,920 (13.2%) lived in an urban area, and 11,685 (80.6%) lived in a metropolitan area. The percentage of Black persons who received a late (stage 3, acquired immunodeficiency syndrome) diagnosis of HIV infection was highest in rural areas (25.2%), followed by urban and metropolitan areas (21.9% and 19.0%, respectively) (Table 1) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/102576). Females were more likely than were males to receive a late-stage diagnosis. The highest percentage of late-stage diagnoses was among females in rural areas (females, rural: 31.4%, urban: 23.1%, metropolitan: 20.6%; males, rural: 23.0%, urban: 21.5%, metropolitan: 18.6%). The highest percentages of late-stage diagnoses occurred among persons aged 45–54 years in both rural and metropolitan areas (47.9% and 31.4%, respectively); in urban areas, the percentage of late-stage diagnoses was highest among persons aged ≥55 years (43.1%). By transmission category, the percentage of late-stage diagnoses was highest in all areas among males whose infection was attributed to heterosexual contact (rural: 37.2%, urban: 32.5%, metropolitan: 28.3%).

Overall, the percentage of Black persons with HIV infection diagnosed during 2018 who were linked to care within 1 month of diagnosis was 76.7% in rural areas, 77.0% in urban areas, and 77.2% in metropolitan areas (Table 2) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/102576). Males were less likely than were females to be linked to care, regardless of area (males, rural: 75.2%, urban: 75.0%, metropolitan: 76.4%; females, rural: 81.8%, urban: 82.7%, metropolitan: 79.5%).

¶ Alabama, Alaska, California, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

** Disease stages are defined as follows: stage zero, the first positive HIV test result ≤6 months after a negative HIV test result and remaining at Stage zero until 6 months after the first positive test result; stage 1, a CD4 count of ≥500 cells/μL or CD4 percentage of ≥26; stage 2, a CD4 count of 200–499 cells/μL or CD4 percentage of 14–25; stage 3 (acquired immunodeficiency syndrome [AIDS]), a CD4 count of <200 cells/μL or CD4 percentage of <14 or documentation of an AIDS-defining condition. Stages of disease are further classified as stage zero; stages 1–2: early-stage diagnosis; and stage 3 [AIDS]: late-stage diagnosis.

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TABLE 1. Stage of disease at time of human immunodeficiency virus (HIV) diagnosis during 2018 among Black or African American persons aged ≥13 years, by population of area of residence and selected characteristics — 41 states and the District of Columbia, 2018*

Characteristic	Total no.	No. (%)				
		Stage zero†	Stage 1 (CD4 ≥500 cells/μL or ≥ 26%)	Stage 2 (CD4 = 200–499 cells/μL or 14%–25%)	Stage 3 (AIDS) (OI or CD4 <200 cells/μL or <14%)	Stage unknown§
Rural						
Gender						
Male	**648**	40 (6.2)	137 (21.1)	197 (30.4)	149 (23.0)	125 (19.3)
Female	**242**	8 (3.3)	70 (28.9)	58 (24.0)	76 (31.4)	30 (12.4)
Transgender¶	**7**	2 (28.6)	0 (—)	1 (14.3)	1 (14.3)	3 (42.9)
Age group at diagnosis, yrs						
13–24	**225**	25 (11.1)	49 (21.8)	86 (38.2)	19 (8.4)	46 (20.4)
25–34	**289**	18 (6.2)	73 (25.3)	85 (29.4)	58 (20.1)	55 (19.0)
35–44	**163**	5 (3.1)	39 (23.9)	48 (29.4)	47 (28.8)	24 (14.7)
45–54	**117**	2 (1.7)	23 (19.7)	16 (13.7)	56 (47.9)	20 (17.1)
≥55	**103**	0 (—)	23 (22.3)	21 (20.4)	46 (44.7)	13 (12.6)
Transmission category**						
Male-to-male sexual contact	**489**	38 (7.8)	95 (19.5)	164 (33.5)	94 (19.2)	98 (20.0)
Injection drug use						
Male	**33**	0 (—)	12 (37.8)	3 (9.5)	11 (32.9)	6 (18.8)
Female	**19**	1 (2.6)	6 (32.0)	5 (23.7)	7 (35.1)	1 (6.7)
Male-to-male sexual contact and injection drug use	**14**	1 (8.4)	5 (32.9)	2 (15.4)	1 (9.1)	5 (34.3)
Heterosexual contact††						
Male	**118**	2 (1.3)	24 (20.5)	29 (24.7)	44 (37.2)	19 (16.4)
Female	**222**	9 (3.8)	64 (28.7)	52 (23.6)	69 (30.9)	29 (12.9)
Total§§	**897**	**50 (5.6)**	**207 (23.1)**	**256 (28.5)**	**226 (25.2)**	**158 (17.6)**
Urban						
Gender						
Male	**1,399**	77 (5.5)	300 (21.4)	448 (32.0)	301 (21.5)	273 (19.5)
Female	**502**	15 (3.0)	143 (28.5)	154 (30.7)	116 (23.1)	74 (14.7)
Transgender¶	**19**	3 (15.8)	4 (21.1)	9 (47.4)	3 (15.8)	0 (—)
Age group at diagnosis, yrs						
13–24	**575**	48 (8.3)	137 (23.8)	209 (36.3)	52 (9.0)	129 (22.4)
25–34	**651**	29 (4.5)	169 (26.0)	218 (33.5)	129 (19.8)	106 (16.3)
35–44	**323**	8 (2.5)	79 (24.5)	89 (27.6)	96 (29.7)	51 (15.8)
45–54	**211**	8 (3.8)	34 (16.1)	57 (27.0)	74 (35.1)	38 (18.0)
≥55	**160**	2 (1.3)	28 (17.5)	38 (23.8)	69 (43.1)	23 (14.4)
Transmission category**						
Male-to-male sexual contact	**1,121**	68 (6.1)	254 (22.6)	370 (33.0)	218 (19.5)	211 (18.8)
Injection drug use						
Male	**45**	2 (4.0)	9 (19.7)	13 (28.7)	10 (21.5)	12 (26.0)
Female	**36**	1 (3.6)	9 (26.2)	6 (16.7)	10 (28.4)	9 (25.1)
Male-to-male sexual contact and injection drug use	**28**	1 (4.7)	7 (25.4)	8 (29.7)	4 (15.6)	7 (24.6)
Heterosexual contact††						
Male	**221**	8 (3.4)	32 (14.5)	66 (29.8)	72 (32.5)	44 (19.8)
Female	**464**	15 (3.2)	134 (28.7)	147 (31.6)	105 (22.7)	64 (13.8)
Total§§	**1,920**	**95 (4.9)**	**447 (23.3)**	**611 (31.8)**	**420 (21.9)**	**347 (18.1)**
Metropolitan						
Gender						
Male	**8,502**	619 (7.3)	1,979 (23.3)	2,647 (31.1)	1,584 (18.6)	1,673 (19.7)
Female	**2,941**	119 (4.0)	912 (31.0)	817 (27.8)	606 (20.6)	487 (16.6)
Transgender¶	**242**	24 (9.9)	78 (32.2)	74 (30.6)	29 (12.0)	37 (15.3)
Age group at diagnosis, yrs						
13–24	**2,916**	292 (10.0)	760 (26.1)	1,029 (35.3)	273 (9.4)	562 (19.3)
25–34	**4,172**	294 (7.0)	1,129 (27.1)	1,289 (30.9)	667 (16.0)	793 (19.0)
35–44	**1,980**	83 (4.2)	492 (24.8)	563 (28.4)	469 (23.7)	373 (18.8)
45–54	**1,444**	56 (3.9)	309 (21.4)	351 (24.3)	453 (31.4)	275 (19.0)
≥55	**1,173**	37 (3.2)	279 (23.8)	306 (26.1)	357 (30.4)	194 (16.5)
Transmission category**						
Male-to-male sexual contact	**6,998**	567 (8.1)	1,702 (24.3)	2,225 (31.8)	1,157 (16.5)	1,347 (19.2)

See table footnotes on the next page.

TABLE 1. (*Continued*) Stage of disease at time of HIV diagnosis during 2018 among Black or African American persons aged ≥13 years, by population of area of residence and selected characteristics — 41 states and the District of Columbia, United States*

		No. (%)				
Characteristic	**Total no.**	**Stage zero†**	**Stage 1 (CD4 ≥500 cells/µL or ≥ 26%)**	**Stage 2 (CD4 = 200–499 cells/µL or 14%–25%)**	**Stage 3 (AIDS) (OI or CD4 <200 cells/µL or <14%)**	**Stage unknown§**
Injection drug use						
Male	**283**	16 (5.6)	64 (22.4)	73 (25.6)	69 (24.4)	62 (21.9)
Female	**214**	10 (4.5)	58 (27.1)	55 (25.5)	50 (23.2)	42 (19.7)
Male-to-male sexual contact and injection drug use	**195**	14 (7.4)	51 (26.3)	52 (26.8)	34 (17.2)	44 (22.3)
Heterosexual contact††						
Male	**1,244**	44 (3.6)	233 (18.7)	363 (29.2)	352 (28.3)	252 (20.3)
Female	**2,722**	110 (4.1)	854 (31.4)	762 (28.0)	551 (20.2)	445 (16.4)
Total§§	**11,685**	**762 (6.5)**	**2,969 (25.4)**	**3,538 (30.3)**	**2,219 (19.0)**	**2,197 (18.8)**

Abbreviations: CD4 = CD4+ T-lymphocyte count (cells/µL) or percentage; OI = opportunistic infection (i.e., AIDS-defining condition).

* Stage of disease at diagnosis of HIV infection based on first CD4 test performed or documentation of an AIDS-defining condition ≤3 months after a diagnosis of HIV infection. Data are based on residence at time of diagnosis. Data not provided for states and associated counties that do not have laws requiring reporting of all CD4 and viral loads, or that have incomplete reporting of laboratory data to CDC. Areas without laws: Idaho, New Jersey, and Pennsylvania. Areas with incomplete reporting: Arizona, Arkansas, Connecticut, Kansas, Kentucky, Vermont, and Puerto Rico.

† First positive HIV test result is within 6 months after a negative HIV test result. The diagnosis of an AIDS-defining condition or a low CD4 test result before the 6 months have elapsed does not change the stage from stage zero to stage 3.

§ Includes persons with no CD4 information.

¶ Transgender includes persons who identified as transgender male-to-female, transgender female-to-male, and additional gender identity. Data not displayed because the numbers were too small to be meaningful. "Transgender male-to-female" includes persons who were assigned "male" sex at birth but have ever identified as "female" gender. "Transgender female-to-male" includes persons who were assigned "female" sex at birth but have ever identified as "male" gender. Additional gender identity examples include "bigender," "gender queer," and "two-spirit."

** Data have been statistically adjusted to account for missing transmission category; therefore, values might not sum to column subtotals and total. Data presented based on sex at birth and include transgender persons.

†† Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

§§ Includes persons whose infection was attributed to hemophilia, blood transfusion, or perinatal exposure, or whose risk factor was not reported or not identified. Data not displayed because the numbers were too small to be meaningful.

Males aged 45–54 years in rural and urban areas with infection attributed to heterosexual contact (rural: 69.9%, urban: 67.1%) and males aged 13–24 years in metropolitan areas with infection attributed to heterosexual contact (62.3%) accounted for the lowest percentage of being linked to care compared with persons with other modes of transmission in those areas.

Overall, the percentage of Black persons aged ≥13 years in rural areas with HIV diagnosed during 2018 who had <200 copies of viral RNA per mL (viral suppression) within 6 months of diagnosis was 59.6% in rural areas, 59.7% in urban areas, and 63.8% in metropolitan areas (Table 3) (Supplementary Figure, https://stacks.cdc.gov/view/cdc/102576). The percentage of males with viral suppression within 6 months of diagnosis was lower than the percentage among females, regardless of area (males, rural: 58.0%, urban: 57.8%, metropolitan: 62.4%; females, rural: 64.0%, urban: 65.1%, metropolitan: 68.1%). By age group and area, the lowest percentage of viral suppression within 6 months of diagnosis was among persons aged 45–54 years in rural and urban areas (52.1% and 56.4%, respectively) and persons aged 13–34 years in metropolitan areas (62.6%). In rural and urban areas, the lowest percentage of viral suppression within 6 months of diagnosis was among males aged 45–54 years with infection attributed to male-to-male sexual contact and to heterosexual contact (44.2% and 42.5%, respectively). In metropolitan areas, the lowest percentage of viral suppression within 6 months of diagnosis was among males aged 13–24 years with infection attributed to heterosexual contact (51.7%) and males aged 25–34 years with infection attributed to injection drug use (IDU) (45.0%).

Discussion

During 2018, one in four (25.2%) diagnosed HIV infections among Black persons in rural areas was a late-stage diagnosis, a percentage that was higher than that among Black persons in urban (21.9%) and metropolitan (19.0%) areas. The percentages of patients linked to care within 1 month of diagnosis were similar in all areas, whereas the percentages of persons with viral suppression within 6 months of diagnosis were lower in rural (59.6%) and urban (59.7%) areas than in metropolitan areas (63.8%). In all areas, the percentages of persons who were linked to care within 1 month of diagnosis and who had viral suppression within 6 months of diagnosis were substantially below the Ending the HIV Epidemic initiative targets of 95% (*9*). These findings likely underscore known differences in health-related behaviors, physical and sociocultural environments, and access to and use of health care systems among Black urban and rural HIV populations (*3*,*4*).

TABLE 2. Linkage to human immunodeficiency virus (HIV) medical care within 1 month of HIV diagnosis among Black or African American persons aged ≥13 years with HIV infection diagnosed during 2018, by population area of residence, age group, and selected characteristics — 41 states and the District of Columbia, 2018*

	Age 13–24 yrs		Age 25–34 yrs		Age 35–44 yrs		Age 45–54 yrs		Age ≥55 yrs		Total	
Characteristic	No.	No. linked (%)	No.	No. linked (%)	No.	No. linked (%)	No.	No. linked (%)	No.	No. linked (%)	No.	No. linked (%)
Rural												
Gender												
Male	187	136 (72.7)	225	166 (73.8)	101	80 (79.2)	73	53 (72.6)	62	52 (83.9)	648	487 (75.2)
Female	36	29 (80.6)	61	45 (73.8)	60	53 (88.3)	44	33 (75.0)	41	38 (92.7)	242	198 (81.8)
Transgender†	2	1 (50.0)	3	3 (100)	2	0 (—)	0	0 (—)	0	0 (—)	7	3 (42.9)
Transmission category§												
Male-to-male sexual contact	177	128 (72.4)	185	138 (74.4)	63	49 (78.1)	41	30 (72.9)	22	18 (82.4)	489	364 (74.4)
Injection drug use												
Male	1	1 (75.0)	7	7 (89.3)	13	9 (74.8)	7	6 (82.6)	5	5 (100)	33	27 (81.8)
Female	2	2 (95.8)	4	3 (79.5)	4	4 (94.9)	4	4 (87.8)	5	5 (92.2)	19	17 (89.5)
Male-to-male sexual contact and injection drug use	2	1 (41.7)	6	2 (37.3)	4	3 (86.1)	1	1 (54.5)	1	1 (92.3)	14	8 (57.1)
Heterosexual contact¶												
Male	9	7 (83.1)	28	21 (75.1)	24	18 (76.7)	24	17 (69.9)	33	28 (82.3)	118	91 (77.1)
Female	34	27 (79.4)	57	41 (71.5)	56	49 (87.8)	40	29 (73.7)	36	33 (92.8)	222	179 (80.6)
Total**	**225**	**166 (73.8)**	**289**	**213 (73.7)**	**163**	**133 (81.6)**	**117**	**86 (73.5)**	**103**	**90 (87.4)**	**897**	**688 (76.7)**
Urban												
Gender												
Male	482	347 (72.0)	492	361 (73.4)	192	155 (80.7)	135	102 (75.6)	98	84 (85.7)	1,399	1,049 (75.0)
Female	87	68 (78.2)	147	117 (79.6)	130	114 (87.7)	76	67 (88.2)	62	49 (79.0)	502	415 (82.7)
Transgender†	6	5 (83.3)	12	10 (90.9)	1	0 (—)	0	0 (—)	0	0 (—)	19	15 (78.9)
Transmission category§												
Male-to-male sexual contact	454	329 (72.4)	421	311 (73.9)	126	102 (80.7)	76	62 (81.7)	45	40 (88.7)	1,121	843 (75.2)
Injection drug use												
Male	4	2 (55.0)	9	5 (52.2)	12	8 (66.1)	10	6 (66.0)	9	7 (77.4)	45	29 (64.4)
Female	6	4 (64.9)	6	5 (83.9)	10	8 (75.8)	7	6 (90.1)	8	6 (78.9)	36	28 (77.8)
Male-to-male sexual contact and injection drug use	6	4 (64.9)	9	7 (76.1)	5	3 (66.7)	6	4 (73.2)	2	1 (75.0)	28	20 (71.4)
Heterosexual contact¶												
Male	22	15 (67.7)	64	47 (74.0)	50	42 (84.0)	44	29 (67.1)	42	36 (84.7)	221	168 (76.0)
Female	80	63 (79.0)	142	113 (79.6)	120	106 (88.7)	69	61 (88.0)	54	43 (79.0)	464	386 (83.2)
Total**	**575**	**420 (73.0)**	**651**	**488 (75.0)**	**323**	**269 (83.3)**	**211**	**169 (80.1)**	**160**	**133 (83.1)**	**1,920**	**1,479 (77.0)**
Metropolitan												
Gender												
Male	2,409	1,833 (76.1)	3,328	2,535 (76.2)	1,256	976 (77.7)	857	637 (74.3)	652	511 (78.4)	8,502	6,492 (76.4)
Female	412	315 (76.5)	736	579 (78.7)	692	552 (79.8)	581	460 (79.2)	520	431 (82.9)	2,941	2,337 (79.5)
Transgender†	95	74 (77.9)	108	81 (80.2)	32	29 (90.6)	6	5 (83.3)	1	1 (100)	242	195 (80.6)
Transmission category§												
Male-to-male sexual contact	2,339	0 (—)	2,941	2,261 (76.9)	921	722 (78.4)	509	374 (73.4)	288	224 (77.7)	6,998	5,379 (76.9)
Injection drug use												
Male	20	13 (63.6)	61	44 (71.5)	62	48 (76.6)	62	45 (71.9)	78	63 (80.1)	283	211 (74.5)
Female	18	14 (78.3)	49	34 (69.0)	45	32 (72.3)	45	35 (77.9)	56	46 (81.1)	214	162 (75.7)
Male-to-male sexual contact and injection drug use	37	29 (77.5)	92	71 (76.8)	33	23 (71.8)	20	15 (77.3)	14	10 (76.5)	195	149 (76.4)
Heterosexual contact¶												
Male	102	64 (62.3)	333	240 (72.0)	268	208 (77.5)	271	208 (76.8)	270	212 (78.7)	1,244	931 (74.9)
Female	386	292 (75.7)	688	545 (79.2)	649	522 (80.4)	535	424 (79.3)	463	385 (83.1)	2,722	2,168 (79.6)
Total**	**2,916**	**2,222 (76.2)**	**4,172**	**3,200 (76.7)**	**1,980**	**1,557 (78.6)**	**1,444**	**1,102 (76.3)**	**1,173**	**943 (80.4)**	**11,685**	**9,024 (77.2)**

Abbreviations: CD4 = CD4+ T-lymphocyte count (cells/μL) or percentage; OI = opportunistic infection (i.e., AIDS-defining condition).

* Linkage to HIV medical care was measured by documentation of ≥ 1 CD4 or VL tests ≤ 1 month or ≤ 3 months of HIV diagnosis. Data are based on residence at time of diagnosis. Data not provided for states and associated counties that do not have laws requiring reporting of all CD4 and viral loads, or that have incomplete reporting of laboratory data to CDC. Areas without laws: Idaho, New Jersey, and Pennsylvania. Areas with incomplete reporting: Arizona, Arkansas, Connecticut, Kansas, Kentucky, Vermont, and Puerto Rico.

† Transgender includes persons who identified as transgender male-to-female, transgender female-to-male, and additional gender identity. Data not displayed because the numbers were too small to be meaningful. "Transgender male-to-female" includes persons who were assigned "male" sex at birth but have ever identified as "female" gender. "Transgender female-to-male" includes persons who were assigned "female" sex at birth but have ever identified as "male" gender. Additional gender identity examples include "bigender," "gender queer," and "two-spirit."

§ Data have been statistically adjusted to account for missing transmission category; therefore, values might not sum to column subtotals and total. Data presented based on sex at birth and include transgender persons.

¶ Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

** Includes persons whose infection was attributed to hemophilia, blood transfusion, perinatal exposure, or whose risk factor was not reported or not identified. Data not displayed because the numbers were too small to be meaningful.

TABLE 3. Human immunodeficiency virus (HIV) viral suppression within 6 months among Black or African American persons aged ≥13 years with HIV infection diagnosed during 2018, by population area of residence, age group, and selected characteristics — 41 states and the District of Columbia, 2018*

	Age ≥13 yrs		Age 13–24 yrs		Age 25–34 yrs		Age 35–44 yrs		Age 45–54 yrs		Age ≥55 yrs	
Characteristic	No.	Suppressed no. (%)	No.	Suppressed no. (%)	No.	Suppressed no. (%)	No.	Suppressed no. (%)	No.	Suppressed no. (%)	No.	Suppressed no (%)
Rural												
Gender												
Male	648	376 (58.0)	187	118 (63.1)	225	132 (58.7)	101	61 (60.4)	73	33 (45.2)	62	32 (51.6)
Female	242	155 (64.0)	36	22 (61.1)	61	33 (54.1)	60	42 (70.0)	44	28 (63.6)	41	30 (73.2)
Transgender†	7	4 (57.1)	2	0 (—)	3	2 (66.7)	2	2 (100)	0	0 (—)	0	0 (—)
Transmission category§												
Male-to-male sexual contact	489	282 (57.6)	177	110 (62.0)	185	111 (60.0)	63	33 (52.3)	41	18 (44.2)	22	10 (43.4)
Injection drug use												
Male	33	18 (55.1)	1	1 (75.0)	7	4 (48.0)	13	10 (75.6)	7	2 (31.9)	5	2 (41.3)
Female	19	12 (60.8)	2	2 (79.2)	4	2 (51.3)	4	3 (79.6)	4	3 (61.0)	5	2 (45.1)
Male-to-male sexual contact and injection drug use	14	9 (61.5)	2	1 (29.2)	6	4 (62.7)	4	3 (75.0)	1	0 (—)	1	1 (100)
Heterosexual contact¶												
Male	118	71 (60.5)	9	7 (79.8)	28	15 (54.4)	24	18 (75.0)	24	12 (51.3)	33	19 (56.6)
Female	222	142 (63.8)	34	20 (79.2)	57	30 (52.2)	56	39 (69.2)	40	26 (63.9)	36	28 (77.2)
Total**	**897**	**535 (59.6)**	**225**	**140 (62.2)**	**289**	**167 (57.8)**	**163**	**105 (64.4)**	**117**	**61 (52.1)**	**103**	**62 (60.2)**
Urban												
Gender												
Male	1,399	808 (57.8)	482	275 (57.1)	492	286 (58.1)	192	118 (61.5)	135	73 (54.1)	98	56 (57.1)
Female	502	327 (65.1)	87	56 (64.4)	147	99 (67.3)	130	88 (67.7)	76	46 (60.5)	62	38 (61.3)
Transgender†	19	11 (57.9)	6	4 (66.7)	12	7 (58.3)	1	0 (—)	0	0 (—)	0	0 (—)
Transmission category§												
Male-to-male sexual contact	1,121	662 (59.1)	454	259 (57.2)	421	250 (59.5)	126	82 (65.3)	76	44 (58.0)	45	26 (58.1)
Injection drug use												
Male	45	22 (48.9)	4	2 (45.0)	9	3 (29.3)	12	6 (51.6)	10	7 (67.0)	9	4 (47.3)
Female	36	20 (56.0)	6	4 (73.7)	6	4 (67.9)	10	6 (56.6)	7	3 (47.9)	8	3 (40.8)
Male-to-male sexual contact and injection drug use	28	14 (50.0)	6	4 (56.3)	9	5 (51.1)	5	1 (16.7)	6	4 (67.9)	2	1 (56.3)
Heterosexual contact¶												
Male	221	118 (53.3)	22	12 (55.3)	64	34 (53.6)	50	29 (57.1)	44	19 (42.5)	42	24 (58.2)
Female	464	307 (66.0)	80	52 (64.7)	142	95 (67.4)	120	82 (68.6)	69	43 (61.8)	54	35 (64.1)
Total**	**1,920**	**1,146 (59.7)**	**575**	**335 (58.3)**	**651**	**392 (60.2)**	**323**	**206 (63.8)**	**211**	**119 (56.4)**	**160**	**94 (58.8)**
Metropolitan												
Gender												
Male	8,502	5,301 (62.4)	2,409	1,503 (62.4)	3,328	2,067 (62.1)	1,256	796 (63.4)	857	534 (62.3)	652	401 (61.5)
Female	2,941	2,003 (68.1)	412	267 (64.8)	736	483 (65.6)	692	486 (70.2)	581	410 (70.6)	520	357 (68.7)
Transgender†	242	147 (60.7)	95	56 (58.9)	108	58 (53.7)	32	26 (81.3)	6	3 (50.0)	1	1 (100)
Transmission category§												
Male-to-male sexual contact	6,998	4,420 (63.2)	2,339	1,474 (63.0)	2,941	1,856 (63.1)	921	595 (64.6)	509	315 (62.0)	288	180 (62.3)
Injection drug use												
Male	283	146 (51.5)	20	7 (37.4)	61	28 (45.0)	62	32 (52.1)	62	31 (50.0)	78	47 (60.8)
Female	214	124 (58.0)	18	11 (61.4)	49	23 (47.5)	45	25 (54.9)	45	30 (65.3)	56	35 (62.8)
Male-to-male sexual contact and injection drug use	195	112 (57.4)	37	21 (55.5)	92	53 (57.8)	33	17 (52.1)	20	11 (57.1)	14	10 (72.8)
Heterosexual contact¶												
Male	1,244	756 (60.8)	102	53 (51.7)	333	188 (56.4)	268	174 (64.8)	271	179 (66.1)	270	163 (60.4)
Female	2,722	1,873 (68.8)	386	248 (64.4)	688	459 (66.7)	649	464 (71.4)	535	380 (71.0)	463	322 (69.4)
Total**	**11,685**	**7,451 (63.8)**	**2,916**	**1,826 (62.6)**	**4,172**	**2,611 (62.6)**	**1,980**	**1,308 (66.1)**	**1,444**	**947 (65.6)**	**1,173**	**759 (64.7)**

Abbreviations: CD4 = CD4+ T-lymphocyte count (cells/µL) or percentage; OI = opportunistic infection (i.e., AIDS-defining condition); VL = viral load.

* VL test result of <200 copies/ml indicates HIV viral suppression. VL test results are within 6 months of diagnosis of HIV infection during 2018. Data are based on residence at time of diagnosis. Data not provided for states and associated counties that do not have laws requiring reporting of all CD4 and VLs, or that have incomplete reporting of laboratory data to CDC. Areas without laws: Idaho, New Jersey, and Pennsylvania. Areas with incomplete reporting: Arizona, Arkansas, Connecticut, Kansas, Kentucky, Vermont, and Puerto Rico.

† Transgender includes persons who identified as transgender male-to-female, transgender female-to-male, and additional gender identity. Data not displayed because the numbers were too small to be meaningful. "Transgender male-to-female" includes persons who were assigned "male" sex at birth but have ever identified as "female" gender. "Transgender female-to-male" includes persons who were assigned "female" sex at birth but have ever identified as "male" gender. Additional gender identity examples include "bigender," "gender queer," and "two-spirit."

§ Data have been statistically adjusted to account for missing transmission category; therefore, values might not sum to column subtotals and total. Data presented based on sex at birth and include transgender persons.

¶ Heterosexual contact with a person known to have, or to be at high risk for, HIV infection.

By transmission category, the highest percentages of late-stage diagnoses in all areas were among males with infection attributed to heterosexual contact. The lowest levels of linkage to care within 1 month of diagnosis were among males in rural areas with infection attributed to both male-to-male sexual contact and IDU, and males in urban areas with infection attributed to IDU. Viral suppression within 6 months of diagnosis was least common in all areas among males aged ≥13 years with infection attributed to IDU. Broader implementation of routine HIV testing is needed to identify persons with undiagnosed infections and to initiate early treatment, particularly among older persons. Interventions that support patient retention and re-engagement in HIV care are necessary to improve care outcomes and reduce HIV transmission. Locally tailored strategies among Black persons who inject drugs and sexually active adults at higher risk for HIV infection should be implemented for effective prevention in both urban and rural areas.

The findings in this report are subject to at least three limitations. First, analyses were limited to the 42 jurisdictions with complete laboratory reporting; these jurisdictions might not be representative of all Black persons living with diagnosed HIV infection in the United States. Second, CD4 and viral load test results reported to HIV surveillance programs were used for determining stage of disease and monitoring linkage to care and viral suppression; CD4 and viral load laboratory tests might not have been obtained at all care visits. Not having these tests performed among patients in care or unreported to surveillance systems limits the ability to monitor care outcomes. Finally, comparisons of numbers and percentages by area, sex, age group, and transmission category should be made cautiously because population subgroups vary in size and some have small numbers. Reported numbers ≤12 and their accompanying percentages are not discussed.

Early HIV diagnosis and treatment among Black persons with HIV infection are necessary to reduce disparities and achieve national prevention goals. For equitable health to be achieved for Black persons in all geographic areas, culturally appropriate and stigma-free sexual health care is needed, particularly among those who live in rural communities. Although 80% of Black persons with diagnosed HIV live in metropolitan areas, identifying geographic disparities is important to ensure HIV-related health equity. Disparities in care outcomes should be addressed and interventions prioritized that address social determinants of health.[††]

[††] https://www.cdc.gov/socialdeterminants/docs/sdh-white-paper-2010.pdf

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Summary

What is already known about this topic?

Disparities in HIV care outcomes exist for Black persons with diagnosed human immunodeficiency virus (HIV) infection, and access to care and treatment services varies by residence area.

What is added by this report?

During 2018, rural Black persons received a higher percentage of late-stage HIV diagnosis (25.2%) than did those in urban (21.9%) and metropolitan areas (19.0%). Linkage to care within 1 month of diagnosis was similar across geographic areas; however, viral suppression within 6 months of diagnosis was highest in metropolitan areas (63.8%).

What are the implications for public health practice?

Early diagnosis and prompt treatment of Black persons with HIV infection, especially in rural areas, are necessary to reduce disparities in HIV care outcomes.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Mortality Among Minority Populations with Systemic Lupus Erythematosus, Including Asian and Hispanic/Latino Persons — California, 2007–2017

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Systemic lupus erythematosus (SLE) is a multisystem autoimmune disease with manifestations that vary widely in severity. Although minority populations are at higher risk for SLE and have more severe outcomes (*1*), population-based estimates of mortality by race and ethnicity are often lacking, particularly for Asian and Hispanic/Latino persons. Among 812 patients in the California Lupus Surveillance Project (CLSP) during 2007–2009 (*2*,*3*), who were matched to the 2007–2017 National Death Index (NDI), 16.6% had died by 2017. This proportion included persons of White (14.4%), Black (25%), Asian (15.3%), and Hispanic/Latino (15.5%) race/ethnicity. Standardized mortality ratios (SMRs) of observed-to-expected deaths among persons with SLE within each racial/ethnic group were 2.3, 2.0, 3.8, and 3.9, respectively. These findings provide the first population-based estimates of mortality among Asian and Hispanic/Latino persons with SLE. Coordination of robust care models between primary care providers and rheumatologists could ensure that persons with SLE receive a timely diagnosis and appropriate treatments that might help address SLE-associated mortality.

CLSP included residents of San Francisco County, California, during January 1, 2007–December 31, 2009. Potential patients were identified using community rheumatology and nephrology clinics, community hospitals, and integrated health care systems (*2*,*3*). Clinical information was ascertained through review of medical records.* The State of California Institutional Review Board granted a waiver for this public health surveillance activity, and the project was reviewed and approved by the University of California, San Francisco, Institutional Review Board. This activity was also reviewed by CDC and conducted consistent with applicable federal law and CDC policy.† Patients were not contacted for this linkage study.

Patients with SLE were defined using either the American College of Rheumatology (ACR) classification criteria (at least four of the 11 revised criteria as defined in 1982 and updated in 1997) (*4*,*5*) or two alternative definitions: SLE diagnosed by the patient's treating rheumatologist plus three ACR criteria or lupus-related kidney disease (World Health Organization class II–VI lupus nephritis upon biopsy or documented record of SLE diagnosis and dialysis or renal transplantation). SLE patients in CLSP were submitted to the 2007–2017 NDI to search for potential matches (general sensitivity of 81.2%–97.9% and specificity of approximately 100%) (*6*). Matching required at least one of the following data items or combinations: first and last name and social security number, first and last name and month and year of birth, social security number, or full date of birth and sex. If none of these combinations was available, the case had insufficient information for submission to NDI and was excluded from analyses. Among the 909 patients with SLE in CLSP, 812 (89%) had sufficient information to be able to be linked with the 2007–2017 NDI. Patients were considered a match based on provided information including social security number.§ Multivariable-adjusted risk ratios examining factors associated with mortality were estimated using a Poisson regression model adjusting for age group, sex, race, Hispanic/Latino ethnicity, and number of years since diagnosis. Population estimates by age group, sex, race, and Hispanic/Latino ethnicity for San Francisco County during 2007–2017 were obtained from CDC Wonder¶ and were used to calculate SMRs using indirect age standardization in 11 age groups, as the ratio of observed deaths among persons with SLE to expected deaths in the San Francisco County population. Expected deaths were calculated by multiplying the overall age-specific death rate of the general population in San Francisco County by the total number of SLE patients in each age group; age-specific death rates of the general population by sex, race, and ethnicity were also calculated. Two-sided hypothesis tests were conducted controlling for the type I error rate at 5% ($\alpha = 0.05$) and estimated 95% confidence intervals. Stata (version 16.0; StataCorp) was used to conduct all analyses.

* Potential patients were identified using the following *International Classification of Diseases, Ninth Revision*, *Clinical Modification* diagnostic codes: 710.0 (SLE), 695.4 (discoid lupus), 710.8 (other specified connective tissue disease), and 710.9 (unspecified connective tissue disease). Secondary sources of possible patients included a commercial laboratory, which was queried for a comprehensive panel of SLE-related serologic tests and the California Office of Statewide Health Planning and Development hospital discharge database (https://doi.org/10.1002/art.40191).

† 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.

§ Except for one case in which the social security number was not included in the NDI record but was considered a match through first and last name, month and year of birth, and state where death took place.

¶ https://wonder.cdc.gov

Among the 812 SLE patients analyzed, 731 (90%) were female; race/ethnicities included White (38%), Black (20%), Asian (36%), and Hispanic/Latino (17%), and 5% of persons were of mixed/other race. A total of 135 (16.6%) deaths were identified. Mean age at diagnosis among all SLE patients was 34.9 years (range = 19.0–50.8 years), and mean age at death was 62.0 years (range = 46.2–77.8 years). Mortality increased with age. The highest percentage of deaths (25%) occurred among Black SLE patients; this group had a significantly increased risk for mortality after adjusting for age group, sex, ethnicity, and disease duration (Table 1). On average, Black persons died 6.8 years earlier than did White persons (p = 0.05); persons of Hispanic/Latino ethnicity died 9.5 years earlier than did persons who were not of Hispanic/Latino ethnicity (p = 0.02).

Overall, SMRs were three times higher among SLE patients than among those in the general population of San Francisco County (Table 2). Compared with SMRs among their non-SLE counterparts, SMRs among patients with SLE were four times higher in females and among persons of Asian and Hispanic/Latino race/ethnicity, three times higher among males, and two times higher among White and Black persons. Among females, SMRs were especially high among Asian (4.1) and Hispanic/Latina (5.8) patients.

Discussion

Mortality was almost four times higher than expected among Asian and Hispanic/Latino persons with SLE and was especially high among Hispanic/Latina females. Consistent with other SLE cohorts, Black persons with SLE had higher mortality than did White persons (*7*,*8*). However, this analysis did not find an association between lower mortality and either Asian race or Hispanic/Latino ethnicity, as has been previously reported in the Medicaid population (*7*). Socioeconomic position might interact with race among Medicaid recipients, and there might be potential differences in the non-SLE comparator populations that were included in the other studies. Results of this study are consistent with findings from studies that demonstrated higher mortality among persons with SLE than that in the general population (*1*,*9*); one recent report found a threefold higher SMR among persons with SLE, using a similar study design

TABLE 1. Factors associated with mortality among patients with systemic lupus erythematosus (SLE) — California Lupus Surveillance Project,* 2007–2017

Characteristic	Deaths/No. of SLE patients	% Mortality	Multivariable-adjusted risk ratio† (95% CI)
Overall	**135/812**	**16.6**	**NA**
Sex			
Female	119/731	16.3	1.0 (0.6–1.6)
Male	16/81	19.8	Reference
Age group (yrs)			
10–34	11/204	5.4	Reference
35–44	15/175	8.6	1.5 (0.7–3.1)
45–54	26/185	14.1	2.1 (1.1–4.2)
55–64	33/153	21.6	3.3 (1.8–6.3)
65–74	35/70	50.0	7.4 (4.0–14.0)
≥75	15/25	60.0	9.3 (4.8–18.0)
Race			
White	45/312	14.4	Reference
Black	41/164	25.0	1.5 (1.1–2.3)
Asian	45/295	15.3	1.2 (0.8–1.7)
Other	2/22	9.1	1.3 (0.3–5.9)
Ethnicity§			
Non-Hispanic/Latino	112/604	18.5	Reference
Hispanic/Latino	19/123	15.5	1.1 (0.7–1.8)

Abbreviations: CI = confidence interval; NA = not available.

* Population estimates by age group, sex, race, and ethnicity for San Francisco County during 2007–2017 were obtained from CDC Wonder (https://wonder.cdc.gov). Data are from the Multiple Cause of Death Files, 1999–2019 accessed March 21, 2020, (https://wonder.cdc.gov/mcd.html).

† Risk ratios estimated using a multivariable Poisson model that modeled sex, age group, race (White, Black, Asian, other), ethnicity (non-Hispanic/Latino or Hispanic/Latino) simultaneously, adjusting for years since diagnosis. A total of 104 patients were excluded from the multivariable model: 19 (including two deaths) were missing race information, and 85 (including four deaths) were missing Hispanic/Latino ethnicity status.

§ Hispanic/Latino ethnicity is considered a distinct concept from race; therefore, it was collected and reported separately from race.

TABLE 2. Age-standardized mortality ratios (SMRs)* for persons with systemic lupus erythematosus (SLE),† overall and by sex, race,§ and Hispanic/Latino ethnicity¶ — California Lupus Surveillance Project, 2007–2017

Characteristic	No. of SLE patients	No. of observed deaths	No. of expected deaths	SMR (95% CI)
Overall	**812**	**135**	**45.7**	**3.0 (2.5–3.5)**
Sex				
Female	731	119	31.6	3.8 (3.1–4.5)
Male	81	16	5.6	2.9 (1.7–4.7)
Race				
White	312	45	20.0	2.3 (1.6–3.0)
Black	164	41	20.8	2.0 (1.4–2.7)
Asian	295	45	12.0	3.8 (2.7–5.0)
Ethnicity (females and males)				
Hispanic/Latino	123	19	4.9	3.9 (2.4–6.1)
Race/Ethnicity (females)**				
White	283	40	13.8	2.9 (2.1–3.9)
Black	146	37	14.8	2.5 (1.8–3.4)
Asian	264	37	9.0	4.1 (2.9–5.7)
Hispanic/Latina	110	18	3.1	5.8 (3.5–9.2)

Abbreviation: CI = confidence interval.

* SMR is a ratio between the observed number of deaths in those with SLE and the number of deaths expected, based on age groups defined in CDC Wonder (https://wonder.cdc.gov). Sex, race, and Hispanic/Latino ethnicity specific rates in San Francisco County were used, depending on the particular characteristic examined. CIs are calculated for each estimated SMR by assuming a Poisson distribution.

† Age in 2008 was used for adjustment.

§ Forty-one patients were excluded from race-specific analyses, including four who died: 22 had missing race information and 19 identified as a race other than White, Black or Asian, for which estimates are not available through CDC Wonder.

¶ Eighty-five patient records missing Hispanic/Latino ethnicity status, including four deaths, were excluded from ethnicity-specific estimates.

** For female-specific race and ethnicity analyses, crude rates for age group <15 years were not provided by CDC Wonder or were unreliable and therefore not included in calculations; there was insufficient sample size to generate specific race/ethnic estimates for men.

and methods, though limited to Black and White persons (*8*). There are important gaps in knowledge about SLE among Asian and Hispanic/Latino populations; reasons for these knowledge gaps include smaller sample sizes in observational studies and lower likelihood of Asian and Hispanic/Latino persons being represented in insurance claim data sets (*10*). CLSP provides a unique opportunity to examine SLE incidence, prevalence, and outcomes in these groups because of the relative higher proportion of racial and ethnic populations (Hispanic/Latino, Asian, and Black) among the total population within the area and a comprehensive case finding approach. Mortality for these groups was especially high: Asian females with SLE were four times more likely to die than were Asian females without SLE in the general San Francisco County population, and Hispanic/Latina females with SLE were six times more likely to die than were persons in the corresponding general populations. Higher mortality within these populations might be the result of more severe outcomes and manifestations of SLE, as previously demonstrated (*3*), or possibly less access to care.

The findings in this report are subject to at least five limitations. First, SLE patients might not have been included in the initial CLSP surveillance study unless seen by a specialist. However, this is unlikely given the treatment needs of persons with SLE; further, capture/recapture methods from the initial CLSP study suggested that only two patients were missed (*2*). Second, deaths might not have been identified among the 97 patients with insufficient information to match with NDI. Third, race and ethnicity were determined from the medical record and could be misclassified. Fourth, the number of incident cases (117) and corresponding deaths (23) was small and therefore results could not be provided for incident versus prevalent cases. Finally, results might not be generalizable outside of San Francisco County. The strengths of this study include the use of a comprehensive, population-based surveillance study of well-defined SLE patients, the relatively large numbers of Asian and Hispanic/Latino persons, and the long period for observing mortality.

Mortality among persons with SLE is high among all racial and ethnic groups but is especially pronounced in Asian and Hispanic/Latino populations. CDC,[**] the Lupus Foundation of America,[††] and ACR[§§] are conducting high-impact research investigations to advance the understanding of racial, ethnic, and socioeconomic disparities among persons with SLE, and to develop SLE-specific interventions, such as coordination of robust care models between primary care providers and rheumatologists to ensure that persons with SLE receive a timely diagnosis and appropriate treatments that might help address SLE-associated mortality.

** https://www.cdc.gov/lupus/
†† https://www.lupus.org/
§§ https://www.rheumatology.org/

Summary

What is already known about this topic?

Systemic lupus erythematosus (SLE) is an autoimmune disease that disproportionately affects minority populations. Estimates of SLE mortality by race and ethnicity are lacking, particularly for Asian and Hispanic/Latino persons.

What is added by this report?

In a population-based study of SLE patients in San Francisco County during 2007–2017, mortality among Asian persons with SLE was four times higher, and among Hispanic/Latina females with SLE mortality was six times higher, than that of their counterparts in the general population.

What are the implications for public health practice?

Coordination of robust care models between primary care providers and rheumatologists could ensure persons with SLE receive a timely diagnosis and appropriate treatments that might help address SLE-associated mortality.

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Trends in Use of Telehealth Among Health Centers During the COVID-19 Pandemic — United States, June 26–November 6, 2020

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Telehealth can facilitate access to care, reduce risk for transmission of SARS-CoV-2 (the virus that causes coronavirus disease 2019 [COVID-19]), conserve scarce medical supplies, and reduce strain on health care capacity and facilities while supporting continuity of care. Health Resources and Services Administration (HRSA)–funded health centers* expanded telehealth† services during the COVID-19 pandemic (*1*). The Centers for Medicare & Medicaid Services eliminated geographic restrictions and enhanced reimbursement so that telehealth services–enabled health centers could expand telehealth services and continue providing care during the pandemic (*2*,*3*). CDC and HRSA analyzed data from 245 health centers that completed a voluntary weekly HRSA Health Center COVID-19 Survey§ for 20 consecutive weeks to describe trends in telehealth use. During the weeks ending June 26–November 6, 2020, the overall percentage of weekly health care visits conducted via telehealth (telehealth visits) decreased by 25%, from 35.8% during the week ending June 26 to 26.9% for the week ending November 6, averaging 30.2% over the study period. Weekly telehealth visits declined when COVID-19 cases were decreasing and plateaued as cases were increasing. Health centers in the South and in rural areas consistently reported the lowest average percentage of weekly telehealth visits over the 20 weeks, compared with health centers in other regions and urban areas. As the COVID-19 pandemic continues, maintaining and expanding telehealth services will be critical to ensuring access to care while limiting exposure to SARS-CoV-2.

In April 2020, HRSA began administering a voluntary weekly Health Center COVID-19 Survey to track the effect of COVID-19 on health centers' testing capacity, operations, patients, and staff members. Potential respondents were 1,382 HRSA-funded health centers. CDC and HRSA analyzed data from 245 health centers that responded to the Health Center COVID-19 Survey for 20 consecutive weeks (weeks ending June 26–November 6, 2020) to examine trends in telehealth use, assess differences by U.S. Census region¶ and urbanicity,** and compare telehealth patterns with the 7-day average number of new known COVID-19 cases within the counties where the included health centers were located. Region and urbanicity have previously been shown to be strongly associated with telehealth use (*1*). Each health center recorded the percentage of weekly telehealth visits in intervals of five (range = 0–100). Compared with health centers that responded at least once to the Health Center COVID-19 Survey over the study period (range = 912–1,011), consecutively responding health centers were more often located in more urban geographic areas (62.9% versus 58.5%) and in the Northeast (20.4% versus 16.7%) and West (29.4% versus 27.1%) regions than were those that did not report consecutively.

The average percentage of weekly telehealth visits was calculated nationally by region, and by urbanicity. Overall and weekly changes in telehealth visits (absolute percentage point difference and percentage change) for the first 10 weeks (weeks ending June 26–August 28, 2020) and the second 10 weeks (weeks ending September 4–November 6, 2020) were calculated. Weekly changes were calculated as the average of week-to-week differences in weekly telehealth visits for the first and second 10 weeks of the study period. The Kruskal-Wallis test was used to measure differences in the overall average percentage of weekly telehealth visits by region and urbanicity. Post hoc tests for pairwise comparisons were conducted if the Kruskal-Wallis test identified a significant main effect. P-values <0.05 were considered statistically significant. The 7-day average number of new known COVID-19 cases from 210 counties where the

* Data from HRSA-funded health centers (i.e., Federally Qualified Health Centers) are included for the analysis presented.

† Telehealth consists of the use of electronic information and telecommunication technologies to support clinical health care, patient and professional health-related education, public health, and health administration. https://www.hrsa.gov/rural-health/telehealth

§ https://bphc.hrsa.gov/emergency-response/coronavirus-health-center-data/

¶ *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; *U.S. territories*: American Samoa, Puerto Rico, and U.S. Virgin Islands; *Freely associated states*: Federated States of Micronesia, Marshall Islands, and Palau. https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-regions-and-divisions-of-the-united-states.html

** Urban/rural classification is based on the Federal Office of Rural Health Policy criteria. https://www.hrsa.gov/rural-health/about-us/definition/index.html

245 health centers were located was accessed from USAFacts[††] and calculated for each week of the survey and compared with the average percentage of weekly telehealth visits nationally by region and urbanicity. SPSS Statistics software (version 20; IBM) was used to conduct all analyses. These activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.[§§]

The overall average percentage of weekly telehealth visits among 245 consecutively responding health centers decreased 25%, from 35.8% during the week ending June 26, to 26.9% for the week ending November 6, averaging 30.2% over the study period (Table). Health centers in the South census regions and rural areas reported the lowest average percentage of weekly telehealth visits compared with health centers in other census regions and urban areas. During the first 10 weeks of study (June 26–August 28), health centers in the Northeast reported the largest absolute change in average percentage of weekly telehealth visits (–13.3%) followed by health centers in the Midwest (–7.3%). Urban health centers reported a larger absolute change in percentage of weekly telehealth visits for both the first 10 weeks (–7.6%) and the second 10 weeks of study (–3.0) compared with the change in rural health centers (–2.6% and –1.1%, respectively). Health centers in the Northeast reported stable weekly telehealth visits, with an absolute change of 0.1% over the second 10 weeks of study (September 4–November 6). Within each region and urbanicity stratum, the overall change in average percentage of telehealth visits differed significantly between the first 10 weeks and the last 10 weeks of the study period.

The overall average percentage of weekly telehealth visits differed significantly among some regions. Pairwise comparisons found that the overall average percentage in the South was significantly lower than that in the Northeast (p<0.01) and the West (p<0.01). The percentages of telehealth visits in the Northeast and the West did not differ significantly (p = 0.793). Urban health centers reported a significantly higher overall average percentage of telehealth visits than did rural health centers (p<0.01). The number of COVID-19 cases varied by region and increased overall during the second half of the study period (Figure 1). The increase in COVID-19 cases in the Northeast in the second 10 weeks of the study period aligned with the plateauing and slightly increasing trend in average percentage of weekly telehealth visits. The number of COVID-19 cases in the counties where urban health centers were located peaked in the week ending July 4 in the first 10 weeks and consistently increased in the second 10 weeks (Figure 2). However, the average percentage of weekly telehealth visits continued to trend downward.

†† Daily COVID-19 case counts were obtained from USAFacts. https://usafacts.org/articles/detailed-methodology-covid-19-data/

§§ 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. Percentage of weekly telehealth visits* among consecutively responding Health Resources and Services Administration (HRSA)–funded health centers† (N = 245), by U.S. Census region§ and urbanicity — Health Center COVID-19 Survey, United States, June 26–November 6, 2020

Regions	Total no. of health centers (%)	Weekly telehealth visits, week ending, no. (%)				Change in average percentage of weekly telehealth visits, absolute difference¶ (%)			
		Overall**	Jun 26	Aug 28	Nov 6	Overall,** Jun 26–Aug 28	Weekly,†† Jun 26–Aug 28	Overall,** Sept 4–Nov 6	Weekly,†† Sept 4–Nov 6
U.S. Census region									
Northeast	**50.0 (20.4)**	37.7 (0–100)§§	48.3 (0–95)	35.0 (0–80)	35.1 (0–95)	−13.3 (−27.5)	−1.5 (−3.5)	0.1 (0.3)	0.01 (0.2)
Midwest	**41.0 (16.7)**	28.4 (0–90)	36.0 (0–90)	28.7 (0–80)	24.5 (0–80)	−7.3 (−20.3)	−0.8 (−2.4)	−3.3 (−11.8)	−0.4 (−1.5)
South	**77.0 (31.4)**	20.4 (0–95)§§	22.7 (0–95)	21.6 (0–90)	17.8 (0–90)	−1.1 (−4.9)	−0.1 (−0.5)	−2.7 (−13.0)	−0.4 (−1.9)
West	**72.0 (29.4)**	36.3 (0–100)§§	41.0 (0–90)	36.3 (0–85)	32.3 (0–85)	−4.7 (−11.5)	−0.5 (−1.3)	−3.0 (−8.5)	−0.4 (−1.0)
Puerto Rico¶¶	**5.0 (2.0)**	31.3 (0–80)	35.0 (5–65)	32.0 (15–65)	28.0 (5–70)	−3.0 (−8.6)	−0.3 (0.8)	−1.0 (−3.4)	−0.4 (−0.5)
Urbanicity									
Urban	**154.0 (62.9)**	35.2 (0–100)§§	42.0 (0–95)	34.4 (0–90)	30.9 (0–95)	−7.6 (−18.1)	−0.8 (−2.2)	−3.0 (−8.7)	−0.4 (−1.0)
Rural	**91.0 (37.1)**	21.7 (0–95)	25.2 (0–90)	22.6 (0–90)	20.1 (0–90)	−2.6 (−10.2)	−0.3 (−1.1)	−1.1 (−5.2)	−0.3 (−1.1)
Total	**245.0 (100)**	**30.2 (0–100)§§**	**35.8 (0–95)**	**30.1 (0–90)**	**26.9 (0–95)**	**−5.7 (−16.0)**	**−0.6 (−1.9)**	**−2.3 (−7.8)**	**−0.3 (−1.1)**

Abbreviation: COVID-19 = coronavirus disease 2019.

* Percentage of weekly visits conducted virtually.

† Health centers include HRSA-funded Federally Qualified Health Centers, which fall under the Consolidated Health Center Program (Section 1905(l)(2)(B) of the Social Security Act). Only data from HRSA-funded Federally Qualified Health Centers are included in this analysis.

§ *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

¶ Change calculated as absolute difference in percentage points.

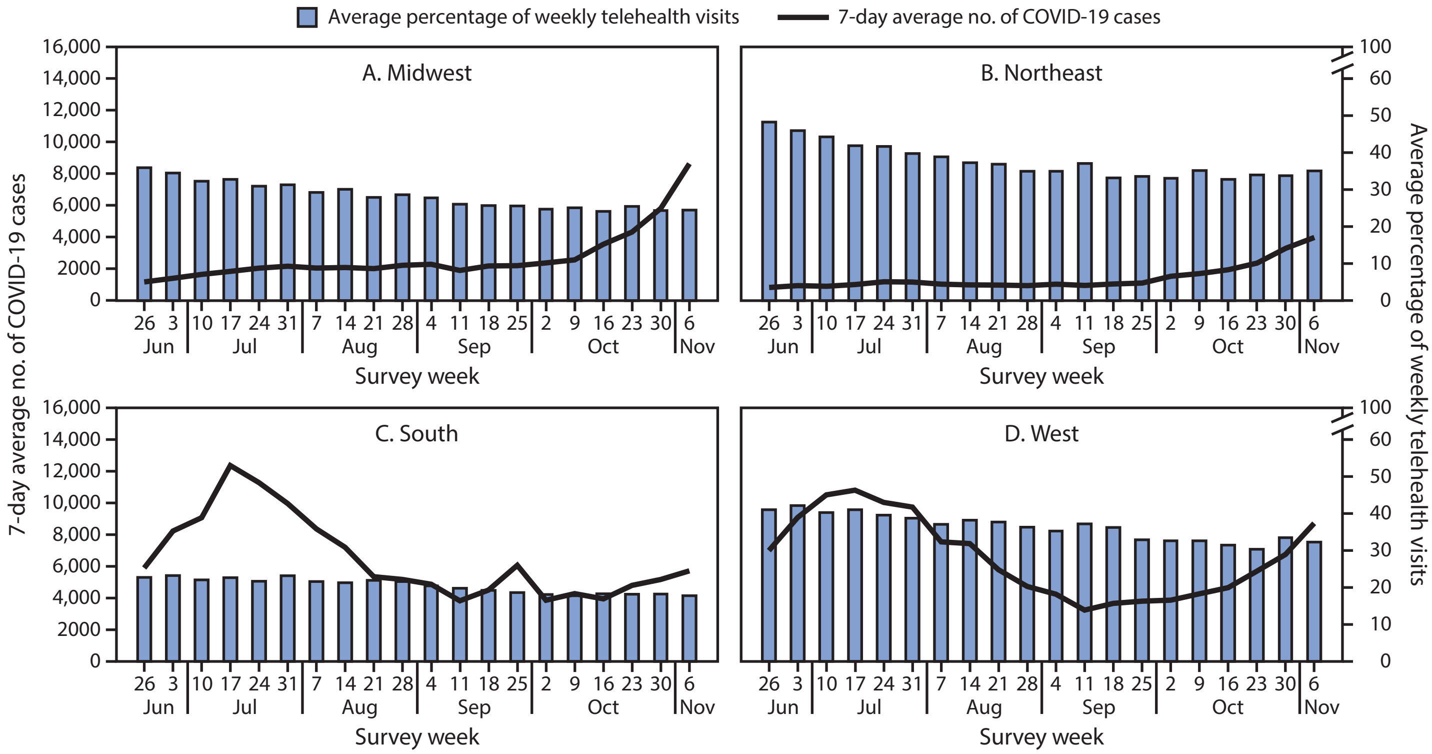
** Results are based on data for the entire study period (weeks ending June 26–November 6, 2020).

†† Average of week-to-week differences in the average percentage of weekly visits conducted by telehealth, for the study period (weeks ending June 26–November 6, 2020).

§§ Kruskal-Wallis Test shows significant differences in the overall average percentage of telehealth visits by U.S. Census regions (p<0.01). Health centers in the South had lower overall average percentages of telehealth visits compared with those in the Northeast (p<0.01) and the West (p<0.01). Urban health centers had higher overall average percentages of telehealth visits than did rural health centers (p<0.01).

¶¶ Consecutively responding health centers in dependent areas for the study period included only those in Puerto Rico.

FIGURE 1. Average percentage of weekly telehealth visits* among consecutively responding† Health Resources and Services Administration (HRSA)–funded health centers§ (N = 245) and 7-day average number of incident COVID-19 cases,¶ by U.S. Census region — United States, June 26–November 6, 2020**



Abbreviation: COVID-19 = coronavirus disease 2019.

* Percentage of weekly visits conducted virtually.

† Health centers that responded to the voluntary weekly HRSA Health Center COVID-19 Survey each week for 20 weeks.

§ Health centers include HRSA-funded Federally Qualified Health Centers, which fall under the Consolidated Health Center Program (Section 1905(l)(2)(B) of the Social Security Act). Only data from HRSA-funded Federally Qualified Health Centers are included in this analysis.

¶ Seven-day average number of incident COVID-19 cases was calculated for each week of the study period for the 210 counties where 245 consecutively responding health centers are located.

** Dependent areas are not included because of the low number (five) reporting from this region.

Discussion

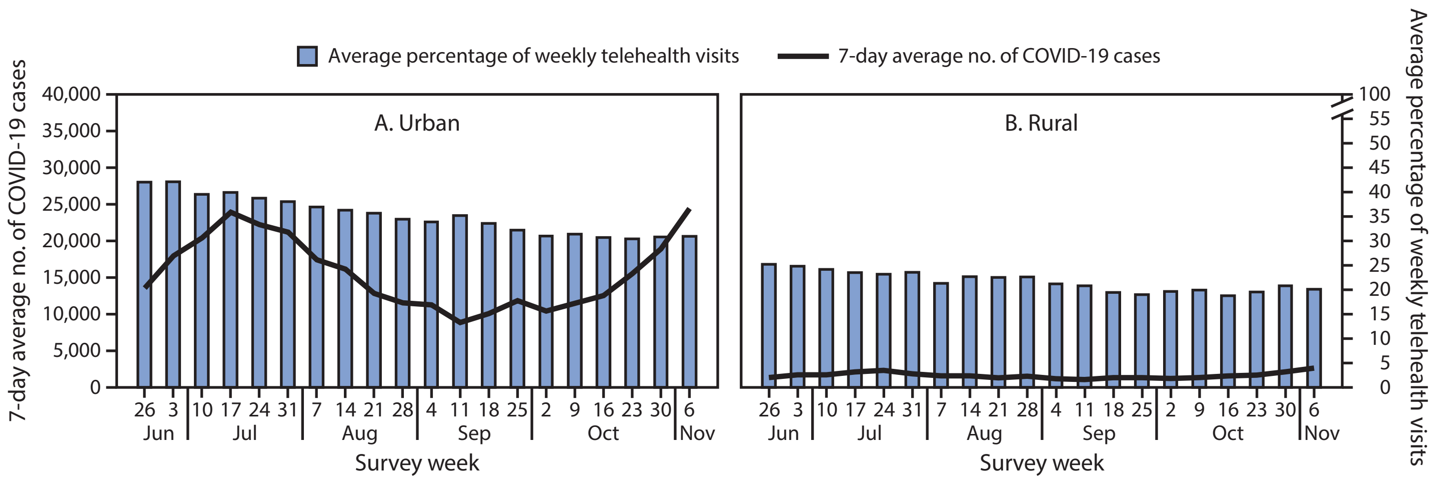
Health centers have expanded telehealth visits considerably; nearly one third of health visits were conducted using telehealth during the study period. According to 2019 Health Center Program Data,¶¶ 43% of health centers were capable of providing telemedicine, compared with 95% of the health centers that reported using telehealth during the COVID-19 pandemic (*1*). The largest increase in use of telehealth was reported in April 2020 (*4*,*5*). Following the release of Guidelines for Opening Up America Again*** on April 16, health care facilities resumed in-person visits. As COVID-19 cases declined from April to June, in-person care increased, and telehealth visits decreased (*4*,*5*). During June through late July, telehealth visits continued to decline, but at a slower rate in the South, where the number of COVID-19 cases sharply increased. Weekly telehealth visits plateaued beginning in mid-September, concomitant with another national surge of COVID-19 cases. Although in-person visits are needed to provide timely routine care and for urgent and emergency situations, maintaining telehealth capacity is critical during the COVID-19 pandemic. Telehealth visits can facilitate patient triage, which can reduce the effect of patient surge on facilities, address limitations to health care access, conserve personal protective equipment, and reduce disease transmission (*6*).

Health centers in the South and in rural areas have disproportionately experienced challenges and barriers, including the logistics of implementing telehealth, lack of partners or providers, and limited broadband access (*7*). State policies to provide financial assistance for telehealth infrastructure and technical guidance to providers facilitate telehealth implementation in underserved areas (*8*). Policy and practice changes under the COVID-19 Public Health Emergency proclamation (*2*) have enabled health centers to augment telehealth through the

¶¶ https://data.hrsa.gov/tools/data-reporting/program-data/national/table?tableName=ODE&year=2019

*** https://assets.documentcloud.org/documents/6840714/Guidelines.pdf

FIGURE 2. Average percentage of weekly telehealth visits* among consecutively responding† Health Resources and Services Administration (HRSA)–funded health centers§ (N = 245) and 7-day average number of incident COVID-19 cases,¶ by urbanicity — United States, June 26–November 6, 2020**



Abbreviation: COVID-19 = coronavirus disease 2019.
* Percentage of weekly visits conducted virtually.
† Health centers that responded to the voluntary weekly HRSA Health Center COVID-19 Survey each week for 20 weeks.
§ Health centers include HRSA-funded Federally Qualified Health Centers, which fall under the Consolidated Health Center Program (Section 1905(l)(2)(B) of the Social Security Act). Only data from HRSA-funded Federally Qualified Health Centers are included in this analysis.
¶ Seven-day average number of COVID-19 cases was calculated for each week of the study period for the 210 counties where 245 consecutively responding health centers are located.
** Data presented do not include health centers in U.S. dependent areas because daily COVID-19 county-level case data were not available from USAFacts (https://usafacts.org/).

issuance of federal guidance and the subsequent support of federal resources. However, these additional resources might have a limited effect on barriers affecting patients, who need reliable broadband and communication devices capable of supporting telehealth as well as support on how to effectively use technology for telehealth visits (*7*,*9*). Programs that provide access to compatible devices and incorporate technical assistance to patients for virtual care to ensure productive encounters can reduce barriers to receipt of quality telehealth services. Assessment of disparities in access to and use of telehealth across population subgroups will be important in the future.

The findings in this report are subject to at least three limitations. First, the analysis was limited to health centers that consecutively reported data to HRSA during the study period and might not be representative of all health centers. Second, the analysis was limited to unweighted averages of percentages of weekly telehealth visits because numbers of telehealth visits are not recorded in the Health Center COVID-19 Survey. Finally, the number of COVID-19 cases in counties where health centers are located might not fully reflect the effect of the COVID-19 community transmission on the health center's provision of telehealth visits.

Although resumption of in-person health care visits is anticipated, ongoing community transmission of SARS-CoV-2 might delay the transition to prepandemic levels of in-person care. Telehealth is critical to improving access to health care, especially among populations with limited access to care, and to enhancing the U.S. health care system's capacity to continue to respond to the pandemic. HRSA-funded health centers have played a critical role as primary care providers by providing testing, treatment, and preventive care, including vaccination (*10*). As the COVID-19 pandemic continues, provision and expansion of health services using telehealth is critical to maintaining access to care while limiting exposure to SARS-CoV-2. Sustaining expanded use of telehealth visits in health centers

Summary

What is already known about this topic?

Telehealth can facilitate access to care, reduce risk for transmission of SARS-CoV-2, conserve scarce medical supplies, and reduce strain on health care capacity and facilities while supporting continuity of care.

What is added by this report?

During June 26–November 6, 2020, 30.2% of weekly health center visits occurred via telehealth. Telehealth visits declined as the number of new COVID-19 cases decreased but plateaued as the number of cases increased. Health centers in the South and rural areas consistently reported the lowest average percentage of weekly telehealth visits.

What are the implications for public health practice?

As the COVID-19 pandemic continues, maintaining the expansion of telehealth remains critical to providing access to care.

during and after the pandemic might require continuation of existing flexibilities provided under Centers for Medicare & Medicaid Services telehealth reimbursement policies (*2*,*3*) and local level considerations of additional support and resources.

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Decline in Receipt of Vaccines by Medicare Beneficiaries During the COVID-19 Pandemic — United States, 2020

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On March 13, 2020, the United States declared a national emergency concerning the novel coronavirus disease 2019 (COVID-19) outbreak (*1*). In response, many state and local governments issued shelter-in-place or stay-at-home orders, restricting nonessential activities outside residents' homes (*2*). CDC initially issued guidance recommending postponing routine adult vaccinations, which was later revised to recommend continuing to administer routine adult vaccines (*3*). In addition, factors such as disrupted operations of health care facilities and safety concerns regarding exposure to SARS-CoV-2, the virus that causes COVID-19, resulted in delay or avoidance of routine medical care (*4*), likely further affecting delivery of routine adult vaccinations. Medicare enrollment and claims data of Parts A (hospital insurance), B (medical insurance), and D (prescription drug insurance) were examined to assess the change in receipt of routine adult vaccines during the pandemic. Weekly receipt of four vaccines (13-valent pneumococcal conjugate vaccine [PCV13], 23-valent pneumococcal polysaccharide vaccine [PPSV23], tetanus-diphtheria or tetanus-diphtheria-acellular pertussis vaccine [Td/Tdap], and recombinant zoster vaccine [RZV]) by Medicare beneficiaries aged ≥65 years during January 5–July 18, 2020, was compared with that during January 6–July 20, 2019, for the total study sample and by race and ethnicity. Overall, weekly administration rates of the four examined vaccines declined by up to 89% after the national emergency declaration in mid-March (*1*) compared with those during the corresponding period in 2019. During the first week following the national emergency declaration, the weekly vaccination rates were 25%–62% lower than those during the corresponding week in 2019. After reaching their nadirs of 70%–89% below 2019 rates in the second to third week of April 2020, weekly vaccination rates gradually began to recover through mid-July, but by the last study week were still lower than were those during the corresponding period in 2019, with the exception of PPSV23. Vaccination declined sharply for all vaccines studied, overall and across all racial and ethnic groups. While the pandemic continues, vaccination providers should emphasize to patients the importance of continuing to receive routine vaccinations and provide reassurance by explaining the procedures in place to ensure patient safety (*3*).

Medicare enrollment and insurance claims data for beneficiaries enrolled in a fee-for-service plan during weeks 2–29 of 2019 (January 6–July 20) and 2020 (January 5–July 18) were obtained from the Centers for Medicare & Medicaid Services Chronic Conditions Warehouse (*5*). PCV13 and PPSV23 were covered by Part B, which pays for services from health care providers, outpatient care, and some preventive services. Td/Tdap was covered by Part B if it was administered as part of medically necessary service because of an injury and was covered by Part D, which covers a range of prescription drugs, if it was administered as part of preventive care. RZV was covered by Part D. Weekly claims for vaccination were identified by procedure code or national drug code on claims with a service date within the week examined (measured Sunday through Saturday).* Because some of the weeks spanned 2 different months, the denominator populations for PCV13 and PPSV23 vaccination in each week were defined as Medicare beneficiaries who were continuously enrolled in Parts A and B in the claim month and the previous month, and were aged ≥65 years on the first day of that previous month. The denominator population for Td/Tdap and RZV were defined similarly, except that beneficiaries were continuously enrolled in Parts A, B, and D. Weekly rates of receipt of the examined vaccines were calculated as the percentage of the denominator population that received ≥1 dose of the corresponding vaccine during that week.† The percentage change in vaccination rate in a week was calculated as the ratio of the rate in that week in 2020 to the rate in the corresponding week in 2019, minus 1. Descriptive statistical analyses were conducted for the total study sample and stratified by race and ethnicity (non-Hispanic White [White], non-Hispanic Black [Black], Hispanic or Latino (Hispanic), non-Hispanic Asian/Asian American/Pacific Islander [Asian], non-Hispanic other [Other]).§ All statistical analyses were conducted during September 12–15, 2020, using SAS (version 9.4; SAS Institute). This activity was reviewed

* Procedure codes alone for PCV13 and PPSV23 and procedure codes plus national drug codes for Td/Tdap and RZV.

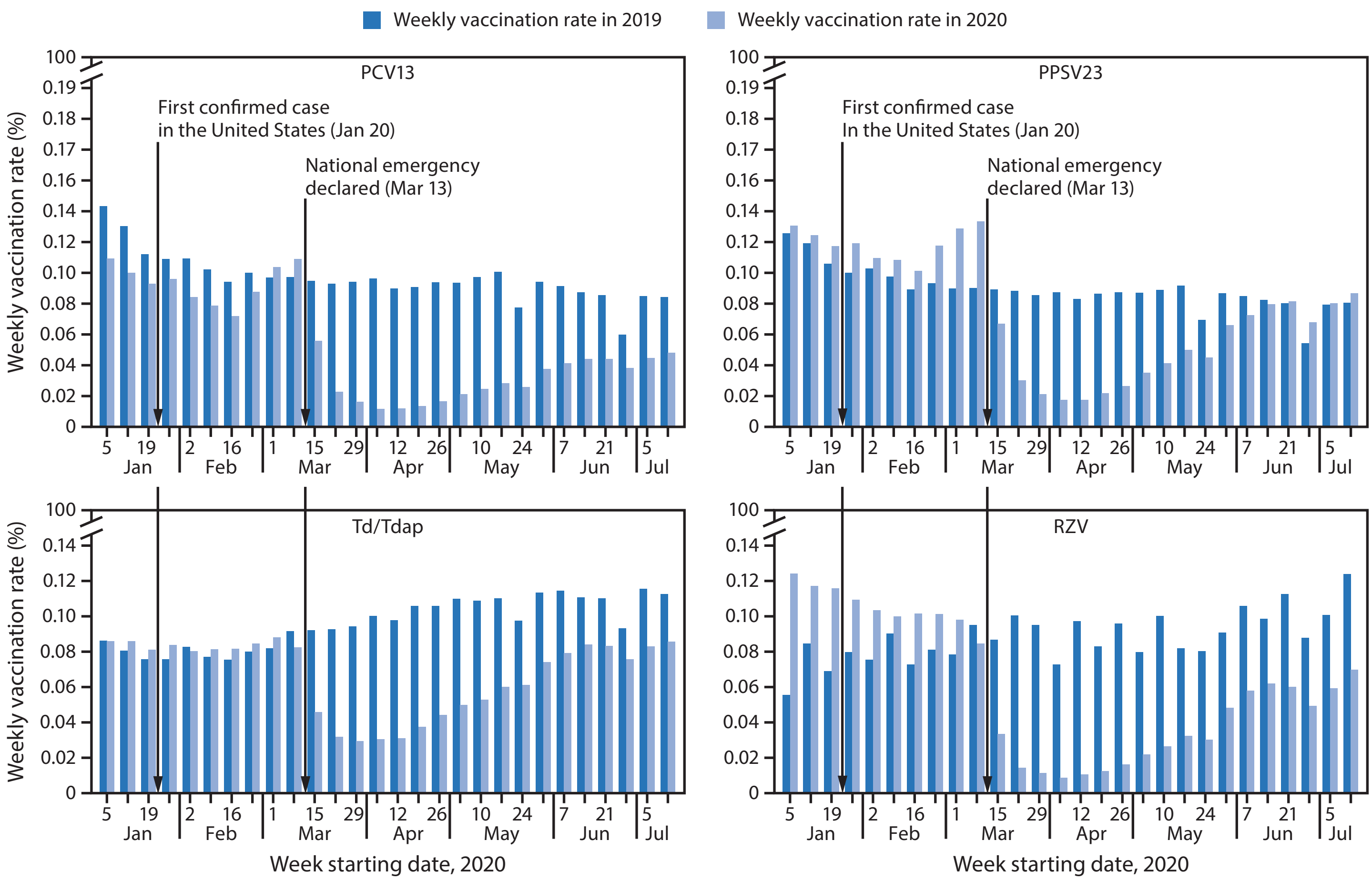
† RZV was recommended by the Advisory Committee on Immunization Practices (ACIP) to be administered as a two-dose series. In the analysis a Medicare beneficiary was counted as receiving RZV if either the first or the second dose was administered and was counted twice if both doses were administered (in different weeks) during the study period. https://www.cdc.gov/mmwr/volumes/67/wr/mm6703a5.htm?s_cid=mm6703a5_w

§ Race/ethnicity of beneficiary was reported in the Medicare enrollment database, which was obtained from the Social Security Administration's beneficiary record. American Indian or Alaska Native persons and persons whose race/ethnicity was unknown were grouped into Other. https://www2.ccwdata.org/documents/10280/19022436/codebook-mbsf-abcd.pdf by CDC and was conducted consistent with applicable federal law and CDC policy.[¶]

During the study period, the average denominator populations were 27,194,802 in 2019 and 26,916,993 in 2020 for PCV13 and PPSV23, and 18,752,789 in 2019 and 18,701,076 in 2020 for Td/Tdap and RZV. Among Medicare beneficiaries, weekly rates of vaccination for each of the four vaccines declined precipitously after the national emergency declaration, compared with the corresponding weeks in 2019 (Figure). During January 5–March 14, 2020, weekly percentages of Medicare beneficiaries vaccinated with PPSV23, Td/Tdap, and RZV were consistently higher than were those during the corresponding week in 2019. Weekly vaccination rates dropped sharply during the first week after the national emergency declaration on March 13, with declines ranging from 25% for PPSV23 to 62% for RZV. The largest declines in weekly vaccination rates occurred during April 5–11, 2020, for PCV13, PPSV23, and Td/Tdap and during April 12–18, 2020, for RZV, when weekly vaccination rates dropped by 70% for Td/Tdap to 89% for RZV. After reaching this nadir, vaccination rates began to recover gradually. At the end of the study period (week commencing July 12), the weekly vaccination rate for PPSV23 was 8% higher than that during the corresponding week in 2019, but weekly vaccination rates for other examined vaccines remained 24% (Td/Tdap) to 43% (RZV) lower.

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

FIGURE. Percentage of Medicare beneficiaries aged ≥65 years who received PCV13,* PPSV23, Td/Tdap, and RZV† vaccines, by week§ — United States, January 6–July 20, 2019¶ and January 5–July 18, 2020



Source: Medicare enrollment and claims data from the Centers for Medicare & Medicaid Services Chronic Conditions Warehouse. https://www2.ccwdata.org/web/guest/home

Abbreviations: ACIP = Advisory Committee on Immunization Practices; PCV13 = 13-valent pneumococcal conjugate vaccine; PPSV23 = 23-valent pneumococcal polysaccharide vaccine; RZV = recombinant zoster vaccine; Td/Tdap = tetanus-diphtheria or tetanus-diphtheria-acellular pertussis vaccine.

* ACIP voted to stop recommending routine PCV13 use among adults aged ≥65 years in June 2019.

† In October 2017, RZV was approved by the Food and Drug Administration and recommended by ACIP preferentially over Zoster Vaccine Live for use in immunocompetent adults aged ≥50 years.

§ Calculated as the percentage of the study sample of Medicare enrollees who received ≥1 dose of the corresponding vaccine during that week.

¶ The starting date of the first examined week in 2019 is January 6.

TABLE. Change in weekly percentage* of Medicare beneficiaries aged ≥65 years who received routinely recommended adult vaccines, overall and by race/ethnicity† — United States, January–July 2020

Vaccine§ and race/ethnicity	% Change in weekly vaccination rate¶		
	Prepandemic average Jan 5–Feb 29	Pandemic nadir**	Most recently assessed pandemic week July 12–18
PCV13			
Total	**−20**	**−88**	**−43**
White	−20	−88	−42
Black	−20	−87	−44
Hispanic/Latino	−20	−89	−62
Asian	−10	−92	−57
Other	−17	−89	−42
PPSV23			
Total	**12**	**−80**	**8**
White	12	−81	10
Black	9	−70	−2
Hispanic/Latino	10	−78	−22
Asian	22	−85	−9
Other	13	−83	3
Td/Tdap			
Total	**5**	**−70**	**−24**
White	5	−68	−23
Black	1	−76	−30
Hispanic/Latino	−3	−80	−44
Asian	11	−86	−38
Other	10	−76	−34
RZV			
Total	**47**	**−89**	**−44**
White	46	−89	−44
Black	57	−86	−11
Hispanic/Latino	65	−88	−40
Asian	58	−91	−53
Other	56	−89	−44

Source: Medicare enrollment and claims data from the Centers for Medicare & Medicaid Services Chronic Conditions Warehouse. https://www2.ccwdata.org/web/guest/home

Abbreviations: ACIP = Advisory Committee on Immunization Practices; PCV13 = 13-valent pneumococcal conjugate vaccine; PPSV23 = 23-valent pneumococcal polysaccharide vaccine; RZV = recombinant zoster vaccine; Td/Tdap = tetanus-diphtheria or tetanus-diphtheria-acellular pertussis vaccine.

* Calculated as the percentage of the study sample of Medicare enrollees who received ≥1 dose of the vaccine during that week. Percentage change in vaccination rate in a week was calculated as the ratio of the vaccination rate in that week in 2020 to the rate in the corresponding week in 2019, minus 1.

† Black, White, Asian, and Other racial/ethnic groups were non-Hispanic; Hispanics could be of any race.

§ Weeks in 2020 were compared with the equivalent weeks in 2019: January 5–February 29, 2020 versus January 6–March 2, 2019 for prepandemic average; April 5–11 or April 12–18, 2020 versus April 7–13 or April 14–20, 2019 for nadir; July 12–18, 2020 versus July 14–20, 2019 for the last examined week.

¶ ACIP voted to stop recommending routine PCV13 use among adults aged ≥65 years in June 2019. In October 2017, RZV was approved by the Food and Drug Administration and recommended preferentially over Zoster Vaccine Live by ACIP for use in immunocompetent adults aged ≥50 years.

** Nadirs were observed during April 5–11 and April 12–18, 2020, depending on vaccine and race/ethnicity group.

Among Medicare enrollees in the study sample, an average (across all vaccines studied) of 85% were White, 7% were Black, 4% were Other racial and ethnic groups, and 2% each were Asian or Hispanic. Patterns of decline and recovery in vaccination among each racial/ethnic group were similar to the overall findings, but certain disparities in magnitude were observed (Table). By the most recently assessed week, the rate of PPSV23 receipt among White adults was 10% higher than that during the corresponding week in 2019, and the declines in PCV 13 and Td/Tdap vaccination (42% and 23%, respectively) were smallest among White adults. By comparison, the change in vaccination rates in the most recent week of the study period compared with the corresponding week in 2019 ranged from –57% (PCV13) to –9% (PPSV23) for Asian adults, –44% (PCV13) to –2% (PPSV23) for Black adults, –62% (PCV13) to –22% (PPSV23) for Hispanic adults, and –44% (RZV) to 3% (PPSV23) for Other race adults. The smallest decline in RZV vaccination rate (11%) during the most recent week was among Black adults.

Discussion

Before the March 13, 2020, COVID-19 national emergency declaration, the weekly rate of receipt of PPSV23, Td/Tdap, and RZV** among Medicare beneficiaries aged ≥65 years in 2020 was consistently higher than that in the corresponding 2019 week. Because the Advisory Committee on Immunization Practices voted in June 2019 to stop recommending PCV13 for adults aged ≥65 years,†† vaccination with PCV13 among this population declined in 2020 compared with that in 2019. Since the declaration, rates of adult vaccination with these three vaccines and PCV13 were substantially lower than were those during the corresponding period in 2019, with steady recovery after mid-April 2020. These findings are consistent with previous reports of declines in routine pediatric vaccine ordering and

** The prepandemic weekly RZV vaccination rates in 2020 were notably higher than those in the equivalent week of 2019, likely because RZV was recently approved and recommended: In October 2017, RZV was approved by the Food and Drug Administration and recommended preferentially over Zoster Vaccine Live by ACIP for use in immunocompetent adults aged ≥50 years. https://www.cdc.gov/mmwr/volumes/67/wr/mm6703a5.htm?s_cid=mm6703a5_w

†† On June 26, 2019, ACIP voted to stop recommending routine PCV13 use among adults aged ≥65 years. Instead, ACIP recommended administration of PCV13 based on shared clinical decision-making for adults aged ≥65 years who do not have an immunocompromising condition, cerebrospinal fluid leak, or cochlear implant, and who have not previously received PCV13. https://www.cdc.gov/mmwr/volumes/68/wr/mm6846a5.htm?s_cid=mm6846a5_w

Summary

What is already known about this topic?

Routine health care services have been disrupted during the COVID-19 pandemic.

What is added by this report?

During the first week after the national COVID-19 emergency declaration in March 2020, weekly vaccination rates among Medicare beneficiaries aged ≥65 years declined by 25%–62%, compared with the corresponding period in 2019. By mid-April, vaccination rates in this group reached nadirs of 70%–89% below 2019 rates. Rates partially recovered gradually during May–July 2020.

What are the implications for public health practice?

Vaccination providers should emphasize the importance of routine adult vaccination to their patients and ensure the safe provision of vaccines to protect older adults from vaccine-preventable diseases during the ongoing COVID-19 pandemic.

vaccine administration (*6*) and childhood vaccination coverage (*7*) during the pandemic. Declines were similar across all racial/ethnic groups; however, the magnitude of recovery varied by race and ethnicity and vaccine. Vaccination rates among racial and ethnic minority adults were lower than were those among White adults.[§§] The COVID-19 pandemic has disproportionally affected certain racial and ethnic minority groups directly (*8*); therefore, monitoring and early intervention to mitigate similar disparities in indirect effects of the pandemic, such as use of other preventive services, might be needed to avoid compounding this disparity.

The findings in this report are subject to at least three limitations. First, the analysis included only Medicare beneficiaries in a fee-for-service plan, which represents approximately 66% of total Medicare beneficiaries; therefore, the findings might not be applicable to all older U.S. adults, who might also have a different racial or ethnic distribution. Second, vaccination was identified on claims data submitted for reimbursement. Vaccination claims not accounted for were those that were not submitted yet or were not billed to Medicare. Finally, race/ethnicity groups other than White and Black could be potentially misidentified in the Medicare administrative enrollment records (*9*); therefore, actual declines in vaccination among those groups might be different from those reported.

Because all 50 states had begun lifting business restrictions or stay-at-home orders in some way by August 2020 (*10*), the likelihood of exposure to infectious diseases, including vaccine-preventable diseases, is increasing.[¶¶] Levels of SARS-CoV-2 virus circulation and associated illnesses increased during September 2020–January 2021.[***] In response, some jurisdictions reissued lockdown policies,[†††] which might have affected observed recovery in vaccination rates. As the pandemic continues, vaccination providers should continue efforts to resolve disruptions in routine adult vaccination (*3*). When resuming in-person visits, vaccination providers should take actions to prevent the spread of SARS-CoV-2 and address patient concerns about exposure to SARS-CoV-2 during visits. Vaccination providers should also provide reassurance that vaccination services (including influenza vaccination to mitigate non-COVID respiratory illness and preserve health care capacity to treat COVID-19 during the influenza season) can be delivered safely and emphasize the importance of routine vaccination to protect patient health. It is important that vaccination providers counsel patients about expected reactogenicity of some vaccines, such as RZV, to help them understand the potential overlap between vaccination reactions and symptoms of COVID-19. Ultimately, continued efforts by vaccination providers and public health officials at all levels, including specific vaccination guidance for providers by state health departments,[§§§] will be needed to ensure that routine adult vaccination returns to prepandemic levels to optimize protection of all older persons against vaccine-preventable diseases. Now that safe and effective COVID-19 vaccines are available, those efforts could also help older U.S adults obtain COVID-19 vaccination.

§§ https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/NHIS-2017.html

¶¶ Persons can contract varicella zoster virus, the virus that causes zoster, from someone who has zoster. If the infected persons never had chickenpox or never received the chickenpox vaccine, they will develop chickenpox, and perhaps then develop zoster later in life. However, zoster cannot be contracted from someone who has zoster. https://www.cdc.gov/shingles/about/transmission.html

*** https://www.cdc.gov/coronavirus/2019-ncov/covid-data/pdf/covidview-02-05-2021.pdf

††† https://www.chicago.gov/content/dam/city/sites/covid/health-orders/2021/2021.1.20-Stay-at-Home-Advisory.pdf

§§§ Washington: https://www.doh.wa.gov/Portals/1/Documents/1600/coronavirus/PleaseContinueVaccinatingPatients.pdf; Massachusetts: https://www.mass.gov/doc/encouraging-vaccination-during-the-covid-19-pandemic/download

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Required and Voluntary Occupational Use of Hazard Controls for COVID-19 Prevention in Non–Health Care Workplaces — United States, June 2020

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Certain hazard controls, including physical barriers, cloth face masks, and other personal protective equipment (PPE), are recommended to reduce coronavirus 2019 (COVID-19) transmission in the workplace (*1*). Evaluation of occupational hazard control use for COVID-19 prevention can identify inadequately protected workers and opportunities to improve use. CDC's National Institute for Occupational Safety and Health used data from the June 2020 SummerStyles survey to characterize required and voluntary use of COVID-19–related occupational hazard controls among U.S. non–health care workers. A survey-weighted regression model was used to estimate the association between employer provision of hazard controls and voluntary use, and stratum-specific adjusted risk differences (aRDs) among workers reporting household incomes <250% and ≥250% of national poverty thresholds were estimated to assess effect modification by income. Approximately one half (45.6%; 95% confidence interval [CI] = 41.0%–50.3%) of non–health care workers reported use of hazard controls in the workplace, 55.5% (95% CI = 48.8%–62.2%) of whom reported employer requirements to use them. After adjustment for occupational group and proximity to others at work, voluntary use was approximately double, or 22.3 absolute percentage points higher, among workers who were provided hazard controls than among those who were not. This effect was more apparent among lower-income (aRD = 31.0%) than among higher-income workers (aRD = 16.3%). Employers can help protect workers from COVID-19 by requiring and encouraging use of occupational hazard controls and providing hazard controls to employees (*1*).

Although many workplaces have implemented CDC (*1*) and Occupational Safety and Health Administration (OSHA) (*2*) guidance on engineering and administrative controls to prevent COVID-19, certain occupations might necessitate close contact among workers. Widespread occupational use of masks as source control or of physical barriers, masks, or other PPE to minimize exposure is likely to reduce COVID-19 transmission among workers and their communities. Workers with lower incomes have higher prevalences of comorbidities that increase risk for severe COVID-19–associated illness (*3*) and might face barriers to voluntary occupational hazard control use, including difficulty accessing masks or other PPE and reduced ability to independently choose to use hazard controls (*4*).

Survey questions were administered by Porter Novelli Public Services through the SummerStyles survey, one in a series of annual surveys. Respondents were recruited randomly by mail using address-based probability sampling to represent the noninstitutionalized, adult U.S. population; surveys were conducted via an online panel in English, and data were weighted to match U.S. Current Population Survey (*5*) proportions.* The June 2020 survey had a response rate of 62.7% (4,053) and included questions on COVID-19–related workplace characteristics. Respondents who did not work (1,409; 35%) or primarily worked from home after March 1, 2020 (819; 20%), used PPE at work before the COVID-19 pandemic (1,038; 26%),† worked in health care occupations (23; 0.6%), or did not answer questions on hazard control use (22; 0.5%) were successively excluded to identify 742 (18%) non–health care, nonremote workers who did not use PPE at work before the COVID-19 pandemic. All further analyses were conducted using survey weights. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§

Required and voluntary occupational use of hazard controls¶ and reasons for nonuse were described using percentages and 95% CIs as "Yes — my employer required it" (required use), "Yes — it was not required, but I used it" (voluntary use), "No — my employer did not allow it," "No — I could not get any," and "No — I did not think it was needed." Voluntary use was then described among the subset of persons who were neither required to nor prohibited from using hazard controls (540); a survey-weighted regression model estimated the association between employer provision of hazard controls** and voluntary

* Porter Novelli Styles survey respondents received 5,000 reward points, equivalent to approximately $5, for completing the survey, but were not required to answer any of the questions and could choose to exit the survey at any point. Data are weighted to match U.S. Current Population Survey proportions for sex, age, household income, race/ethnicity, household size, education, census region, metro status, and parental status of adolescents aged 12–17 years. http://styles.porternovelli.com/consumer-youthstyles/

† The survey provided examples of PPE used before the COVID-19 pandemic to respondents, including "eye protection, gloves, a hard hat, a face mask, or a respirator."

§ 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.

¶ Use of occupational hazard controls for COVID-19 prevention was determined by the survey question "Since March 1, 2020, even though it is not normally required, did you wear any personal protective equipment (PPE) or use other physical barriers at work to prevent exposure to the virus that causes COVID-19?"

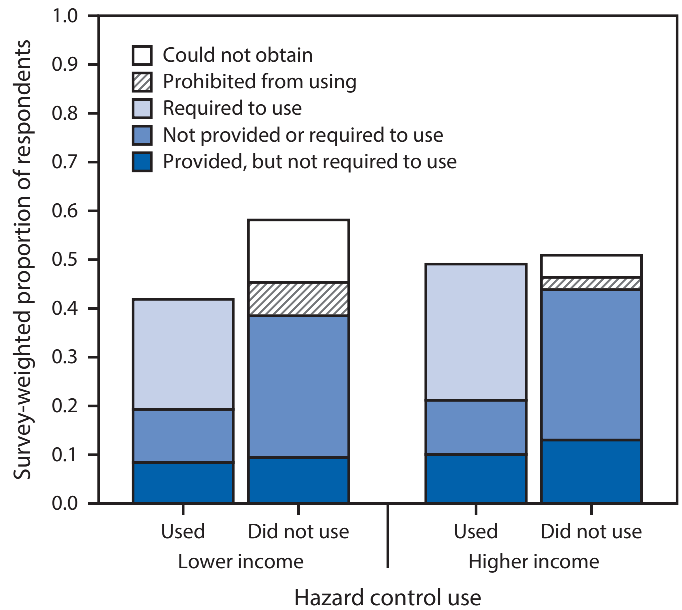
** Employer provision of hazard controls was determined by the survey question "Did your employer provide you with the PPE that you used or, if you chose not to use PPE, offer any to you?"

use as a risk difference. Models were adjusted for occupational group and proximity to others at work.†† Respondents were classified as lower-income if the lower bound of the reported categorical household income was <250% of the 2019 national poverty threshold (*6*) based on reported household size and number of children. Stratum-specific aRDs were estimated to assess effect modification by income. All analyses were conducted using R software (version 4.0.2; The R Foundation).

Approximately one half (45.6%; 95% CI = 41.0%–50.3%) of non–health care workers reported use of occupational hazard controls (Figure). Most users of hazard controls (55.5%; 95% CI = 48.8%–62.2%) were required to do so by employers, and 44.5% (95% CI = 37.8%–51.2%) reported voluntary use. Among workers not using hazard controls, 8.1% (95% CI = 4.3%–11.8%) were prohibited from using them, 14.8% (95% CI = 9.9%–19.6%) could not obtain them, and 77.2% (95% CI = 71.5%–82.9%) did not believe they were needed. Overall, lower-income workers were more likely than were higher-income workers to be prohibited from using hazard controls (6.8%; 95% CI = 2.7%–10.9% versus 2.5%; 95% CI = 0.7%–4.3%) or to be unable to obtain them (12.6%; 95% CI = 6.9%–18.2% versus 4.5%; 95% CI = 2.5%–6.5%). Higher-income workers were more likely to report required use (27.7%; 95% CI = 22.4%–32.9%) and to use hazard controls overall (48.9%; 95% CI = 43.3%–54.4%) than were lower-income workers (22.3%; 95% CI = 15.5%–29.1% and 41.5%; 95% CI = 33.6%–49.3%, respectively).

Among 540 workers for whom use of hazard controls was voluntary, 28.9% used them (Table 1). Some workers who were not required to use hazard controls were provided with them (29.7%; 95% CI = 24.8%–34.5%), and unadjusted voluntary use among workers provided with hazard controls (44.9%;) was twice that among those for whom hazard controls were not provided (22.4%;). After adjusting for occupational group and proximity to others at work, voluntary use was approximately double, or 22.3, absolute percentage points higher, among workers who were provided with hazard controls than among those who were not (Table 2). This effect was nonsignificantly larger among lower-income workers (aRD = 31.0%) than among higher-income workers (aRD = 16.3%).

FIGURE. Reported occupational hazard control use for prevention of COVID-19 among survey respondents who reported primarily working outside the home in non–health care occupations after March 1, 2020, by household income* and workplace hazard control policies — 2020 SummerStyles, United States, June 2020



* Lower income: lower bound of the reported categorical household income <250% of the 2019 national poverty threshold based on household size and number of children; higher income: lower bound met or exceeded this threshold.

Discussion

Hazard controls, including physical barriers, cloth face masks, and other forms of PPE are important safeguards against occupational transmission of COVID-19 when work cannot be performed remotely (*1*,*2*). However, the use of COVID-19–specific hazard controls in non–health care workplaces is poorly characterized. A March 2020 survey, conducted before CDC's recommendation for public mask use, reported that 7% of U.S. hourly-wage service-sector workers were required to use masks and that 19% were provided masks by their employers (*7*). The current analysis identified employer requirement and provision of hazard controls in June 2020 among a broader sample of occupations and found that many workers were neither provided with them nor required to use them. Employer provision of hazard controls was associated with greater use among all workers, particularly among lower-income workers.

†† Occupation was collapsed into broad groups for analysis: 1) professional and technical, including management; business and financial operations; computer and mathematical; architecture and engineering; life, physical, and social sciences; community and social services; lawyer/judge; teacher, except college and university; teacher, college and university; other professional; business operations; financial operations or financial services; education, training, and library; and arts, design, entertainment, sports, and media; 2) farming and production, including farming, forestry, and fishing; construction and extraction; installation, maintenance, and repair; precision production; and transportation and material moving; 3) sales and office and administrative support, including sales representative; retail sales; other sales; office and administrative support; and sales; 4) service, including protective service; food preparation and serving; building and grounds cleaning and maintenance; and personal care and service; and 5) other, including armed services and other. Close proximity was classified as follows: required to perform job tasks within 6 feet of others always; most of the time; approximately one half of the time; some of the time; and never. Occupational group and close proximity to others at work were identified as potential confounders of the proposed association between employer provision of hazard controls and hazard control use after evaluating relationships among all covariates of interest using standard causal inference epidemiologic methods and were included as adjustment variables in regression models.

TABLE 1. Survey-weighted proportions of occupational use of hazard controls among non–health care worker survey respondents who reported primarily working outside the home in settings where hazard control use was voluntary after March 1, 2020, by worker characteristics (N = 540) — 2020 SummerStyles, United States, June 2020

	Voluntary hazard control use	
Characteristic (no. with available information if <540)	**Unweighted no. of respondents***	**Survey-weighted % (95% CI)**
Total	**540**	**28.9 (24.2–33.7)**
Employer provided hazard controls (531)		
Yes	175	44.9 (35.6–54.2)
No	356	22.4 (17.0–27.8)
Sex		
Male	284	27.9 (21.4–34.3)
Female	256	30.1 (23.1–37.1)
Race/Ethnicity		
White, non-Hispanic	424	26.8 (21.9–31.7)
Black, non-Hispanic	32	31.8 (13.7–49.9)
Other, non-Hispanic	38	36.7 (13.7–59.8)
Hispanic	46	34.9 (17.8–52.0)
Age group, yrs		
18–29	65	16.5 (6.3–26.7)
30–44	154	34.9 (26.3–43.5)
45–59	182	27.6 (19.9–35.2)
≥60	139	43.2 (33.9–52.5)
Occupational group (511)		
Professional and technical	201	25.9 (19.2–32.5)
Farming and production	61	26.1 (11.7–40.5)
Sales and office/Administrative support	84	30.8 (18.9–42.8)
Service	53	26.9 (13.7–40.1)
Other	112	36.1 (24.6–47.7)
Proximity to others at work (within 6 ft) (538)		
Never	119	21.9 (11.7–32.1)
Some of the time	188	33.2 (25.5–41.0)
Approximately one half of the time	73	30.4 (17.5–43.3)
Most of the time	85	25.9 (15.3–36.5)
Always	73	34.6 (19.8–49.4)
Household income†		
Lower income	193	27.0 (19.0–35.1)
Higher income	347	30.4 (24.8–36.0)

Abbreviation: CI = confidence interval.
* Unweighted sample size might not sum to column total because of missing values.
† Lower income: lower bound of the reported categorical household income <250% of the 2019 national poverty threshold based on household size and number of children; higher income: lower bound met or exceeded this threshold.

Employers are required to provide a workplace free from recognized hazards (*8*). When engineering and administrative controls cannot fully protect workers, OSHA mandates that employers identify and provide necessary PPE at no cost to workers (*8*). Adherence to this mandate as employers adjust to new hazards posed by COVID-19 is vital to minimizing occupational transmission. CDC also recommends that employers encourage mask use to reduce transmission in workplaces where PPE is not routinely deemed necessary (*1*). Employer requirement and provision of hazard controls that are not considered PPE, such as cloth face masks and physical barriers, are complements to, not substitutes for, other workplace policies and worker protections (*1*,*2*).

TABLE 2. Adjusted, survey-weighted occupational use of hazard controls among non–health care worker survey respondents who reported primarily working outside the home in settings where hazard control use was voluntary after March 1, 2020, by employer provision of hazard controls and household income — 2020 SummerStyles, United States, June 2020

	Respondent hazard control use,* % (95% CI)		
Characteristics	**Total**	**Lower household income**†	**Higher household income**†
Did employer provide hazard controls?			
Yes	45.2 (36.1–54.3)	49.3 (31.8–66.7)	42.7 (33.0–52.5)
No	23.0 (17.7–28.3)	18.3 (10.7–25.9)	26.5 (19.6–33.4)
Risk difference*	22.3 (11.8–32.7)	31.0 (12.3–49.6)	16.3 (4.3–28.3)

Abbreviation: CI = confidence interval.
* Adjusted for occupational group and proximity to others at work. Adjusted hazard control use was estimated as a predictive marginal mean.
† Lower income: lower bound of the reported categorical household income <250% of the 2019 national poverty threshold based on household size and number of children; higher income: lower bound met or exceeded this threshold.

Failure to protect workers from COVID-19 might exacerbate existing health disparities, including those among lower-income populations (*3*). Workers with lower incomes are more likely than are those with higher incomes to have preexisting health conditions that might increase the risk for severe COVID-19–associated illness (*3*). In this survey population, lower-income workers were also more likely to be unable to obtain or be prohibited from using occupational hazard controls. Cost to employees might hinder hazard control use, especially use of disposable items requiring regular replacement. Workers with lower incomes might also experience more job insecurity (*4*); workers should not be subjected to negative repercussions for reporting hazards and using hazard controls (*9*). A small minority of respondents, including a comparatively higher proportion of lower-income workers, reported being prohibited from using hazard controls by their employers. Targeted study can help identify reasons for such prohibition. Use of specific hazard controls should not be prohibited unless it impedes worker safety; in such situations, safe alternatives should be identified.

The findings in this report are subject to at least six limitations. First, survey questions did not distinguish between types of hazard controls despite differing implications for COVID-19 transmission. Second, employer provision of hazard controls was queried dichotomously. Respondents might have been provided some, but not all, recommended hazard controls. Third, some covariates were missing, and 7.0% of eligible workers were excluded from regression analyses because values were missing for one or more of the following: occupation (5.4%), employer provision of hazard controls (1.7%), or proximity to others at work (0.4%). Fourth, variance might be underestimated because sample design variables

Summary

What is already known about this topic?

Certain hazard controls, including physical barriers, masks, and other personal protective equipment are recommended to reduce workplace COVID-19 transmission, but use is poorly characterized.

What is added by this report?

In June 2020, fewer than one half of nonremote, non–health care workers reported use of hazard controls to prevent COVID-19, and slightly more than one half of these reported required use. Voluntary use was approximately double (22 percentage points higher) among workers whose employers provided hazard controls than among those whose employers did not. This association was stronger among lower-income workers.

What are the implications for public health practice?

Employers can help protect workers against COVID-19 by requiring and encouraging occupational hazard control use and providing recommended hazard controls.

were unavailable; all analyses applied provided survey weights, treating the sample as a single stratum. Fifth, responses among this cross-sectional, English-language, opt-in panel sample might not be representative of the experiences of the broader workforce over time. Finally, small survey numbers within the relevant population produced large CIs for many estimates.

This analysis highlights the value of employer-provided hazard controls for increasing voluntary workplace use, particularly among workers with lower incomes. Employers can help protect workers against COVID-19 by requiring and encouraging occupational hazard control use and providing recommended hazard controls, along with other COVID-19 workplace precautions.

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Please note: This report has been corrected.

Maximizing Fit for Cloth and Medical Procedure Masks to Improve Performance and Reduce SARS-CoV-2 Transmission and Exposure, 2021

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On February 10, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Universal masking is one of the prevention strategies recommended by CDC to slow the spread of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) (*1*). As of February 1, 2021, 38 states and the District of Columbia had universal masking mandates. Mask wearing has also been mandated by executive order for federal property* as well as on domestic and international transportation conveyances.† Masks substantially reduce exhaled respiratory droplets and aerosols from infected wearers and reduce exposure of uninfected wearers to these particles. Cloth masks§ and medical procedure masks¶ fit more loosely than do respirators (e.g., N95 facepieces). The effectiveness of cloth and medical procedure masks can be improved by ensuring that they are well fitted to the contours of the face to prevent leakage of air around the masks' edges. During January 2021, CDC conducted experimental simulations using pliable elastomeric source and receiver headforms to assess the extent to which two modifications to medical procedure masks, 1) wearing a cloth mask over a medical procedure mask (double masking) and 2) knotting the ear loops of a medical procedure mask where they attach to the mask's edges and then tucking in and flattening the extra material close to the face (knotted and tucked masks), could improve the fit of these masks and reduce the receiver's exposure to an aerosol of simulated respiratory droplet particles of the size considered most important for transmitting SARS-CoV-2. The receiver's exposure was maximally reduced (>95%) when the source and receiver were fitted with modified medical procedure masks. These laboratory-based experiments highlight the importance of good fit to optimize mask performance. Until vaccine-induced population immunity is achieved, universal masking is a highly effective means to slow the spread of SARS-CoV-2** when combined with other protective measures, such as physical distancing, avoiding crowds and poorly ventilated indoor spaces, and good hand hygiene. Innovative efforts to improve the fit of cloth and medical procedure masks to enhance their performance merit attention.

At least two recent studies examined use of mask fitters to improve the fit of cloth and medical procedure masks. Fitters can be solid (*2*) or elastic (*3*) and are worn over the mask, secured with head ties or ear loops. The results indicated that when fitters are secured over a medical procedure mask, they can potentially increase the wearer's protection by ≥90% for aerosols in the size range considered to be the most important for transmitting SARS-CoV-2 (generally <10 μm). Other studies found that knotting and tucking a medical procedure mask or placing a sleeve made of sheer nylon hosiery material around the neck and pulling it up over either a cloth or medical procedure mask (*3,4*) also significantly improved the wearer's protection by fitting the mask more tightly to the wearer's face and reducing edge gaps. A recent expert commentary (*5*) proposed double masking as another means to improve the fit of medical procedure masks and maximize the filtration properties of the materials from which they are typically constructed, such as spun-bond and melt-blown polypropylene. Based on experiments that measured the filtration efficiencies of various cloth masks and a medical procedure mask (*6*), it was estimated that the better fit achieved by combining these two mask types, specifically a cloth mask over a medical procedure mask, could reduce a wearer's exposure by >90%.

During January 2021, CDC conducted various experiments to assess two methods to improve medical procedure mask performance by improving fit and, in turn, filtration: 1) double masking and 2) knotting and tucking the medical procedure mask (Figure 1). The first experiment assessed how effectively various mask combinations reduced the amount of particles emitted during a cough (i.e., source control) in terms of collection efficiency. A pliable elastomeric headform was used

* https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-the-federal-workforce-and-requiring-mask-wearing

† https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/21/executive-order-promoting-covid-19-safety-in-domestic-and-international-travel

§ A cloth mask refers to any mask constructed from textiles or fabrics (both natural and synthetic) that is not a surgical mask or N95 respirator and is not intended for use as personal protective equipment. At present, there are no national standards established for cloth masks although such standards are under consideration by ASTM (formerly known as American Society for Testing and Materials).

¶ A medical procedure mask refers to any commercially produced mask regulated by the Food and Drug Administration under 21 CFR 878.4040 for performing medical procedures. These are variably labeled as surgical, laser, isolation, dental, or medical procedure masks. They may be variably shaped, including flat pleated, cone shaped, or duck bill. Medical procedure masks are loose fitting and are not expected to provide a reliable level of protection against airborne or aerosolized particles as N95 respirators regulated by the National Institute for Occupational Safety and Health. A more detailed comparison of medical procedure masks and respirators is available. https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf

** https://www.cdc.gov/coronavirus/2019-ncov/more/masking-science-sars-cov2.html to simulate a person coughing by producing aerosols from a mouthpiece (0.1–7 μm potassium chloride particles) (*7*). The effectiveness of the following mask configurations to block these aerosols was assessed: a three-ply medical procedure mask alone, a three-ply cloth cotton mask alone, and the three-ply cloth mask covering the three-ply medical procedure mask (double masking). The second experiment assessed how effectively the two modifications to medical procedure masks reduced exposure to aerosols emitted during a period of breathing. Ten mask combinations, using various configurations of no mask, double masks, and unknotted or knotted and tucked medical procedure masks, were assessed (e.g., source with no mask and receiver with double mask or source with double mask and receiver with no mask). A knotted and tucked medical procedure mask is created by bringing together the corners and ear loops on each side, knotting the ears loops together where they attach to the mask, and then tucking in and flattening the resulting extra mask material to minimize the side gaps[††] (Figure 1). A modified simulator with two pliable elastomeric headforms (a source and a receiver) was used to simulate the receiver's exposure to aerosols produced by the source (*8*). In a chamber approximately 10 ft (3.1 m) long by 10 ft wide by 7 ft (2.1 m) high, which simulated quiet breathing during moderate work, the source headform was programmed to generate the aerosol from its mouthpiece at 15 L/min (International Organization for Standardization [ISO] standard for a female performing light work), and the receiver headform's minute ventilation was set at 27 L/min (ISO average of a male or female engaged in moderate work).[§§] For each of the 10 masking configurations, three 15-minute runs were completed.

†† https://youtu.be/UANi8Cc71A0
§§ https://www.iso.org/standard/67530.html

Results from the first experiment demonstrated that the unknotted medical procedure mask alone blocked 56.1% of the particles from a simulated cough (standard deviation [SD] = 5.8), and the cloth mask alone blocked 51.4% (SD = 7.1). The combination of the cloth mask covering the medical procedure mask (double mask) blocked 85.4% of the cough particles (SD = 2.4), and the knotted and tucked medical procedure mask blocked 77.0% (SD = 3.1).

In the second experiment, adding a cloth mask over the source headform's medical procedure mask or knotting and tucking the medical procedure mask reduced the cumulative exposure of the unmasked receiver by 82.2% (SD = 0.16) and 62.9% (SD = 0.08), respectively (Figure 2). When the source was unmasked and the receiver was fitted with the double mask or the knotted and tucked medical procedure mask, the receiver's cumulative exposure was reduced by 83.0% (SD = 0.15) and 64.5% (SD = 0.03), respectively. When the source and receiver were both fitted with double masks or knotted and tucked masks, the cumulative exposure of the receiver was reduced 96.4% (SD = 0.02) and 95.9% (SD = 0.02), respectively.

Discussion

These laboratory-based experiments highlight the importance of good fit to maximize overall mask performance. Medical procedure masks are intended to provide source control (e.g., maintain the sterility of a surgical field) and to block splashes. The extent to which they reduce exhalation and inhalation of particles in the aerosol size range varies substantially, in part because air can leak around their edges, especially through the side gaps (*9*). The reduction in simulated inhalational exposure observed for the medical procedure mask in this report was lower than reductions reported in studies of other medical procedure masks that were assessed under similar experimental conditions, likely because of substantial air leakage around the edges of the mask used here (*10*). In

FIGURE 1. Masks tested, including *A*, unknotted medical procedure mask; *B*, double mask (cloth mask covering medical procedure mask); and *C*, knotted/tucked medical procedure mask

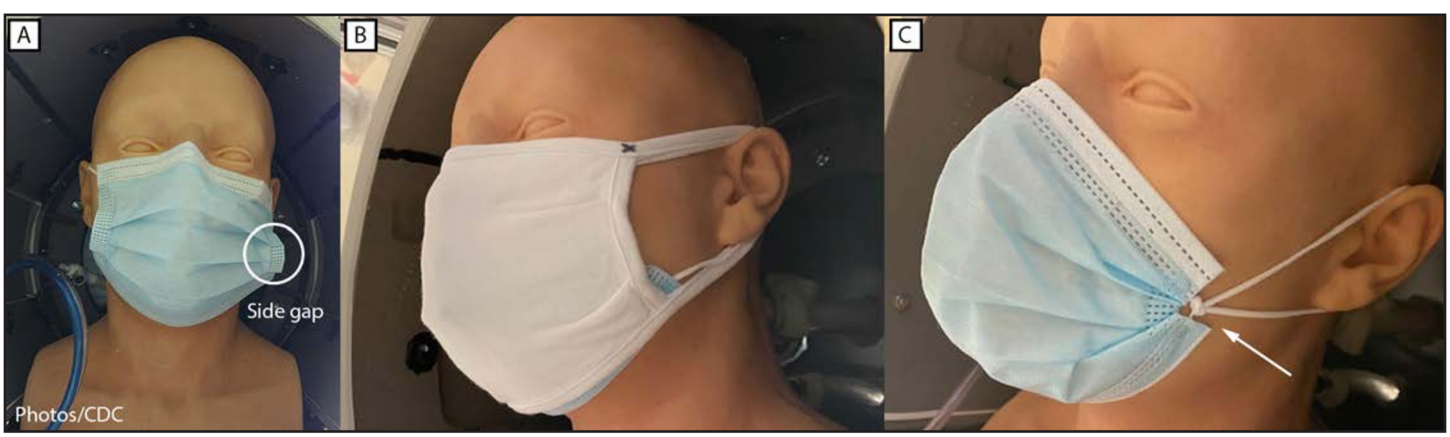
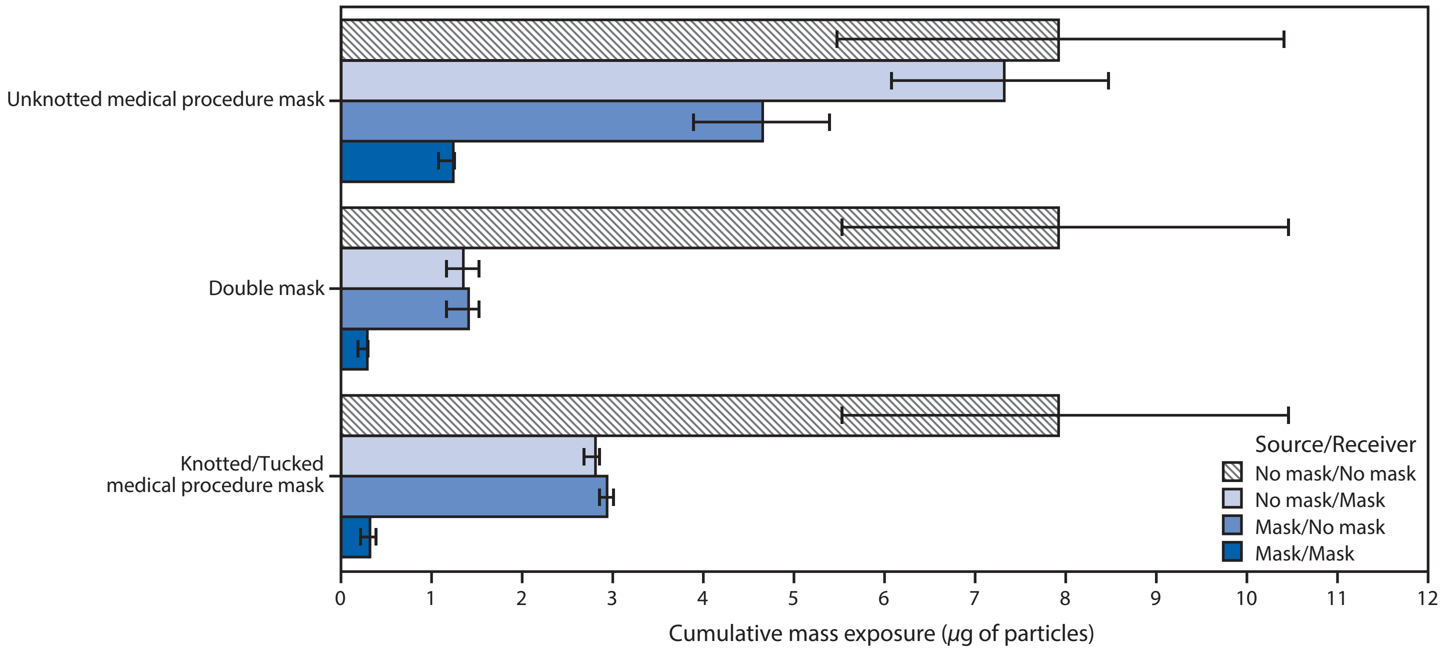


FIGURE 2. Mean cumulative exposure* for various combinations of no mask, double masks, and unknotted and knotted/tucked medical procedure masks†



* To an aerosol of 0.1–7 μm potassium chloride particles (with 95% confidence intervals indicated by error bars) measured at mouthpiece of receiver headform configured face to face 6 ft from a source headform, with no ventilation and replicated 3 times. Mean improvements in cumulative exposures compared with no mask/no mask (i.e., no mask wearing, or 100% exposure) were as follows: *unknotted medical procedure mask*: no mask/mask = 7.5%, mask/no mask = 41.3%, mask/mask = 84.3%; *double mask*: no mask/mask = 83.0%, mask/no mask = 82.2%, mask/mask = 96.4%; *knotted/tucked medical procedure mask*: no mask/mask = 64.5%, mask/no mask = 62.9%, mask/mask = 95.9%.

† Double mask refers to a three-ply medical procedure mask covered by a three-ply cloth cotton mask. A knotted and tucked medical procedure mask is created by bringing together the corners and ear loops on each side, knotting the ears loops together where they attach to the mask, and then tucking in and flattening the resulting extra mask material to minimize the side gaps.

Summary

What is already known about this topic?

Universal masking is recommended to slow the spread of COVID-19. Cloth masks and medical procedure masks substantially reduce exposure from infected wearers (source control) and reduce exposure of uninfected wearers (wearer exposure).

What is added by this report?

CDC conducted experiments to assess two ways of improving the fit of medical procedure masks: fitting a cloth mask over a medical procedure mask, and knotting the ear loops of a medical procedure mask and then tucking in and flattening the extra material close to the face. Each modification substantially improved source control and reduced wearer exposure.

What are the implications for public health?

These experiments highlight the importance of good fit to maximize mask performance. There are multiple simple ways to achieve better fit of masks to more effectively slow the spread of COVID-19.

another study, adding mask fitters to two medical procedure masks, which produced different reductions in exposure when unmodified, enhanced their efficiencies to the same equally high levels (*2*). This observation suggests that modifications to improve fit might result in equivalent improvements, regardless of the masks' baseline filtration efficiencies.

The findings in this report are subject to at least four limitations. First, these experiments were conducted with one type of medical procedure mask and one type of cloth mask among the many choices that are commercially available and were intended to provide data about their relative performance in a controlled setting. The findings of these simulations should neither be generalized to the effectiveness of all medical procedure masks or cloths masks nor interpreted as being representative of the effectiveness of these masks when worn in real-world settings. Second, these experiments did not include any other combinations of masks, such as cloth over cloth, medical procedure mask over medical procedure mask, or medical procedure mask over cloth. Third, these findings might not be generalizable to children because of their smaller size or to men with beards and other facial hair, which interfere with fit. Finally, although use of double masking or knotting and tucking are two of many options that can optimize fit and enhance mask performance for source control and for wearer protection, double masking might impede breathing or obstruct peripheral vision for some wearers, and knotting and tucking can change the shape of the mask such that it no longer covers fully both the nose and the mouth of persons with larger faces.

Controlling SARS-CoV-2 transmission is critical not only to reduce the widespread effects of the COVID-19 pandemic on human health and the economy but also to slow viral evolution and the emergence of variants that could alter transmission dynamics or affect the usefulness of diagnostics, therapeutics, and vaccines. Until vaccine-induced population immunity is achieved, universal masking is a highly effective means to slow the spread of SARS-CoV-2 when combined with other protective measures, such as physical distancing, avoiding crowds and poorly ventilated indoor spaces, and good hand hygiene. The data in this report underscore the finding that good fit can increase overall mask efficiency. Multiple simple ways to improve fit have been demonstrated to be effective. Continued innovative efforts to improve the fit of cloth and medical procedure masks to enhance their performance merit attention.

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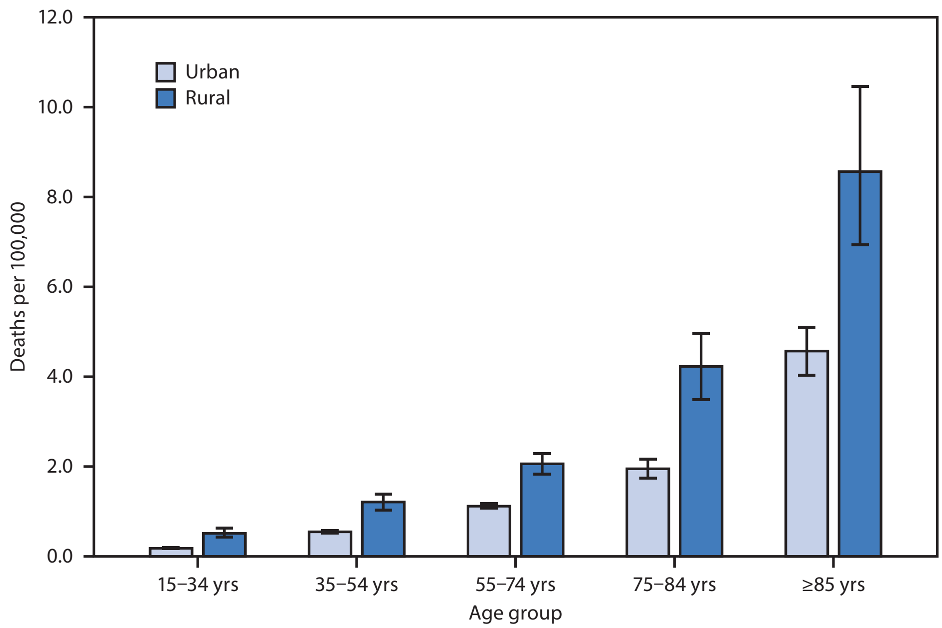
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Death Rates* Attributed to Excessive Cold or Hypothermia† Among Persons Aged ≥15 Years, by Urban-Rural Status§ and Age Group — National Vital Statistics System, United States, 2019



* Crude rate of deaths per 100,000 population; 95% confidence intervals indicated by error bars.

† Deaths attributed to excessive cold or hypothermia were identified using the *International Classification of Diseases, Tenth Revision* multiple cause of death code X31 (Exposure to excessive natural cold) or T68 (Hypothermia).

§ Urban-rural status is determined by the Office of Management and Budget's February 2013 delineation of metropolitan statistical areas (MSAs), in which each MSA must have at least one urban area of ≥50,000 inhabitants. Areas with <50,000 inhabitants are grouped into the rural category.

In 2019, among persons aged ≥15 years, death rates attributed to excessive cold or hypothermia were higher in rural areas than in urban areas across every age group. Crude rates were lowest among those aged 15–34 years at 0.2 and 0.5 per 100,000 population in urban and rural areas, respectively. Rates increased with age, with the highest rates among those aged ≥85 years at 4.6 in urban areas and 8.6 in rural areas. Differences between urban and rural rates also increased with age.

Source: National Center for Health Statistics, National Vital Statistics System, Mortality Data 2019. https://wonder.cdc.gov/mcd-icd10.html

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