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Trends in Diagnosis of HIV Infection, Linkage to Medical Care, and Viral Suppression Among Men Who Have Sex with Men, by Race/Ethnicity and Age — 33 Jurisdictions, United States, 2014–2018

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During 2018, gay, bisexual, and other men who have sex with men (MSM) accounted for 69.4% of all diagnoses of human immunodeficiency virus (HIV) infection in the United States (*1*). Moreover, in all 42 jurisdictions with complete laboratory reporting of CD4 and viral load results,[*] percentages of MSM linked to care within 1 month (80.8%) and virally suppressed (viral load <200 copies of HIV RNA/mL or interpreted as undetected) within 6 months (68.3%) of diagnosis were below target during 2018 (*2*). African American/Black (Black), Hispanic/Latino (Hispanic), and younger MSM disproportionately experience HIV diagnosis, not being linked to care, and not being virally suppressed. To characterize trends in these outcomes, CDC analyzed National HIV Surveillance System[†] data from 2014 to 2018. The number of diagnoses of HIV infection among all MSM decreased 2.3% per year (95% confidence interval [CI] = 1.9–2.8). However, diagnoses did not significantly change among either Hispanic MSM or any MSM aged 13–19 years; increased 2.2% (95% CI = 1.0–3.4) and 2.0% (95% CI = 0.6–3.3) per year among Black and Hispanic MSM aged 25–34 years, respectively; and were highest in absolute count among Black MSM. Annual percentages of linkage to care within 1 month and viral suppression within 6 months of diagnosis among all MSM increased (2.9% [95% CI = 2.4–3.5] and 6.8% [95% CI = 6.2–7.4] per year,

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[*] CDC established three criteria for complete laboratory reporting: 1) the jurisdiction's laws/regulations required reporting of all CD4 and viral load results to the state or local health department; 2) laboratories that perform HIV-related testing for the areas 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 at least 95% of all CD4 and viral load results received during January 2017–September 2019. Additional information is available at https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-supplemental-report-vol-25-2.pdf.

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

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respectively). These findings, albeit promising, warrant intensified prevention efforts for Black, Hispanic, and younger MSM.

CDC used data reported to the National HIV Surveillance System by December 2019 to identify cases of HIV infection that met CDC's HIV infection case definition among MSM, including MSM aged ≥13 years who inject drugs (*3*). Multiple imputation was used to adjust for unknown or missing transmission category (15.6% of cases) (*4*). At the time of diagnosis, all MSM resided in one of 33 jurisdictions[§] with complete laboratory reporting for each year during 2014–2018. Linkage-to-care analyses included MSM with HIV infection diagnosed during the calendar year when the diagnosis was first made. Linkage to care was defined as one or more CD4 or viral load tests performed within 1 month of diagnosis. Viral suppression within 6 months of diagnosis was measured for MSM whose infection was diagnosed during the outcome year and who resided in any of the 33 jurisdictions at the time of diagnosis of HIV infection. Viral suppression was defined as a viral load result of <200 copies/mL or a viral load test interpretation value of undetected.

Results are presented by race/ethnicity (Black, Hispanic, other, and White) and age group (13–19, 20–24, 25–34, 35–44, 45–54, and ≥55 years). The estimated annual percentage change (EAPC) was calculated for each MSM group. Because of unknown population denominators, case counts were used to analyze diagnoses by transmission category; the EAPCs in case counts were calculated by using a Poisson distribution. EAPCs indicate the per-year change, on average, in the number of diagnoses, percentage linked to care, or percentage virally suppressed. EAPC p-values <0.05 indicated statistically significant trends, whereas p-values ≥0.05 indicated no significant change. Analyses were conducted using SAS (version 9.4; SAS Institute).

During 2014–2018, the number of diagnoses of HIV infection among all MSM decreased 2.3% (95% CI = 1.9–2.8) per year (from 19,789 to 18,034), on average (Table 1). Among Black MSM, diagnoses decreased 1.3% per year overall and 6.0% and 5.6% among those aged 20–24 and 45–54 years, respectively. Diagnoses did not significantly change among Black MSM aged 13–19, 35–44, and ≥55 years, but increased 2.2% annually among those aged 25–34 years. Among Hispanic MSM, diagnoses did not significantly change overall or among those aged 13–19, 35–44, 45–54, and ≥55 years. Diagnoses decreased 3.7% per year among Hispanic MSM aged 20–24 years but increased 2.0% among those aged 25–34 years. Among White MSM, diagnoses decreased 4.8% per year overall and 5.6%, 2.1%, 7.8%, and 9.3% among those aged 20–24, 25–34, 35–44, and 45–54 years, respectively. Diagnoses did not significantly change among White MSM aged 13–19 or ≥55 years.

[§] Alabama, Alaska, California, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

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TABLE 1. Diagnoses of human immunodeficiency virus (HIV) infection and linkage to medical care within 1 month of diagnosis among men who have sex with men,[*] by race/ethnicity and age — 33 jurisdictions,[†] United States, 2014–2018[§]

Race/	Diagnoses, no.					EAPC[¶] (95% CI)	Linkage to medical care, no. (%)					EAPC[¶] (95% CI)
Ethnicity	2014	2015	2016	2017	2018	2014–2018	2014	2015	2016	2017	2018	2014–2018
African American/Black												
Age at diagnosis (yrs)												
13–19	574	613	593	600	584	0.1 (−2.4 to 2.7)	335 (58.4)	376 (61.3)	388 (65.4)	417 (69.5)	399 (68.3)	4.4 (1.2 to 7.8)
20–24	2,262	2,163	2,085	1,861	1,784	−6.0 (−7.3 to −4.7)	1,243 (55.0)	1,279 (59.1)	1,326 (63.6)	1,216 (65.3)	1,232 (69.1)	5.7 (3.9 to 7.6)
25–34	2,627	2,731	2,853	2,872	2,860	2.2 (1.0 to 3.4)	1,618 (61.6)	1,685 (61.7)	1,879 (65.8)	1,945 (67.7)	2,024 (70.8)	3.8 (2.3 to 5.3)
35–44	925	912	908	911	933	0.2 (−1.9 to 2.2)	609 (65.9)	593 (65.0)	605 (66.6)	641 (70.4)	662 (71.0)	2.3 (−0.2 to 4.9)
45–54	624	618	583	520	509	−5.6 (−8.0 to −3.1)	423 (67.8)	410 (66.4)	387 (66.3)	356 (68.5)	350 (68.8)	0.6 (−2.6 to 3.8)
≥55	317	278	290	310	297	−0.3 (−3.8 to 3.4)	222 (70.1)	184 (66.2)	198 (68.2)	207 (66.8)	214 (72.1)	0.6 (−3.6 to 5.0)
Subtotal	**7,328**	**7,314**	**7,312**	**7,074**	**6,967**	**−1.3 (−2.0 to −0.6)**	**4,450 (60.7)**	**4,525 (61.9)**	**4,781 (65.4)**	**4,783 (67.6)**	**4,881 (70.1)**	**3.8 (2.9 to 4.8)**
Hispanic/Latino[**]												
Age at diagnosis (yrs)												
13–19	222	234	228	242	222	0.4 (−3.6 to 4.6)	131 (59.1)	157 (67.2)	154 (67.5)	156 (64.2)	163 (73.4)	3.8 (−1.3 to 9.3)
20–24	1,130	1,170	1,108	1,027	995	−3.7 (−5.5 to −1.9)	719 (63.6)	775 (66.2)	763 (68.9)	706 (68.8)	736 (74.0)	3.4 (1.1 to 5.8)
25–34	2,071	2,100	2,264	2,226	2,221	2.0 (0.6 to 3.3)	1,391 (67.2)	1,433 (68.3)	1,659 (73.2)	1,647 (74.0)	1,679 (75.6)	3.2 (1.6 to 4.8)
35–44	1,158	1,125	1,106	1,113	1,071	−1.6 (−3.5 to 0.2)	806 (69.6)	806 (71.7)	807 (73.0)	837 (75.2)	869 (81.1)	3.6 (1.4 to 5.9)
45–54	594	648	569	597	590	−1.0 (−3.5 to 1.5)	416 (70.0)	463 (71.4)	437 (76.8)	455 (76.2)	464 (78.7)	3.0 (0.1 to 6.1)
≥55	191	205	199	213	231	4.4 (0.0 to 9.0)	152 (79.9)	153 (74.4)	151 (75.9)	166 (78.0)	177 (76.6)	−0.3 (−5.1 to 4.7)
Subtotal	**5,366**	**5,482**	**5,473**	**5,417**	**5,331**	**−0.2 (−1.1 to 0.6)**	**3,616 (67.4)**	**3,787 (69.1)**	**3,970 (72.5)**	**3,967 (73.2)**	**4,089 (76.7)**	**3.2 (2.2 to 4.3)**
Other race/ethnicity												
Age at diagnosis (yrs)												
13–19	67	75	65	63	53	−6.0 (−13.0 to 1.5)	39 (58.0)	44 (58.6)	46 (70.9)	48 (76.3)	43 (81.0)	9.9 (−0.2 to 20.9)
20–24	332	337	305	286	215	−9.2 (−12.4 to −5.8)	203 (61.1)	237 (70.4)	215 (70.4)	209 (73.0)	170 (79.1)	5.6 (1.0 to 10.4)
25–34	568	613	605	528	499	−3.9 (−6.4 to −1.3)	408 (71.9)	457 (74.6)	444 (73.3)	405 (76.8)	376 (75.2)	1.2 (−1.9 to 4.4)
35–44	313	269	278	259	216	−7.4 (−10.8 to −3.8)	233 (74.4)	202 (75.1)	218 (78.3)	200 (77.3)	175 (80.7)	1.9 (−2.4 to 6.5)
45–54	199	181	157	179	122	−8.9 (−13.2 to −4.4)	150 (75.3)	138 (76.4)	122 (78.0)	142 (79.4)	106 (86.4)	3.0 (−2.5 to 8.8)
≥55	58	70	87	60	65	0.5 (−6.8 to 8.3)	37 (64.3)	52 (74.4)	65 (74.3)	45 (75.9)	54 (83.9)	5.5 (−3.7 to 15.6)
Subtotal	**1,537**	**1,544**	**1,495**	**1,375**	**1,170**	**−6.1 (−7.7 to −4.6)**	**1,070 (69.6)**	**1,130 (73.2)**	**1,108 (74.1)**	**1,050 (76.3)**	**923 (78.9)**	**3.0 (1.0 to 5.0)**
White												
Age at diagnosis (yrs)												
13–19	105	97	121	121	115	4.0 (−1.9 to 10.3)	56 (53.4)	64 (66.0)	79 (65.2)	77 (63.7)	78 (68.1)	4.4 (−3.1 to 12.5)
20–24	753	671	637	675	560	−5.6 (−7.9 to −3.3)	461 (61.2)	451 (67.3)	417 (65.4)	503 (74.6)	405 (72.2)	4.6 (1.5 to 7.7)
25–34	1,700	1,740	1,617	1,586	1,605	−2.1 (−3.6 to −0.6)	1,179 (69.3)	1,261 (72.4)	1,178 (72.8)	1,154 (72.8)	1,246 (77.6)	2.4 (0.5 to 4.2)
35–44	1,213	1,072	943	905	888	−7.8 (−9.6 to −6.0)	912 (75.2)	809 (75.4)	702 (74.4)	702 (77.5)	694 (78.2)	1.0 (−1.2 to 3.3)
45–54	1,178	1,082	1,034	888	791	−9.3 (−11.1 to −7.5)	904 (76.7)	832 (76.9)	824 (79.7)	689 (77.6)	628 (79.4)	0.8 (−1.5 to 3.1)
≥55	610	585	621	573	607	−0.3 (−2.8 to 2.3)	450 (73.9)	450 (77.0)	479 (77.1)	438 (76.4)	470 (77.4)	0.9 (−2.0 to 3.8)
Subtotal	**5,559**	**5,247**	**4,973**	**4,748**	**4,566**	**−4.8 (−5.7 to −4.0)**	**3,961 (71.3)**	**3,867 (73.7)**	**3,678 (74.0)**	**3,564 (75.1)**	**3,521 (77.1)**	**1.8 (0.7 to 2.8)**
Total	**19,789**	**19,586**	**19,254**	**18,614**	**18,034**	**−2.3 (−2.8 to −1.9)**	**13,097 (66.2)**	**13,308 (67.9)**	**13,538 (70.3)**	**13,362 (71.8)**	**13,414 (74.4)**	**2.9 (2.4 to 3.5)**

Abbreviations: CI = confidence interval; EAPC = estimated annual percentage change.

[*] Men who have sex with men were persons whose sex at birth was male and whose transmission category was either male-to-male sexual contact or male-to-male sexual contact and injection drug use.

[†] Data are based on residence at time of diagnosis of HIV infection. The 33 jurisdictions were Alabama, Alaska, California, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

[§] Data have been statistically adjusted by using multiple imputation to account for unknown or missing transmission category; therefore, values might not sum to column subtotals and total.

[¶] EAPCs indicate the per-year change, on average, in the number of diagnoses of HIV infection or percentage linked to medical care. EAPC p-values <0.05 indicated statistically significant trends, whereas EAPC p-values ≥0.05 indicated no significant trend.

[**] Hispanics/Latinos might be of any race.

The percentage of all MSM who were linked to care within 1 month of diagnosis increased 2.9% per year, on average, from 2014 (66.2%) to 2018 (74.4%). Among Black MSM, the percentage linked to care increased 3.8% per year overall, and it increased among those aged 13–19, 20–24, and 25–34 years. It did not significantly change among those aged 35–44, 45–54, and ≥55 years. Among Hispanic MSM, the percentage linked to care increased 3.2% per year overall, and it increased among those aged 20–24, 25–34, 35–44, and 45–54 years. However, the percentage linked to care did not significantly change among those aged 13–19 and ≥55 years. Among White MSM, the percentage linked to care increased 1.8% per year overall, and it increased among those aged 20–24 and 25–34 years but did not significantly change among all other age groups.

The percentage of all MSM who achieved viral suppression within 6 months of diagnosis increased 6.8% per year, on average, from 2014 (51.1%) to 2018 (67.2%) (Table 2). Among Black MSM, the percentage who achieved viral suppression

TABLE 2. Viral suppression within 6 months of diagnosis among men who have sex with men,* by race/ethnicity and age — 33 jurisdictions,† United States, 2014–2018§

	No. (%)					EAPC¶ (95% CI)
Race/Ethnicity	**2014**	**2015**	**2016**	**2017**	**2018**	**2014–2018**
African American/Black						
Age at diagnosis (yrs)						
13–19	220 (38.4)	277 (45.2)	304 (51.3)	365 (60.9)	372 (63.7)	13.8 (9.7 to 17.9)
20–24	865 (38.2)	966 (44.7)	1,064 (51.0)	985 (52.9)	1,085 (60.8)	11.5 (9.3 to 13.8)
25–34	1,134 (43.2)	1,302 (47.7)	1,495 (52.4)	1,637 (57.0)	1,764 (61.7)	9.3 (7.5 to 11.1)
35–44	445 (48.1)	468 (51.4)	494 (54.4)	533 (58.6)	590 (63.2)	7.0 (4.1 to 10.0)
45–54	313 (50.1)	322 (52.2)	317 (54.3)	309 (59.4)	303 (59.5)	4.8 (1.2 to 8.6)
≥55	153 (48.2)	150 (53.9)	151 (52.1)	153 (49.3)	180 (60.4)	3.8 (−1.1 to 9.1)
Subtotal	**3,130 (42.7)**	**3,485 (47.6)**	**3,826 (52.3)**	**3,982 (56.3)**	**4,294 (61.6)**	**9.4 (8.3 to 10.5)**
Hispanic/Latino**						
Age at diagnosis (yrs)						
13–19	112 (50.7)	128 (54.5)	127 (55.7)	135 (55.5)	145 (65.3)	5.4 (−0.2 to 11.4)
20–24	533 (47.2)	621 (53.1)	639 (57.7)	641 (62.4)	642 (64.5)	8.1 (5.4 to 10.9)
25–34	1,088 (52.5)	1,200 (57.2)	1,403 (62.0)	1,439 (64.7)	1,592 (71.7)	7.7 (5.9 to 9.6)
35–44	647 (55.9)	687 (61.1)	663 (60.0)	727 (65.3)	775 (72.3)	6.1 (3.6 to 8.6)
45–54	338 (56.9)	395 (60.9)	360 (63.2)	384 (64.4)	403 (68.4)	4.3 (1.0 to 7.7)
≥55	111 (58.0)	121 (58.8)	139 (69.8)	131 (61.6)	151 (65.4)	2.8 (−2.6 to 8.5)
Subtotal	**2,829 (52.7)**	**3,152 (57.5)**	**3,330 (60.9)**	**3,456 (63.8)**	**3,708 (69.6)**	**6.8 (5.6 to 8.0)**
Other race/ethnicity						
Age at diagnosis (yrs)						
13–19	31 (46.0)	35 (46.5)	35 (53.9)	43 (68.2)	37 (69.6)	13.2 (1.8 to 25.8)
20–24	146 (44.0)	199 (59.2)	176 (57.7)	188 (65.7)	166 (77.2)	12.7 (7.4 to 18.3)
25–34	322 (56.7)	393 (64.1)	396 (65.4)	371 (70.3)	350 (70.1)	5.2 (1.8 to 8.8)
35–44	202 (64.5)	166 (61.8)	203 (73.0)	192 (74.0)	156 (72.2)	4.2 (−0.5 to 9.1)
45–54	119 (59.5)	121 (66.7)	106 (68.0)	118 (65.7)	95 (77.9)	5.1 (−0.9 to 11.6)
≥55	32 (55.2)	43 (62.2)	49 (56.1)	37 (62.6)	46 (70.5)	5.2 (−4.9 to 16.4)
Subtotal	**851 (55.4)**	**957 (62.0)**	**964 (64.5)**	**949 (69.0)**	**850 (72.6)**	**6.7 (4.5 to 9.0)**
White						
Age at diagnosis (yrs)						
13–19	50 (47.7)	56 (57.9)	69 (57.0)	79 (65.3)	81 (70.7)	9.5 (1.3 to 18.3)
20–24	391 (51.9)	403 (60.0)	373 (58.6)	450 (66.7)	382 (68.2)	6.8 (3.5 to 10.2)
25–34	964 (56.7)	1,098 (63.1)	1,035 (64.0)	1,058 (66.7)	1,147 (71.4)	5.3 (3.3 to 7.3)
35–44	748 (61.7)	693 (64.6)	632 (67.0)	620 (68.5)	648 (73.0)	4.0 (1.6 to 6.5)
45–54	754 (64.1)	708 (65.4)	725 (70.2)	614 (69.2)	567 (71.6)	2.9 (0.4 to 5.4)
≥55	390 (64.0)	378 (64.6)	404 (65.0)	397 (69.3)	433 (71.4)	2.9 (−0.2 to 6.2)
Subtotal	**3,297 (59.3)**	**3,335 (63.6)**	**3,239 (65.1)**	**3,219 (67.8)**	**3,258 (71.4)**	**4.4 (3.3 to 5.6)**
Total	**10,107 (51.1)**	**10,928 (55.8)**	**11,359 (59.0)**	**11,607 (62.4)**	**12,110 (67.2)**	**6.8 (6.2 to 7.4)**

Abbreviations: CI = confidence interval; EAPC = estimated annual percentage change; HIV = human immunodeficiency virus.

* Men who have sex with men were persons whose sex at birth was male and whose transmission category was either male-to-male sexual contact or male-to-male sexual contact and injection drug use.

† Data are based on residence at time of diagnosis of HIV infection. The 33 jurisdictions were Alabama, Alaska, California, District of Columbia, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

§ Data have been statistically adjusted by using multiple imputation to account for unknown or missing transmission category; therefore, values might not sum to column subtotals and total.

¶ EAPCs indicate the per-year change, on average, in the percentage virally suppressed. EAPC p-values <0.05 indicated statistically significant trends, whereas EAPC p-values ≥0.05 indicated no significant trend.

** Hispanics/Latinos can be of any race.

increased 9.4% per year overall, and it increased among those aged 13–19, 20–24, 25–34, 35–44, and 45–54 years. The percentage virally suppressed did not significantly change among Black MSM aged ≥55 years. Among Hispanic MSM, the percentage who were virally suppressed increased 6.8% per year overall, and it increased among those aged 20–24, 25–34, 35–44, and 45–54 years; it did not significantly change among those aged 13–19 or ≥55 years. The percentage of White MSM who achieved viral suppression increased 4.4% per year overall, and it increased among those aged 13–19, 20–24, 25–34, 35–44, and 45–54 years; it did not significantly change among those aged ≥55 years.

Summary

What is already known about this topic?

Men who have sex with men (MSM) account for two thirds of annual diagnoses of human immunodeficiency virus (HIV) infection. Increased linkage to care and viral suppression among MSM with HIV infection can prevent transmission.

What is added by this report?

During 2014–2018, diagnoses of HIV infection among MSM in 33 jurisdictions decreased 2.3% per year overall, but Black, Hispanic/Latino, and younger (aged 13–19 years) MSM experienced a small or no decrease. Linkage to care within 1 month and viral suppression within 6 months of diagnosis increased overall (2.9% and 6.8% per year, respectively) and among all racial/ethnic groups.

What are the implications for public health practice?

Intensified prevention efforts for Black, Hispanic/Latino, and younger MSM are needed.

Discussion

Annual diagnoses of HIV infection among MSM in the 33 analyzed jurisdictions decreased during 2014–2018. However, the rate of annual decrease among Black MSM (1.3%) was less than that among White MSM (4.8%), diagnoses did not significantly change among Hispanic MSM or any MSM aged 13–19 years, and diagnoses increased among Black and Hispanic MSM aged 25–34 years. In addition, more diagnoses occurred overall among Black MSM than among other racial/ethnic MSM groups. CDC recently reported that racial/ethnic disparities in estimated rates of diagnosis of HIV infection among MSM increased during 2010–2015, and Black MSM had an HIV diagnosis rate that was 9.3 times that of White MSM in 2015 (*5*). These data warrant intensified prevention efforts for Black and Hispanic MSM, especially those aged 25–34 years, and all MSM aged 13–19 years.

Increased linkage to care promotes viral suppression, which effectively prevents HIV transmission. During 2014–2018, linkage to care within 1 month and viral suppression within 6 months of diagnosis increased (2.9% and 6.8% per year, respectively). Increases were highest among Black and Hispanic MSM. However, among all MSM included in the 2018 analysis, only 67.2% achieved viral suppression within 6 months of diagnosis. Moreover, during 2018, proportionally fewer Black MSM were linked to care and achieved viral suppression than did other racial/ethnic MSM groups. Limited health care access, housing instability, poverty, and systemic racism commonly impede linkage to care and viral suppression (*6*,*7*). Addressing these factors might improve outcomes.

The findings in this report are subject to at least two limitations. First, only 33 of the 51 U.S. jurisdictions had complete laboratory reporting of CD4 and viral load results during 2014–2018. Therefore, data do not represent all diagnoses of HIV infection among MSM during 2014–2018. Second, using EAPCs with p-values <0.05 to identify trends might result in clinically meaningful temporal changes being deemed as having no significant change.

Providing antiretroviral therapy for both HIV preexposure prophylaxis and treatment can prevent HIV infection and, subsequently, the need for linkage to care and viral suppression among MSM (*8*,*9*). However, during 2017, Black and Hispanic MSM who had discussed preexposure prophylaxis with a medical provider were less likely than were White MSM to receive prescriptions for preexposure prophylaxis in 23 jurisdictions (*8*). Providers' implicit racial biases toward Blacks and Hispanics often promote treatment nonadherence (*10*), which inhibits viral suppression (*9*). Therefore, interventions might need to address systemic racism and concomitant racial biases within health care systems (*7*). CDC encourages use of interventions that address social determinants of health[¶] that underlie the high risk for HIV infection among MSM of all races/ethnicities and ages. Such interventions might help prevent HIV infection and eliminate racial/ethnic disparities in HIV infection among MSM.

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

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Public Awareness of Invasive Fungal Diseases — United States, 2019

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Fungal diseases range from minor skin and mucous membrane infections to life-threatening disseminated disease. The estimated yearly direct health care costs of fungal diseases exceed $7.2 billion (*1*). These diseases are likely widely underdiagnosed (*1*,*2*), and improved recognition among health care providers and members of the public is essential to reduce delays in diagnoses and treatment. However, information about public awareness of fungal diseases is limited. To guide public health educational efforts, a nationally representative online survey was conducted to assess whether participants had ever heard of six invasive fungal diseases. Awareness was low and varied by disease, from 4.1% for blastomycosis to 24.6% for candidiasis. More than two thirds (68.9%) of respondents had never heard of any of the diseases. Female sex, higher education, and increased number of prescription medications were associated with awareness. These findings can serve as a baseline to compare with future surveys; they also indicate that continued strategies to increase public awareness about fungal diseases are needed.

Porter Novelli's Fall 2019 ConsumerStyles survey was used to ask, "Have you ever heard of the following infections?" Possible answers were aspergillosis, *Candida* infection or candidiasis, coccidioidomycosis ("Valley fever"), *Cryptococcus* infection, blastomycosis, histoplasmosis, or none of these. The online survey was sent to a nationally representative sample of 4,677 participants aged ≥18 years who were part of the market research and consulting firm Ipsos' KnowledgePanel. Panel members were randomly recruited by mail using address-based probability-based sampling and were provided with a laptop or tablet computer and Internet access if needed; 3,624 completed the survey, for a response rate of 77.5%. Data were weighted to adjust for sampling design and nonresponse to be representative of the U.S. adult population based on the Consumer Population Survey benchmarks for sex, age, race/ethnicity, education, U.S. Census region, household income, home ownership status, metropolitan area status, and Internet access.

Descriptive and bivariate analyses were used to identify potential factors associated with awareness using simple weighted logistic regression of awareness of each fungal disease by various sociodemographic and health care utilization characteristics. Multivariate weighted logistic regression was estimated to derive adjusted odds ratios (AORs); p-values <0.05 were considered statistically significant. Measures of goodness of fit assessed included Akaike Information Criterion, Max-scaled R-squared, and McFadden's pseudo R-squared. All analyses were conducted using SAS survey procedures (version 9.4; SAS Institute). No personally identifying information was included in the data file provided to CDC.*

Fewer than one third of participants (31.1%) had ever heard of any of the fungal diseases listed on the survey. Awareness was lowest for blastomycosis (4.1%), followed by aspergillosis (5.1%), histoplasmosis (7.5%), coccidioidomycosis (7.6%), cryptococcosis (9.0%), and candidiasis (24.6%) (Table 1). Persons aware of one fungal disease were more likely to be aware of others (i.e., awareness was correlated among diseases, p<0.001). Female sex, higher educational level, and increased number of prescription medications were associated with awareness in the multivariable models for all 6 fungal diseases (Table 2). Specifically, females were more than three times as likely to be aware of candidiasis (AOR = 3.40, 95% CI = 2.8–4.1, p<0. 001) compared with males. Each additional prescription medication was associated with 6%–11% increased odds of awareness (all p<0.01). Non-White or multiracial respondents had lower odds of awareness of candidiasis (AOR = 0.68, p<0.001) and coccidioidomycosis (AOR = 0.60, p<0.05) compared with White respondents. Residence in the West was associated with significantly higher odds of coccidioidomycosis awareness (AOR = 2.87, p<0.001) compared with residence in the Midwest. Likelihood of blastomycosis awareness was lower for respondents in the Northeast (AOR = 0.52, 95%CI = 0.29–0.91) and the South (AOR = 0.44, 95% CI = 0.27–0.72) than in the Midwest.

Discussion

Public awareness of fungal diseases is low, a concerning finding because these diseases are associated with substantial illness, death, and economic cost, although their true burden remains largely unquantified (*1*,*2*). Primary prevention of fungal diseases can be challenging, particularly for those acquired via inhalation from the natural environment. Therefore, awareness is critical to help prevent severe disease, because early diagnosis and treatment can prevent incorrect treatment and improve outcomes. For example, knowledge of coccidioidomycosis before seeking health care has been associated with faster diagnosis (*3*).

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* CDC licensed these data from Porter Novelli Public Services. Although Porter Novelli Public Services and its vendors are not subject to CDC IRB review, they do adhere to all professional standards and codes of conduct set forth by the Council of American Survey Research Organizations. Respondents are informed that their answers are being used for market research and they may refuse to answer any question at any time.

TABLE 1. Characteristics of respondents who reported ever having heard of certain fungal infections — Porter Novelli Fall ConsumerStyles Survey, United States, 2019

	Weighted no. (%)						
Characteristics	**Full sample**	**Aspergillosis**	***Candida* infection or candidiasis**	**Coccidioidomycosis (Valley fever)**	***Cryptococcus* infection**	**Blastomycosis**	**Histoplasmosis**
Total	**3,624 (100)**	**184 (5.1)**	**881 (24.6)**	**273 (7.6)**	**321 (9.0)**	**148 (4.1)**	**268 (7.5)**
Sex							
Male	1,756 (48.4)	69 (4.0)[†]	251 (14.4)*	114 (6.5)[†]	137 (7.9)[§]	66 (3.8)	107 (6.2)[†]
Female	1,868 (51.6)	115 (6.2)	631 (34.1)	159 (8.6)	184 (10)	82 (4.5)	161 (8.7)
Age (yrs)							
18–29	771 (21.3)	26 (3.4)	119 (15.8)*	44 (5.8)[†]	56 (7.4)	21 (2.8)	36 (4.8)*
30–44	894 (24.7)	44 (5.0)	202 (22.9)*	56 (6.3)[†]	80 (9.0)	38 (4.3)	52 (5.9)*
45–59	906 (25.0)	51 (5.7)	244 (27.1)*	71 (7.8)[†]	93 (10.3)	44 (4.9)	71 (7.9)*
≥60	1,052 (29.0)	63 (6.0)	316 (30.2)*	103 (9.8)[†]	93 (8.9)	45 (4.3)	109 (10.4)*
Race							
White	2,815 (77.7)	148 (5.3)	720 (25.9)[†]	226 (8.1)[§]	253 (9.1)	119 (4.3)	223 (8.0)[§]
Non-White or multiracial	809 (22.3)	36 (4.5)	162 (20.2)[†]	47 (5.8)[§]	68 (8.5)	30 (3.7)	45 (5.7)[§]
Ethnicity							
Non-Hispanic	3038 (83.8)	162 (5.4)	739 (24.6)	226 (7.5)	273 (9.1)	134 (4.5)[§]	240 (8.0)[†]
Hispanic	586 (16.2)	22 (3.8)	142 (24.3)	47 (8.0)	48 (8.2)	14 (2.4)[§]	28 (4.8)[†]
Education							
Less than high school	390 (10.7)	11 (2.9)*	48 (12.4)*	28 (7.4)[†]	13 (3.4)*	11 (2.9)[†]	21 (5.6)*
High school	1,038 (28.7)	28 (2.8)*	199 (19.5)*	46 (4.5)[†]	56 (5.5)*	22 (2.1)[†]	46 (4.5)*
Some college	1,024 (28.3)	51 (5.0)*	268 (26.4)*	84 (8.2)[†]	102 (10.0)*	44 (4.3)[†]	76 (7.5)*
Bachelor's degree or higher	1,172 (32.3)	94 (8.0)*	367 (31.6)*	115 (9.9)[†]	150 (12.9)*	72 (6.2)[†]	124 (10.7)*
Have a child aged <18 years	982 (27.1)	38 (3.9)[§]	248 (25.6)	67 (6.9)	90 (9.3)	40 (4.1)	58 (6.0)[§]
MSA category							
Nonmetropolitan	491 (13.6)	18 (3.7)	104 (21.4)	24 (5.0)[†]	28 (5.8)[†]	21 (4.3)	38 (7.9)
Metropolitan	3133 (86.4)	166 (5.4)	778 (25.1)	249 (8.0)[†]	293 (9.5)[†]	128 (4.1)	230 (7.4)
Census region[¶]							
Northeast	643 (17.7)	34 (5.3)	170 (26.9)	29 (4.5)*	46 (7.3)	23 (3.6)*	33 (5.1)[†]
Midwest	755 (20.8)	39 (5.2)	187 (25.0)	52 (7.0)*	69 (9.2)	54 (7.2)*	78 (10.4)[†]
South	1,367 (37.7)	67 (4.9)	320 (23.6)	56 (4.2)*	132 (9.7)	37 (2.7)*	103 (7.6)[†]
West	860 (23.7)	44 (5.2)	205 (24.2)	136 (16.0)*	75 (8.8)	34 (4.1)*	55 (6.5)[†]
Characteristic	**Mean (range)**	**Mean (standard error)**					
Age in years	47 (18–94)	55 (1.0)§	56 (0.5)*	57 (0.9)[†]	54 (0.8)	54 (1.2)	57 (0.9)[†]
No. of health care provider visits in the last 12 mos	5 (0–368)	6 (0.6)	6 (0.2)	6 (0.5)	6 (0.4)	5 (0.6)	6 (0.5)
No. of prescription medications	2 (0–36)	3 (0.2)[†]	3 (0.1)*	3 (0.2)[†]	3 (0.2)[†]	3 (0.3)[†]	3 (0.2)*
Household income**	$72,106 (<$5,000 to ≥$250.000)	$83,971 ($3,972)[†]	$77,999 ($2,449)*	$76,925 ($3,137)[†]	$78,699 ($2,960)[†]	$80,397 ($4,621)[†]	$82,051 ($2,457)[†]

Abbreviation: MSA = metropolitan statistical area.

[*] p<0.001.

[†] p<0.005.

[§] p<0.10 for F-test. P value for the F-test for significant effect of variable overall, equivalent to t-test for dichotomous and continuous variables.

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

[**] Household income means and standard errors were mapped from the following income categories: 1 = <$5,000; 2 = $5,000 to $7,499; 3 = $7,500 to $9,999; 4 = $10,000 to $12,499; 5 = $12,500 to $14,999; 6 = $15,000 to $19,999; 7 = $20,000 to $24,999; 8 = $25,000 to $29,999; 9 = $30,000 to $34,999; 10 = $35,000 to $39,999; 11 = $40,000 to $49,999; 12 = $50,000 to $59,999; 13 = $60,000 to $74,999; 14 = $75,000 to $84,999; 15 = $85,000 to $99,999; 16 = $100,000 to $124,999; 17 = $125,000 to $149,999; 18 = $150,000 to $174,999; 19 = $175,000 to $199,999; 20 = $200,000 to $249,999; 21 = ≥$250,000.

TABLE 2. Adjusted odds ratios (AORs) for sociodemographic and health care utilization characteristics associated with awareness of fungal diseases — Porter Novelli Fall ConsumerStyles Survey, United States, 2019

	AOR (95% CI)					
Characteristic	**Aspergillosis**	***Candida*** **infection or candidiasis**	**Coccidioidomycosis (Valley fever)**	***Cryptococcus*** **infection**	**Blastomycosis AOR**	**Histoplasmosis AOR**
Sex (female versus male)	1.67 (1.18–2.38)[†]	3.40 (2.8–4.13)*	1.53 (1.15–2.04)[†]	1.34 (1.02–1.75)[†]	1.15 (0.78–1.70)	1.51 (1.13–2.02)[†]
Age in years	1.00 (0.99–1.01)	1.01 (1.01–1.02)*	1.01 (1.00–1.02)	1.00 (0.99–1.01)	1.00 (0.99–1.01)	1.01 (1.00–1.02)
Race (non-White or multiracial versus White)	0.75 (0.45–1.25)	0.68 (0.52–0.89)[†]	0.60 (0.39–0.91)[†]	0.84 (0.58–1.21)	0.74 (0.41–1.33)	0.63 (0.39–1.01)[§]
Ethnicity (Hispanic versus non-Hispanic)	1.04 (0.60–1.82)	1.38 (1.01–1.87)[†]	0.89 (0.55–1.43)	1.20 (0.77–1.89)	0.65 (0.31–1.37)	0.78 (0.47–1.32)
Education (referent = bachelor's degree or higher)						
Less than high school	0.33 (0.13–0.82)[†]	0.23 (0.13–0.41)*	0.62 (0.30–1.30)	0.22 (0.10–0.47)*	0.52 (0.20–1.34)	0.59 (0.29–1.17)
High school	0.31 (0.18–0.54)*	0.40 (0.3–0.52)*	0.40 (0.25–0.63)*	0.37 (0.25–0.54)*	0.31 (0.17–0.56)*	0.39 (0.26–0.59)*
Some college	0.48 (0.32–0.73)[†]	0.65 (0.52–0.82)*	0.73 (0.53–1.02)	0.67 (0.48–0.92)[†]	0.64 (0.42–0.98)[†]	0.64 (0.45–0.91)[†]
Have child aged <18 yrs	0.78 (0.49–1.23)	1.21 (0.95–1.56)	1.04 (0.70–1.54)	1.06 (0.76–1.48)	0.94 (0.59–1.52)	0.85 (0.57–1.28)
No. of health care provider visits in the last 12 months	0.99 (0.97–1.01)	1 (0.99–1.00)	0.99 (0.98–1.01)	1 (0.99–1.00)	0.99 (0.98–1.01)	1.00 (0.99–1.01)
No. of prescription medications	1.11 (1.03–1.19)[†]	1.06 (1.03–1.10)[†]	1.08 (1.02–1.15)[†]	1.11 (1.05–1.16)*	1.09 (1.02–1.16)[†]	1.10 (1.04–1.16)[†]
Household income[¶]	1.01 (0.96–1.06)	0.99 (0.97–1.02)	1.00 (0.96–1.04)	1.00 (0.97–1.04)	1.01 (0.96–1.07)	1.03 (1–1.07) [§]
MSA category (non-MSA versus MSA)	0.80 (0.45–1.40)	0.90 (0.68–1.19)	0.74 (0.46–1.20)	0.69 (0.45–1.06)[§]	1.17 (0.72–1.91)	1.13 (0.78–1.65)
Census region**						
Northeast	1.17 (0.67–2.04)	1.17 (0.87–1.56)	0.67 (0.40–1.13)	0.87 (0.56–1.35)	0.52 (0.29–0.91)[†]	0.51 (0.34–0.79)[†]
Midwest	Ref	Ref	Ref	Ref	Ref	Ref
South	1.07 (0.65–1.78)	0.99 (0.77–1.28)	0.58 (0.36–0.93)[†]	1.15 (0.79–1.67)	0.44 (0.27–0.72)[†]	0.79 (0.56–1.13)
West	1.10 (0.65–1.88)	1.03 (0.78–1.36)	2.87 (1.94–4.25)*	1.02 (0.68–1.53)	0.69 (0.42–1.12)	0.72 (0.47–1.10)
Max-rescaled R squared	0.06	0.15	0.12	0.06	0.06	0.07

Abbreviations: CI = 95% confidence interval; MSA = metropolitan statistical area; Ref = referent.

* p<0.001.

[†] p<0.05.

[§] p<0.10.

[¶] Household income included 21 categories, ranging from <$5,000 to >$250,000 yearly. AOR is therefore interpreted as the effect on odds of awareness associated with an increase in income from the mean category ($60,000–$74,999), to the next highest category ($75,000–$84,999).

Previous analyses show that coccidioidomycosis awareness is high in Arizona (97%) (*4*) and lower in California (42%) (California Department of Public Health, unpublished data, 2020). More than 95% of cases occur in these two states, with most cases concentrated in Arizona's Sonoran Desert and California's southern San Joaquin Valley (*5*). The results suggest much lower levels of awareness in the West (of which Arizona and California account for 87% of the population) than previous studies (*4,5*), possibly because of methodologic differences. The lower awareness of coccidioidomycosis among non-White and multiracial respondents is noteworthy given that Black race and Filipino ethnicity are risk factors for severe or disseminated disease. Focused messaging could be useful for these groups (*6*).

Public awareness of histoplasmosis and blastomycosis has not been studied, although public health surveillance shows that 15% of patients with histoplasmosis reported awareness of the disease before their diagnosis, and many were aware because they worked in the health care field (*7*). In 2018, the United States had approximately 5.3 million health diagnosing and treating practitioners nationwide (1.6% of the U.S. population). Some survey respondents might have been familiar with fungal diseases through their occupations; this is supported by the correlation between awareness of each disease. Low blastomycosis awareness is consistent with the disease being considerably less common than coccidioidomycosis and histoplasmosis. Notably, regional awareness patterns for blastomycosis and coccidioidomycosis corresponded to geographic areas where they are more prevalent. Nonetheless, more widespread awareness is essential because these geographic areas appear to be wider than previously appreciated (*8*), and travel-associated cases occur regularly.

Candidiasis can include severe bloodstream infections and other invasive disease, as well as skin and mucous membrane infections. Higher awareness about candidiasis compared with other diseases in this analysis is not surprising given that vulvovaginal *Candida* infections are common, resulting in nearly 1.4 million outpatient visits per year nationwide (*1*). Nonetheless, the fact that only one third of women had heard of candidiasis contrasts with the commonly cited (but not well documented) estimate that 75% of women have at least one vaginal *Candida* infection during their lifetime (*9*),

Summary

What is already known about this topic?

Invasive fungal diseases cause considerable morbidity and mortality. Awareness is essential for early diagnosis and treatment.

What is added by this report?

Public awareness of invasive fungal diseases was low in a 2019 survey of 3,624 adults; approximately two thirds of respondents had never heard of any of the diseases on the survey.

What are the implications for public health practice?

These results are the first estimates of nationwide public awareness of fungal diseases and serve as a baseline for future studies to assess knowledge gaps. Continued educational efforts to improve awareness are needed.

suggesting that many women might know this condition by another name. Future studies might examine familiarity with the more common term “yeast infection.”

In general, mold appears to be well recognized as a potential health risk; for example, 96% of residents surveyed in a posthurricane setting answered “yes” to “do you think mold can make people sick?” (*10*). However, no previous evaluations of awareness about nonallergic health conditions from mold, specifically invasive mold infections, the most common of which is aspergillosis, could be found. Although an estimated 15,000 U.S. hospitalizations occur annually with aspergillosis (*1*), typically involving severe illness, the disease might not be widely known because invasive aspergillosis most commonly affects severely immunocompromised persons. This is supported by the finding of the association between awareness and increasing number of prescription medications, a proxy for health status.

The findings in this report are subject to at least four limitations. First, the data were self-reported. The extent, accuracy, and source of participants’ knowledge could not be determined. Second, no information was available about participants’ health literacy, although greater awareness at higher educational levels was apparent. Third, as shown by the goodness of fit measures, a great deal of the variation in awareness of these fungal diseases remains to be explained, and some might be idiosyncratic based on experiences of family or friends with these diseases. Finally, information about risk factors such as immunosuppression, environmental exposures, and occupation was not available but could help public health and health care professionals develop targeted prevention messages to groups at high risk.

These first nationally representative estimates of public fungal disease awareness demonstrate major gaps, indicating a need for continued efforts to strengthen education messages, particularly for groups at higher risk and those with lower educational attainment. These data also provide a baseline for future studies to evaluate fungal disease knowledge, attitudes, and behaviors in more detail.

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Characteristics and Maternal and Birth Outcomes of Hospitalized Pregnant Women with Laboratory-Confirmed COVID-19 — COVID-NET, 13 States, March 1–August 22, 2020

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Pregnant women might be at increased risk for severe coronavirus disease 2019 (COVID-19) (*1*,*2*). The COVID-19-Associated Hospitalization Surveillance Network (COVID-NET) (*3*) collects data on hospitalized pregnant women with laboratory-confirmed SARS-CoV-2, the virus that causes COVID-19; to date, such data have been limited. During March 1–August 22, 2020, approximately one in four hospitalized women aged 15–49 years with COVID-19 was pregnant. Among 598 hospitalized pregnant women with COVID-19, 54.5% were asymptomatic at admission. Among 272 pregnant women with COVID-19 who were symptomatic at hospital admission, 16.2% were admitted to an intensive care unit (ICU), and 8.5% required invasive mechanical ventilation. During COVID-19–associated hospitalizations, 448 of 458 (97.8%) completed pregnancies resulted in a live birth and 10 (2.2%) resulted in a pregnancy loss. Testing policies based on the presence of symptoms might miss COVID-19 infections during pregnancy. Surveillance of pregnant women with COVID-19, including those with asymptomatic infections, is important to understand the short- and long-term consequences of COVID-19 for mothers and newborns. Identifying COVID-19 in women during birth hospitalizations is important to guide preventive measures to protect pregnant women, parents, newborns, other patients, and hospital personnel. Pregnant women and health care providers should be made aware of the potential risks for severe COVID-19 illness, adverse pregnancy outcomes, and ways to prevent infection.

COVID-NET conducts population-based surveillance for laboratory-confirmed COVID-19–associated hospitalizations in 14 states encompassing 99 counties* (*3*). Thirteen states (California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah) contributed data to this report. Residents of the predefined surveillance catchment area who had a positive molecular test for SARS-CoV-2 during hospitalization or up to 14 days before hospital admission were classified as having a COVID-19–associated hospitalization and were included in COVID-NET surveillance. Persons included in COVID-NET surveillance are referred to as having COVID-19 throughout this report. SARS-CoV-2 testing was performed at the discretion of health care providers or through facility policies dictating uniform or criteria-based testing of patients upon admission. Trained surveillance officers performed medical chart abstractions for a convenience sample of hospitalizations using a standardized case report form. This analysis included women aged 15–49 years who were pregnant at hospital admission. Descriptive statistics were calculated for hospitalized pregnant women with complete

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* Counties in COVID-NET surveillance: *California* (Alameda, Contra Costa, and San Francisco); *Colorado* (Adams, Arapahoe, Denver, Douglas, and Jefferson); *Connecticut* (Middlesex and New Haven); *Georgia* (Clayton, Cobb, DeKalb, Douglas, Fulton, Gwinnett, Newton, and Rockdale); *Iowa* (one county); *Maryland* (Allegany, Anne Arundel, Baltimore, Baltimore City, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, St. Mary's, Somerset, Talbot, Washington, Wicomico, and Worcester); *Michigan* (Clinton, Eaton, Genesee, Ingham, and Washtenaw); *Minnesota* (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington); *New Mexico* (Bernalillo, Chaves, Doña Ann, Grant, Luna, San Juan, and Santa Fe); *New York* (Albany, Columbia, Genesee, Greene, Livingston, Monroe, Montgomery, Ontario, Orleans, Rensselaer, Saratoga, Schenectady, Schoharie, Wayne, and Yates); *Ohio* (Delaware, Fairfield, Franklin, Hocking, Licking, Madison, Morrow, Perry, Pickaway, and Union); *Oregon* (Clackamas, Multnomah, and Washington); *Tennessee* (Cheatham, Davidson, Dickson, Robertson, Rutherford, Sumner, Williamson, and Wilson); and *Utah* (Salt Lake).

chart review and discharge disposition (i.e., discharged or died during hospitalization). Women with one or more signs or symptoms included on the COVID-NET case report form (*3*) at the time of hospital admission were classified as symptomatic. Birth outcomes were described for pregnancies completed during a COVID-19–associated hospitalization. Reason for hospital admission was collected starting in June. Data were analyzed using SAS software (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[†] Sites obtained approval for COVID-NET surveillance from their state and local institutional review boards, as required.

During March 1–August 22, 2020, COVID-NET identified 7,895 hospitalized women aged 15–49 years with COVID-19; discharge disposition was determined, and chart review was completed for 2,318 (29.4%) (Figure 1). Among 2,255 (97.3%) women with information about pregnancy status, 598 (26.5%) were pregnant, with median age 29 years. Among 577 (96.5%) pregnant women with reported race and ethnicity, 42.5% were Hispanic or Latino (Hispanic), and 26.5% were non-Hispanic Black (Black) (Table).

Among 596 women with COVID-19 whose pregnancy trimester was known, 14 (2.3%), 61 (10.2%), and 521 (87.4%) were hospitalized during the first, second, and third trimesters,

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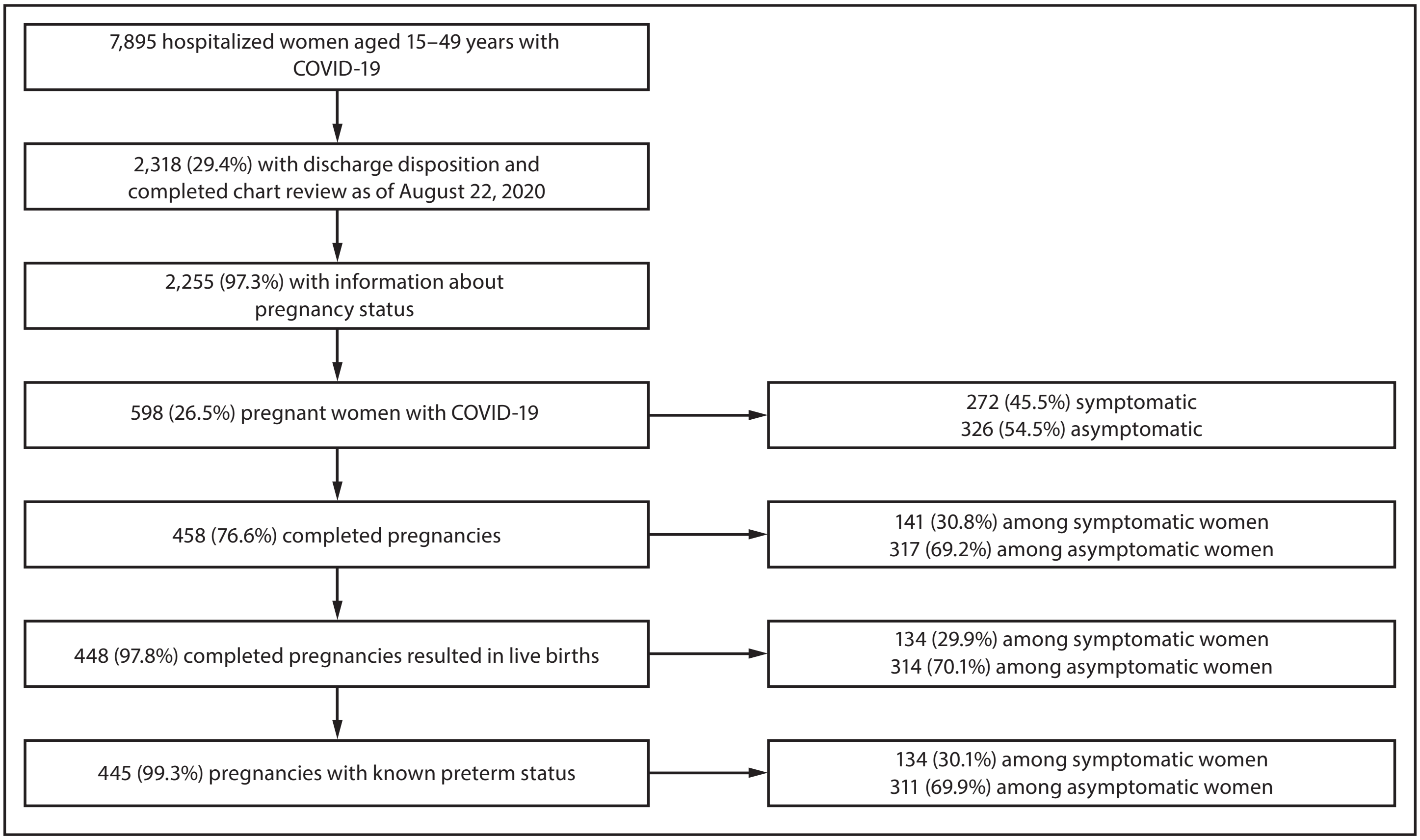
[†] 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE 1. Pregnancy status, signs and symptoms,[*] and birth outcomes[†,§,¶] among hospitalized women aged 15–49 years with COVID-19[**] — COVID-NET, 13 states,[††] March 1–August 22, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19-Associated Hospitalization Surveillance Network.

[*] Symptomatic women were those who had one or more signs or symptoms (fever/chills, cough, shortness of breath, muscle aches, nausea/vomiting, headache, sore throat, abdominal pain, chest pain, nasal congestion/rhinorrhea, decreased smell, decreased taste, diarrhea, upper respiratory illness/influenza-like illness, wheezing, hemoptysis/bloody sputum, conjunctivitis, rash, altered mental state, and seizure) at hospital admission; asymptomatic women did not have any of these signs or symptoms at admission.

[†] The 448 pregnancies resulting in live births resulted in the birth of 457 newborns; nine women had twins. Two newborns included in this category who were born alive subsequently died during the birth hospitalization.

[§] Ten completed pregnacies resulted in pregnancy losses. Pregnancy losses might include spontaneous abortion/miscarriage, therapeutic abortion, or stillbirth.

[¶] Pregnancies with known preterm status were those resulting in a live birth for which the gestational age at delivery was known. For three pregnancies resulting in live births, the gestational age at the time of birth was unknown.

[**] Women residing in the predefined COVID-NET surveillance catchment with a positive real-time reverse transcription–polymerase chain reaction (RT-PCR) test for SARS-CoV-2, during hospitalization or up to 14 days before admission. Among the 597 (99.8%) pregnant women for whom the COVID-19 test type was known, all had a positive RT-PCR test result; the COVID-19 test type for one pregnant woman with a positive COVID-19 test result was unknown.

[††] California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

TABLE. Characteristics and outcomes of hospitalized pregnant women with COVID-19 — COVID-NET, 13 states,[*] March 1–August 22, 2020

	no./No. (%)		
Characteristic	**Overall (N = 598)**	**Symptomatic at admission (n = 272)**	**Asymptomatic at admission (n = 326)**
Age group, yrs			
15–24	167/598 (27.9)	69/272 (25.4)	98/326 (30.1)
25–34	318/598 (53.2)	143/272 (52.6)	175/326 (53.7)
35–49	113/598 (18.9)	60/272 (22.1)	53/326 (16.3)
Race/Ethnicity (n = 577)			
Hispanic or Latino	245/577 (42.5)	131/265 (49.4)	114/312 (36.5)
American Indian or Alaska Native, non-Hispanic	8/577 (1.4)	4/265 (1.5)	4/312 (1.3)
Asian or Pacific Islander, non-Hispanic	72/577 (12.5)	37/265 (14.0)	35/312 (11.2)
Black, non-Hispanic	153/577 (26.5)	57/265 (21.5)	96/312 (30.8)
White, non-Hispanic	97/577 (16.8)	35/265 (13.2)	62/312 (19.9)
Multiracial	2/577 (0.3)	1/265 (0.4)	1/312 (0.3)
Pregnancy trimester at hospital admission (n = 596)			
First	14/596 (2.3)	13/271 (4.8)	1/325 (0.3)
Second	61/596 (10.2)	50/271 (18.5)	11/325 (3.4)
Third	521/596 (87.4)	208/271 (76.8)	313/325 (96.3)
Reason for hospital admission (n = 324)[†]			
COVID-19–related illness	61/324 (18.8)	59/122 (48.4)	2/202 (1.0)
Obstetrics/Labor and delivery	242/324 (74.7)	55/122 (45.1)	187/202 (92.6)
Other	21/324 (6.5)	8/122 (6.6)	13/202 (6.4)
Underlying conditions			
Any underlying condition or conditions	123/598 (20.6)	63/272 (23.2)	60/326 (18.4)
Asthma	49/598 (8.2)	30/272 (11.0)	19/326 (5.8)
Cardiovascular disease (excludes hypertension)	6/598 (1.0)	6/272 (2.2)	0/326 (—)
Chronic lung disease	6/598 (1.0)	6/272 (2.2)	0/326 (—)
Chronic metabolic disease	44/598 (7.4)	23/272 (8.5)	21/326 (6.4)
Diabetes mellitus[§]	23/598 (3.8)	15/272 (5.5)	8/326 (2.5)
Thyroid dysfunction	21/598 (3.5)	9/272 (3.3)	12/326 (3.7)
Hypertension	26/598 (4.3)	12/272 (4.4)	14/326 (4.3)
Liver disease	10/598 (1.7)	5/272 (1.8)	5/326 (1.5)
Neurologic conditions	12/598 (2.0)	6/272 (2.2)	6/326 (1.8)
Other underlying condition or conditions[¶]	7/598 (1.2)	3/272 (1.1)	4/326 (1.2)
Smoking			
Current smoker	13/598 (2.2)	8/272 (2.9)	5/326 (1.5)
Former smoker	41/598 (6.9)	20/272 (7.4)	21/326 (6.4)
Not a smoker/Unknown smoking history	544/598 (91.0)	244/272 (89.7)	300/326 (92.0)
Chest radiograph findings (n = 132)[**]			
Infiltrate/Consolidation	103/132 (78.0)	99/121 (81.8)	4/11 (36.4)
Bronchopneumonia/Pneumonia	39/132 (29.5)	39/121 (32.2)	0/11 (—)
Pleural effusion	2/132 (1.5)	1/121 (0.8)	1/11 (9.1)
Chest CT findings (n = 48)[††]			
Ground glass opacities	21/48 (43.8)	17/40 (42.5)	4/8 (50.0)
Infiltrate/Consolidation	31/48 (64.6)	28/40 (70.0)	3/8 (37.5)
Bronchopneumonia/pneumonia	17/48 (35.4)	15/40 (37.5)	2/8 (25.0)
Pleural effusion	7/48 (14.6)	5/40 (12.5)	2/8 (25.0)
COVID-19 investigational treatments			
Received treatment (not mutually exclusive)	52/598 (8.7)	43/272 (15.8)	9/326 (2.8)
Remdesivir	18/598 (3.0)	18/272 (6.6)	0/326 (—)
Azithromycin[§§]	25/598 (4.2)	24/272 (8.9)	1/326 (0.3)
Hydroxychloroquine	21/598 (3.5)	19/272 (7.0)	2/326 (0.6)
Convalescent plasma	9/598 (1.5)	9/272 (3.3)	0/326 (0)
Chloroquine	1/598 (0.2)	1/272 (0.4)	0/326 (0)
Other	17/598 (2.8)	10/272 (3.7)	7/326 (2.2)
Hospital length of stay, median (IQR), days	2 (2–3)	3 (2–5)	2 (2–3)
ICU admission	44/598 (7.4)	44/272 (16.2)	0/326 (—)
ICU length of stay, median (IQR), days (n = 41)[¶¶]	5 (2–13)	5 (2–13)	—

See table footnotes on the next page.

TABLE. (*Continued*) Characteristics and outcomes of hospitalized pregnant women with COVID-19 — COVID-NET, 13 states,[*] March 1–August 22, 2020

	no./No. (%)		
Characteristic	**Overall (N = 598)**	**Symptomatic at admission (n = 272)**	**Asymptomatic at admission (n = 326)**
Interventions			
Invasive mechanical ventilation[***]	23/598 (3.8)	23/272 (8.5)	0/326 (—)
BIPAP/CPAP[***]	3/598 (0.5)	3/272 (1.1)	0/326 (—)
High flow nasal cannula[***]	5/598 (0.8)	5/272 (1.8)	0/326 (—)
Systemic steroids	34/598 (5.7)	22/272 (8.1)	12/326 (3.7)
Vasopressors	32/598 (5.4)	22/272 (8.1)	10/326 (3.1)
ECMO	2/598 (0.3)	2/272 (0.7)	0/326 (—)
Renal replacement therapy or dialysis	2/598 (0.3)	2/272 (0.7)	0/326 (—)
New clinical discharge diagnoses (n = 554)[†††]			
Acute respiratory distress syndrome	15/554 (2.7)	14/251 (5.6)	1/303 (0.3)
Acute respiratory failure	41/554 (7.4)	41/251 (16.3)	0/303 (—)
Pneumonia	75/554 (13.5)	73/251 (29.1)	2/303 (0.7)
Sepsis	21/554 (3.8)	21/251 (8.4)	0/303 (—)
In-hospital death	2/598 (0.3)	2/272 (0.7)	0/326 (—)
Current pregnancy plurality			
Singleton pregnancy	567/598 (94.8)	253/272 (93.0)	314/326 (96.3)
Multiple pregnancy	14/598 (2.3)	8/272 (2.9)	6/326 (1.8)
Unknown	17/598 (2.8)	11/272 (4.0)	6/326 (1.8)
Pregnancy-associated conditions (n = 581)[§§§]			
Gestational diabetes	64/581 (11.0)	31/261 (11.9)	33/320 (10.3)
Hypertensive disorders of pregnancy[¶¶¶]	70/581 (12.0)	33/261 (12.6)	37/320 (11.6)
Intrauterine growth restriction	11/581 (1.9)	4/261 (1.5)	7/320 (2.2)
None	453/581 (78.0)	202/261 (77.4)	251/320 (78.4)
Pregnancy status at discharge or death			
Still pregnant	139/598 (23.2)	130/272 (47.8)	9/326 (2.8)
No longer pregnant	458/598 (76.6)	141/272 (51.8)	317/326 (97.2)
Unknown	1/598 (0.2)	1/272 (0.4)	0/326 (—)
Pregnancy outcomes (n = 458)			
Live birth[****]	448/458 (97.8)	134/141 (95.0)	314/317 (99.1)
Term live birth (≥37 wks)[††††]	389/445 (87.4)	103/134 (76.9)	286/311 (92.0)
Pre-term live birth (<37 wks)[††††]	56/445 (12.6)	31/134 (23.1)	25/311 (8.0)
Pregnancy loss[§§§§]	10/458 (2.2)	7/141 (5.0)	3/317 (0.9)
Pregnancy loss at <20 wks' gestation	4/458 (0.9)	3/141 (2.1)	1/317 (0.3)
Pregnancy loss at ≥20 wks' gestation	5/458 (1.1)	4/141 (2.8)	1/317 (0.3)
Pregnancy loss at unknown gestational age	1/458 (0.2)	0/141 (–)	1/317 (0.3)
In-hospital newborn death[¶¶¶¶]	2/448 (0.4)	2/134 (1.5)	0/314 (—)
Mode of delivery (n = 458)			
Vaginal	302/458 (65.9)	79/141 (56.0)	223/317 (70.3)
Cesarean section	151/458 (33.0)	59/141 (41.8)	92/317 (29.0)
Unknown	5/458 (1.1)	3/141 (2.1)	2/317 (0.6)

Abbreviations: BIPAP/CPAP = bilevel positive airway pressure/continuous positive airway pressure; COVID-19 = coronavirus disease 2019; CT = computed tomography; ECMO = extracorporeal membrane oxygenation; ICU = intensive care unit; IQR = interquartile range.

[*] California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

[†] Information not available for those hospitalized before June 2020.

[§] Does not include gestational diabetes.

[¶] One or more other underlying conditions, which included blood disorders/hemoglobinopathy (four), immunocompromised condition (two), renal disease (one), and rheumatologic/autoimmune/inflammatory condition (one).

[**] Among those who had a chest radiograph performed during hospitalization or ≤3 days before the hospital admission.

[††] Among those who had a chest CT/MRI performed during hospitalization or ≤3 days before the hospital admission.

[§§] If administered with another COVID-19 investigational treatment.

[¶¶] Includes women admitted to an ICU with a known ICU length of stay.

[***] Highest level of respiratory support for each woman who needed respiratory support.

[†††] Based on discharge summary diagnoses, for those who had discharge summaries.

[§§§] Among those with information on pregnancy-associated conditions.

[¶¶¶] Preeclampsia or gestational hypertension.

[****] Number of pregnancies resulting in live birth; might have been a singleton or multiple delivery.

[††††] Among live births with known gestational age at delivery.

[§§§§] Pregnancy losses might include spontaneous abortion/miscarriage, therapeutic abortion, or stillbirth.

[¶¶¶¶] The denominator refers to the 448 pregnancies resulting in live births. These 448 pregnancies resulted in the birth of 457 newborns; nine women had twins. The deaths of two newborns that occurred during the birth hospitalization were indicated on their mothers' hospital charts.

respectively. The reason for hospital admission was reported for 324 women: 242 (74.7%) were hospitalized for obstetric indications (including labor and delivery), 61 (18.8%) for COVID-19–related illness, and 21 (6.5%) for other reasons. The most common reason for admission during the first or second pregnancy trimester was COVID-19–related illness (56.8%) and during the third trimester, obstetric indications (81.9%). Among hospitalized pregnant women with COVID-19, 20.6% had at least one underlying medical condition; asthma (8.2%) and hypertension (4.3%) were the most prevalent.

Overall, 272 (45.5%) pregnant women with COVID-19 were symptomatic at the time of hospital admission, and 326 (54.5%) were asymptomatic. Women hospitalized during the first or second trimester were more frequently symptomatic (84.0%) than were those hospitalized during the third trimester (39.9%). Among symptomatic women, the most commonly reported symptoms were fever or chills (59.6%) and cough (59.2%) (Figure 2).

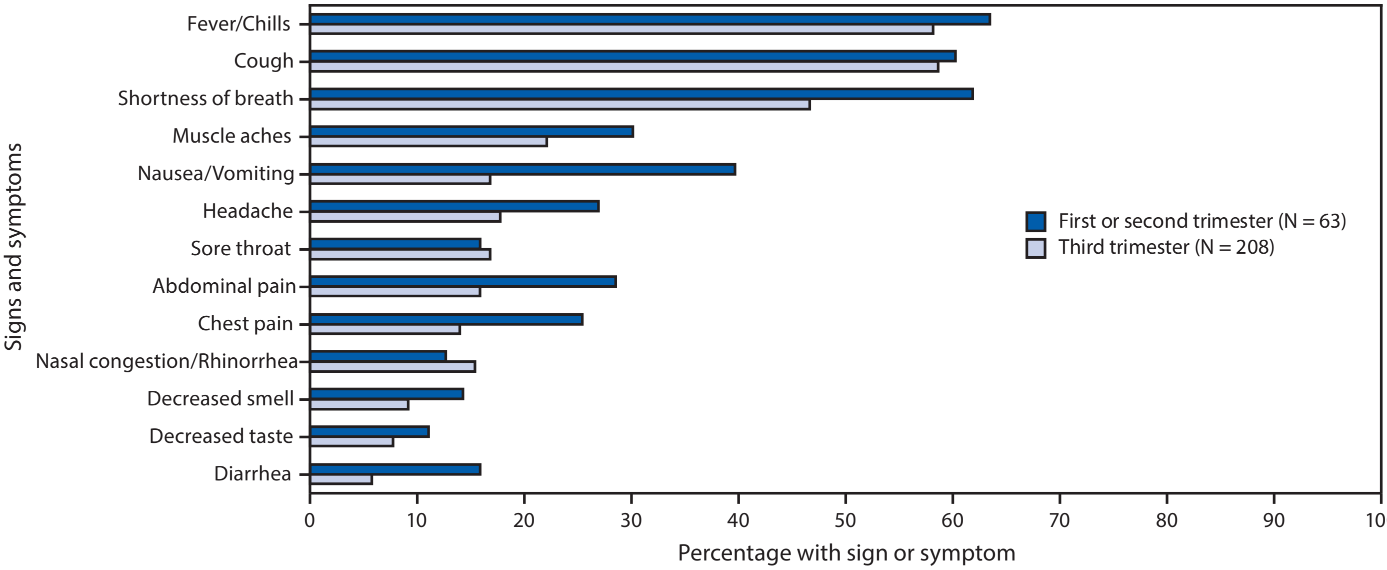
Among 272 hospitalized symptomatic pregnant women, 44 (16.2%) were admitted to an ICU and 23 (8.5%) required invasive mechanical ventilation. Two (0.7%) deaths were reported among symptomatic women. No asymptomatic women were admitted to an ICU, required invasive mechanical ventilation, or died.

At hospital discharge, 458 women (76.6%) with COVID-19 had completed pregnancies, including 448 (97.8%) that resulted in live births and 10 (2.2%) in pregnancy losses (Figure 1). Pregnancy losses occurred among both symptomatic and asymptomatic hospitalized women with COVID-19 (Table). Four pregnancy losses (0.9% of completed pregnancies) occurred at <20 weeks' gestation, five (1.1%) at ≥20 weeks' gestation, and one (0.2%) at unknown gestational age. Among 445 pregnancies resulting in live births with known gestational age at delivery, 87.4% were term births (≥37 weeks' gestation), and 12.6% were preterm (<37 weeks). Among pregnancies resulting in live births, preterm delivery was reported for 23.1% of symptomatic women and 8.0% of asymptomatic women. Two live-born newborns died during the birth hospitalization (Table); both were born to symptomatic women who required invasive mechanical ventilation.

Discussion

One in four women aged 15–49 years who had a COVID-19–associated hospitalization during March 1–August 22, 2020 was pregnant, based on a convenience sample from COVID-NET. Approximately one half of pregnant women

FIGURE 2. Signs and symptoms* at hospital admission among symptomatic hospitalized pregnant women with COVID-19,† by pregnancy trimester — COVID-NET, 13 states,§ March 1–August 22, 2020



Abbreviations: COVID-19 = coronavirus disease 2019; COVID-NET = COVID-19-Associated Hospitalization Surveillance Network.

* Other signs and symptoms reported on the case report form were upper-respiratory illness/influenza-like illness (11 persons), wheezing (six), hemoptysis/bloody sputum (one), conjunctivitis (one), rash (one), altered mental state (one) and seizure (none). The symptoms decreased smell and decreased taste might not have been ascertained for cases admitted before April 1, 2020, when these symptoms were added as options on the case report form.

† A total of 272 pregnant women with COVID-19 with at least one sign or symptom at the time of hospitalization were identified in COVID-NET. One hospitalized pregnant woman who was symptomatic at admission was not included in this figure because of missing pregnancy trimester.

§ California, Colorado, Connecticut, Georgia, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio, Oregon, Tennessee, and Utah.

were asymptomatic at hospital admission. Among symptomatic pregnant women, 16.2% were admitted to an ICU, 8.5% required invasive mechanical ventilation, and two died during COVID-19–associated hospitalizations; none of these outcomes occurred among asymptomatic pregnant women. Among all pregnancies completed during a COVID-19–associated hospitalization, 2.2% resulted in pregnancy losses. Pregnancy losses occurred among both symptomatic and asymptomatic hospitalized women with COVID-19.

Approximately 5% of women of reproductive age in the general population are pregnant at any given time (*1*). The proportion of hospitalized women aged 15–49 years with COVID-19 who were pregnant in this study (26.5%) suggests that pregnant women have disproportionately higher rates of COVID-19–associated hospitalizations compared to nonpregnant women. Although COVID-19 might be more severe in pregnant women, other factors might also explain these higher hospitalization rates. Providers might have a lower threshold for admitting pregnant women for any reason. Some pregnant women with COVID-19 might be admitted solely to give birth. Pregnant women might also have a higher likelihood of being tested for COVID-19 upon admission than do nonpregnant women. Nevertheless, pregnant women account for a substantial proportion of COVID-19–associated hospitalizations among women of reproductive age.

The proportions of hospitalized pregnant women who were Hispanic (42.5%) and Black (26.5%) were higher than the overall proportions of women aged 15–49 years in the COVID-NET catchment area who were Hispanic (15.3%) or Black (19.5%).[§] Although the racial and ethnic composition of pregnant women in the catchment area is unknown, this report and an earlier study (*1*) suggest that pregnant women who are Hispanic or Black might have disproportionately higher rates of COVID-19–associated hospitalization, compared with those of pregnant women of other races and ethnicities. Long standing inequities in the social determinants of health, such as occupation and housing circumstances that make physical distancing challenging, have put some racial and ethnic minority groups at increased risk for COVID-19–associated illness and death (*4*,*5*). Better understanding of the circumstances under which Hispanic and Black women of reproductive age are exposed to SARS-CoV-2 could inform prevention strategies.

Most pregnant women with COVID-19 in this study were asymptomatic, similar to findings in settings where universal SARS-CoV-2 testing is conducted upon admission to labor and delivery units (*6*). Testing policies based on the presence of symptoms might miss many SARS-CoV-2 infections during pregnancy. Early identification of COVID-19 among hospitalized pregnant women can help ensure that health care providers use appropriate personal protective equipment and limit visitors to those essential for patients' well-being and care.[¶]

The overall proportion of pregnant women with COVID-19 admitted to an ICU (7.4%) was similar to that observed in two European studies (*7*,*8*); however, 16.2% of symptomatic pregnant women in this study were admitted to an ICU, indicating that outcomes might be more severe among pregnant women admitted with acute illness than among those admitted for obstetric indications alone.

Although the preterm delivery rate in the study catchment area during the surveillance period is unknown, the prevalence of preterm delivery among live births during COVID-19–associated hospitalizations (12.6%) was higher than that observed in the general U.S. population in 2018 (10.0%) (*9*). In this study, preterm births occurred approximately three times more frequently in symptomatic pregnant women than in those who were asymptomatic. Preterm newborns might be at increased risk for severe COVID-19 illness, and preventive measures, such as encouraging caretakers to wear a mask and practice hand hygiene, should be emphasized to minimize possible transmission.[**]

Birth outcomes in this analysis were limited to pregnancies completed during a COVID-19–associated hospitalization. COVID-NET only captured medically attended pregnancy losses and likely underestimates the percentage of pregnancy losses that occur among women with COVID-19. Further prospective data on birth outcomes among women infected during all pregnancy trimesters is needed. CDC is collaborating with state and local health departments to conduct detailed surveillance of pregnant women with COVID-19 and their infants.[††]

The findings in this report are subject to at least six limitations. First, at the time of analysis, chart abstractions were ongoing and completed for a convenience sample of 29.4% of women aged 15–49 years. Thus, the estimated proportion of hospitalized women with COVID-19 who were pregnant might be biased, because pregnancy status was not yet ascertained for women without completed chart review. Second, pregnant women included in this analysis might not be representative of all pregnant women within the catchment area. Third, COVID-19 cases might have been missed because of testing practices and test availability, which likely varied across time and facilities. Fourth, the reason for hospital admission was unavailable for 45.8% of women, limiting the ability to distinguish between admissions solely for labor and delivery

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[§] The distribution of race/ethnicity among the COVID-NET catchment area was calculated using 2019 vintage NCHS bridged-race population estimates. https://www.cdc.gov/nchs/nvss/bridged_race.htm.

[¶] https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcare-guidance.html.

[**] https://www.cdc.gov/coronavirus/2019-ncov/hcp/caring-for-newborns.html.

[††] https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/special-populations/pregnancy-data-on-covid-19.html; https://www.cdc.gov/ncbddd/aboutus/pregnancy/emerging-threats.html.

Summary

What is already known about this topic?

Information on the clinical characteristics and birth outcomes of hospitalized U.S. pregnant women with COVID-19 is limited.

What is added by this report?

Among 598 hospitalized pregnant women with COVID-19, 55% were asymptomatic at admission. Severe illness occurred among symptomatic pregnant women, including intensive care unit admissions (16%), mechanical ventilation (8%), and death (1%). Pregnancy losses occurred for 2% of pregnancies completed during COVID-19-associated hospitalizations and were experienced by both symptomatic and asymptomatic women.

What are the implications for public health practice?

Pregnant women and health care providers should be aware of potential risks for severe COVID-19, including adverse pregnancy outcomes. Identifying COVID-19 during birth hospitalizations is important to guide preventive measures to protect pregnant women, parents, newborns, other patients, and hospital personnel.

and those for COVID-19–related illness. Fifth, information on obesity as an underlying prepregnancy condition was not available, so this underlying health condition could not be described. Finally, information on maternal and newborn mortality was only obtained from the maternal medical chart and did not capture outcomes occurring beyond the COVID-19–associated hospitalization.

Severe illness and adverse birth outcomes were observed among hospitalized pregnant women with COVID-19. These findings highlight the importance of preventing and identifying COVID-19 in pregnant women. Pregnant women should avoid close contact with persons with confirmed or suspected COVID-19, maintain 6 feet of distance from nonhousehold members, and take general COVID-19 preventive measures, including wearing masks and practicing hand hygiene.[§§] CDC recommends testing newborns born to mothers with COVID-19, isolation of mothers with COVID-19 and their newborns from other hospitalized mothers and newborns, and infection prevention measures for persons caring for newborns who might be exposed to SARS-CoV-2. Continued surveillance for COVID-19 in pregnant women is important to understand and improve health outcomes for mothers and newborns.

[§§] https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/pregnancy-breastfeeding.html.

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SARS-CoV-2 Infection Among Hospitalized Pregnant Women: Reasons for Admission and Pregnancy Characteristics — Eight U.S. Health Care Centers, March 1–May 30, 2020

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Pregnant women might be at increased risk for severe coronavirus disease 2019 (COVID-19), possibly related to changes in their immune system and respiratory physiology* (*1*). Further, adverse birth outcomes, such as preterm delivery and stillbirth, might be more common among pregnant women infected with SARS-CoV-2, the virus that causes COVID-19 (*2*,*3*). Information about SARS-CoV-2 infection during pregnancy is rapidly growing; however, data on reasons for hospital admission, pregnancy-specific characteristics, and birth outcomes among pregnant women hospitalized with SARS-CoV-2 infections are limited. During March 1–May 30, 2020, as part of Vaccine Safety Datalink (VSD)† surveillance of COVID-19 hospitalizations, 105 hospitalized pregnant women with SARS-CoV-2 infection were identified, including 62 (59%) hospitalized for obstetric reasons (i.e., labor and delivery or another pregnancy-related indication) and 43 (41%) hospitalized for COVID-19 illness without an obstetric reason. Overall, 50 (81%) of 62 pregnant women with SARS-CoV-2 infection who were admitted for obstetric reasons were asymptomatic. Among 43 pregnant women hospitalized for COVID-19, 13 (30%) required intensive care unit (ICU) admission, six (14%) required mechanical ventilation, and one died from COVID-19. Prepregnancy obesity was more common (44%) among pregnant women hospitalized for COVID-19 than that among asymptomatic pregnant women hospitalized for obstetric reasons (31%). Likewise, the rate of gestational diabetes (26%) among pregnant women hospitalized for COVID-19 was higher than it was among women hospitalized for obstetric reasons (8%). Preterm delivery occurred in 15% of pregnancies among 93 women who delivered, and stillbirths (fetal death at ≥20 weeks' gestation) occurred in 3%. Antenatal counseling emphasizing preventive measures (e.g., use of masks, frequent hand washing, and social distancing) might help prevent COVID-19 among pregnant women,§ especially those with prepregnancy obesity and gestational diabetes, which might reduce adverse pregnancy outcomes.

VSD is a collaboration between CDC's Immunization Safety Office and nine U.S. health care organizations serving more than 12 million persons each year. Hospitalizations with a patient diagnosis of COVID-19 were identified using COVID-19 *International Classification of Diseases, Tenth Revision*, *Clinical Modification,* (ICD-10-CM)¶ and site-specific internal diagnosis codes during March 1–May 30, 2020. Pregnant women were identified using a validated algorithm based on ICD-9 diagnosis and procedure codes (*4*) that has been modified for ICD-10. For this study, medical records of women hospitalized with COVID-19 were reviewed by abstractors and adjudicated by a physician to identify the primary reason for hospital admission, pregnancy characteristics, COVID-19 complications, and birth outcomes among women who delivered before July 31, 2020.

Pregnant women with COVID-19 diagnoses were classified into the following three groups based on the primary reason for admission: 1) treatment of COVID-19 without an obstetric reason (e.g., worsening respiratory distress); 2) an obstetric reason, along with symptoms consistent with COVID-19 (e.g., fever, chills, cough, shortness of breath); and 3) an obstetric reason, without COVID-19–compatible symptoms (or with a history of resolved COVID-19), but with a positive test result for SARS-CoV-2 at the time of admission. Demographic and pregnancy characteristics among pregnant women admitted for COVID-19 were compared with those of women admitted for obstetric reasons. Birth outcomes in pregnant women with SARS-COV-2 infection were compared with background rates among all pregnant women in eight VSD sites during the study period. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.** SAS software (version 9.4; SAS Institute) was used to conduct all analyses.

During March 1–May 30, among 4,408 persons hospitalized with a COVID-19 diagnosis at VSD sites, 105 (2.4%)

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* http://dx.doi.org/10.15585/mmwr.mm6938e1.

† https://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/vsd/.

§ https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/pregnancy-breastfeeding.html.

¶ https://www.cdc.gov/nchs/icd/icd10cm.htm.

** 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.

pregnant women were identified. SARS-CoV-2 real-time reverse transcription–polymerase chain reaction test results were positive for 104 women. One additional woman, who had a negative SARS-CoV-2 test result, was symptomatic and had close contacts with confirmed COVID-19; she received a clinical diagnosis of COVID-19. Among these 105 pregnant women, 43 (41.0%) were hospitalized for COVID-19 illness and 62 (59.0%) were admitted for obstetric reasons (Table 1). Among the 62 women admitted for obstetric reasons, 12 (19.4%) had COVID-19–compatible symptoms, and 50 (80.6%) were asymptomatic. The median age of all women was 30 years (range = 17–54 years), and 61.9% were Hispanic or Latino (Table 2). ICU admission was required for 14 (13.3%) hospitalized pregnant women, including 13 (30.2%) of the 43 women hospitalized for COVID-19; six of these women required mechanical ventilation, and one, admitted at 15 weeks' gestation, died from COVID-19. The prevalence of prepregnancy obesity (body mass index ≥ 30 kg/m^2) was 36.2% overall and was higher among the 43 women hospitalized for COVID-19 (44.2%) than among the 62 hospitalized for obstetric reasons (30.6%). Similarly, prevalence of gestational diabetes was higher among women hospitalized for COVID-19 (25.6%) than among those hospitalized for obstetric reasons (8.1%).

TABLE 1. Reason for admission among pregnant women hospitalized* with SARS-CoV-2 infection (N = 105) — eight U.S. health care centers, March 1–May 30, 2020

Reason for admission	COVID-19–compatible symptoms	Comments	No. (%)†
COVID-19	Yes	No obstetric reason	43 (41)
Labor and delivery	No	—	36 (34)
Labor and delivery	No	History of resolved COVID-19§	11 (10)
Labor and delivery	Yes	—	11 (10)
Other obstetric	No	Pyelonephritis, preeclampsia, fetal monitoring after motor vehicle crash	3 (3)
Other obstetric	Yes	Vaginal bleeding, placenta previa	1 (1)

Abbreviation: COVID-19 = coronavirus disease 2019.

* Hospitalization with a COVID-19 diagnosis code.

† Percentages might not sum to 100 because of rounding.

§ Pregnant women with resolved COVID-19 who had positive test results for SARS-CoV-2 by real-time reverse transcription–polymerase chain reaction.

Among all 105 pregnant women hospitalized with COVID-19, 93 (88.6%) had a pregnancy outcome before July 31 (Table 3), including 79 (84.9%) who delivered during their initial hospitalization and 14 (15.1%) during a subsequent hospitalization. One of the remaining 12 women died during initial hospitalization, and 11 were still pregnant at the time of analysis. Preterm delivery prevalence was 15.1% overall and 12.2% among live births, which is nearly 70% higher than baseline rates in VSD during the study period (8.9% among 43,571 live births and stillbirths in VSD). Stillbirth prevalence (3.2%) was more than four times higher among women with SARS-CoV-2 than the baseline rate in VSD during the study period (0.6%). All three stillbirths were antepartum: one with placental abruption and two with no identified etiology based on adjudication.

Discussion

Among 105 hospitalized pregnant women with COVID-19 diagnoses in VSD during March 1–May 30, 41% were hospitalized because of COVID-19 illness, and 59% were admitted for obstetric reasons. Approximately 80% of those admitted for obstetric reasons were asymptomatic with COVID-19. This percentage is similar to findings from a New York City study that reported universal screening of obstetrics patients on admission and found that among 13.7% of women with SARS-CoV-2–positive test results, 87.9% were asymptomatic (*5*). Similarly, among pregnant women admitted to a large managed care organization in southern California for labor and delivery who were offered universal screening, the prevalence of SARS-CoV-2 infection was 0.4%, and all women with positive test results were asymptomatic (*6*).

Compared with background rates of all pregnant women in the VSD population during the same period, the current findings indicate increased percentages of preterm delivery and stillbirths occur among all pregnant women with SARS-CoV-2 infection. Other studies have also found higher rates of preterm delivery and stillbirth in pregnant women with SARS-CoV-2 infection (symptomatic and asymptomatic), compared with those in the general population (*2*,*3*).

Higher percentages of prepregnancy obesity and gestational diabetes were identified among pregnant women hospitalized for COVID-19 illness without an obstetric reason, compared with the percentages of these conditions in pregnant women with SARS-CoV-2 infection who were admitted for obstetric reasons. Underlying medical conditions, including obesity and diabetes have been recognized as risk factors for severe COVID-19 disease (*7*,*8*). A study of 46 pregnant women with COVID-19 (*9*) found that nearly all women with severe infection were overweight or obese. This study also identified higher rates of complications in pregnant women with SARS-CoV-2 infection (including the need for ICU admission or mechanical ventilation) and death, which highlight the importance of all pregnant women and their close contacts adhering to COVID-19 prevention measures.

The findings in this report are subject to at least five limitations. First, the number of pregnant women with SARS-CoV-2 infection was small, limiting the power to detect significant

TABLE 2. Demographic, COVID-19 illness, and pregnancy characteristics of 105 pregnant women hospitalized with SARS-CoV-2 infection, by reason and COVID-19 symptom status — eight U.S. health care centers, March 1–May 30, 2020

Characteristic	No. (%)			
	All pregnant women hospitalized with SARS-CoV-2[*]	Reason for admission		
		COVID-19 illness (no obstetric reason)	Obstetric,[†] symptomatic	Obstetric,[§] asymptomatic
	(n = 105)	(n = 43)	(n = 12)	(n = 50)
Demographic				
Age at hospitalization (yrs), median (range)	30 (17–54)	31 (20–54)	31 (17–38)	29 (19–46)
Age group (yrs)				
15–24	18 (17.1)	4 (9.3)	3 (25.0)	11 (22.0)
25–34	59 (56.2)	26 (60.5)	6 (50.0)	27 (54.0)
35–44	26 (24.8)	12 (27.9)	3 (25.0)	11 (22.0)
≥45	2 (1.9)	1 (2.3)	None	1 (2.0)
Race/Ethnicity				
Hispanic or Latino	65 (61.9)	25 (58.1)	7 (58.3)	33 (66.0)
White, non-Hispanic	13 (12.4)	5 (11.6)	2 (16.7)	6 (12.0)
Asian, non-Hispanic	11 (10.5)	7 (16.3)	1 (8.3)	3 (6.0)
Black, non-Hispanic	6 (5.7)	2 (4.7)	1 (8.3)	3 (6.0)
Other	6 (5.7)[¶]	3 (7.0)[**]	None	3 (6.0)[††]
Unknown	4 (3.8)	1 (2.3)	1 (8.3)	2 (4.0)
Exposure source				
Confirmed SARS-CoV-2 exposure source	33 (31.4)	16 (37.2)	9 (75.0)	10 (20.0)
Household contact	28 (26.7)	14 (32.6)	7 (58.3)	9 (18.0)
Community contact	5 (4.8)	2 (4.7)	2 (16.7)	1 (2.0)
No known confirmed SARS-CoV-2 source	72 (68.6)	27 (62.8)	3 (25)	40 (80)
COVID-19 illness				
Gestational age at inpatient diagnosis of COVID-19, wks, median (range)	38 (12–41)	32 (12–39)	39 (27–40)	39 (24–41)
ICU admission[§§]	14 (13.3)	13 (30.2)	1 (8.3)[¶¶]	None
ARDS	6 (5.7)	5 (11.6)	1 (8.3)[¶¶]	None
Sepsis	16 (15.2)	16 (37.2)	None	None
Mechanical ventilation	7 (6.7)	6 (14.0)	1 (8.3)[¶¶]	None
HFNC	6 (5.7)	5 (11.6)	1 (8.3)	None
Death	1 (1.0)	1 (2.3)	None	None
Any medical treatments or interventions[***]	36 (34.3)	32 (74.4)	3 (25.0)	1 (2.0)
Pregnancy				
Prepregnancy obesity[†††]	38 (36.2)	19 (44.2)	4 (33.3)	15 (30.0)
Gestational diabetes	16 (15.2)	11 (25.6)	1 (8.3)	4 (8.0)
Gestational hypertension or pre-eclampsia	22 (21.0)	6 (14.0)	4 (33.3)	12 (24.0)
First pregnancy; no previous pregnancies	27 (25.7)	6 (14.0)	6 (50.0)	15 (30.0)
History of previous pregnancies	78 (74.3)	37 (86.0)	6 (50.0)	35 (70.0)
History of preterm delivery[§§§]	8 (10.3)	4 (10.8)	None	4 (8.0)

Abbreviations: ARDS = acute respiratory distress syndrome; COVID-19 = coronavirus disease 2019; HFNC = high-flow nasal cannula; ICU = intensive care unit.

[*] Hospitalization with a COVID-19 diagnosis code.

[†] Includes women with COVID-19 symptoms who were admitted for labor and delivery, pyelonephritis, pre-eclampsia, and fetal monitoring after motor vehicle accident in pregnancy.

[§] Includes women asymptomatically infected with SARS-CoV-2 and who were admitted for labor and delivery, vaginal bleeding, or placenta previa.

[¶] Includes one non-Hispanic Hawaiian, one non-Hispanic American Indian/Alaskan Native, and four multiracial pregnant women.

[**] Includes one non-Hispanic Hawaiian, one non-Hispanic American Indian/Alaskan Native, and one multiracial pregnant woman.

[††] Includes three multiracial pregnant women.

[§§] Subcategories are not mutually exclusive.

[¶¶] Represents postpartum COVID-19 illness woman admitted for delivery.

[***] Medical treatments and interventions were ascertained upon review of hospital admission and discharge notes and medical administration records and were only included if determined that they were used to treat COVID-19–related complications; these included albuterol, azithromycin, convalescent plasma, enoxaparin, hydroxychloroquine, lopinavir/ritonavir, mechanical ventilation, oseltamivir, remdesivir, supplemental oxygen, and systemic steroids.

[†††] Body mass index ≥30 kg/m^2.

[§§§] History of preterm delivery reported among women with previous pregnancies.

TABLE 3. Birth outcomes among 93 pregnant women hospitalized with SARS-CoV-2 infection, by reason for admission and symptom status, and with pregnancy outcomes before July 31, 2020 — eight U.S. health care centers, March 1–May 30, 2020

	No. (%)			
		Reason for admission		
Characteristic	**All pregnant women hospitalized with SARS-CoV-2 infection (N = 93)**	**COVID-19 (no obstetric reason) (N = 32)**	**Obstetric,[*] symptomatic (N = 12)**	**Obstetric,[†] asymptomatic (N = 49)**
Time from mother's symptom onset to delivery,[§] days, median (range)	20 (0–103)	39 (0–103)	4 (0–72)	N/A
Gestational age of fetus or infant at delivery, wks, median (range)	39 (31–41)	38 (31–41)	39 (32–40)	39 (33–41)
Preterm delivery	14 (15.1)[¶]	5 (15.6)[**]	2 (16.7)	7 (14.3)
Mode of delivery				
Vaginal	65 (69.9)	20 (62.5)	7 (58.3)	38 (77.6)
Caesarean	28 (30.1)	12 (37.5)	5 (41.7)	11 (22.4)
NICU admission	16 (17.2)	3 (9.4)	2 (16.7)	11(22.4)
Stillbirth[††]	3 (3.2)	None	2 (16.7)	1 (2.0)

Abbreviations: COVID-19 = coronavirus disease 2019; NICU = neonatal intensive care unit.

[*] Includes delivery, pyelonephritis, preeclampsia, and fetal monitoring after motor vehicle accident in pregnancy.

[†] Includes delivery, vaginal bleeding, and placenta previa.

[§] Defined as the date of birth of fetus or infant.

[¶] Median gestational age among preterm deliveries = 34 wks.

[**] Includes three pregnant women with COVID-19 with respiratory distress in whom labor was induced.

[††] Fetal death occurring at ≥20 wks' gestation.

differences among comparison groups. Second, during this study period, various screening policies were being implemented across VSD sites. As a result, asymptomatic women with SARS-CoV-2 infection hospitalized during pregnancy might have been missed, especially earlier in the study period. Third, this study did not routinely identify pregnant women with negative SARS-CoV-2 test results. More information is needed to understand whether a universal screening strategy should be considered in the care of pregnant women, and, if so, when in pregnancy (timing and setting) this should be implemented. Fourth, this study did not collect information on prenatal care, which is known to affect pregnancy outcomes. However, VSD's surveillance population is primarily insured and has high rates of standard prenatal care (*10*), and birth outcomes among pregnant women with SARS-CoV-2 infection were compared with background rates in VSD during the study period. Although studying a primarily insured population might limit generalizability of study findings, VSD does capture publicly insured persons, and includes one large integrated urban safety-net health system[††] serving uninsured patients.

Summary

What is already known about this topic?

Pregnant women might be at increased risk for severe illness from SARS-CoV-2 infection.

What is added by this report?

Prevalences of prepregnancy obesity and gestational diabetes were higher among pregnant women hospitalized for COVID-19–related illness (e.g., worsening respiratory status) than among those admitted for pregnancy-related treatment or procedures (e.g., delivery) and found to have COVID-19. Intensive care was required for 30% (13 of 43) of pregnant women admitted for COVID-19, and one pregnant woman died from COVID-19.

What are the implications for public health practice?

Antenatal counseling emphasizing preventive measures, including use of masks, frequent hand washing, and social distancing, might help prevent COVID-19 among pregnant women, especially those with prepregnancy obesity and gestational diabetes.

Finally, this study did not control for important predisposing factors for adverse birth outcomes, such as pregnancy-related conditions, and more information is needed to understand the effects of SARS-CoV-2 infection on pregnancy outcome.

This report addresses gaps in previously reported surveillance data by using a combination of diagnosis codes, medical record review, and physician adjudication to identify various reasons for hospital admission among pregnant women with COVID-19, their pregnancy characteristics, and birth outcomes. This report highlights the importance of antenatal counseling in pregnant women, especially those with prepregnancy obesity and gestational diabetes. Counseling should emphasize preventive measures for all pregnant women and their close contacts, including use of masks, frequent hand washing, social distancing, and avoidance of large gatherings to help prevent SARS-CoV-2 infection and COVID-19–associated pregnancy complications.

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[††] https://www.denverhealth.org/about-denver-health.

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COVID-19 Contact Tracing in Two Counties — North Carolina, June–July 2020

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Contact tracing is a strategy implemented to minimize the spread of communicable diseases (*1*,*2*). Prompt contact tracing, testing, and self-quarantine can reduce the transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) (*3*,*4*). Community engagement is important to encourage participation in and cooperation with SARS-CoV-2 contact tracing (*5*). Substantial investments have been made to scale up contact tracing for COVID-19 in the United States. During June 1–July 12, 2020, the incidence of COVID-19 cases in North Carolina increased 183%, from seven to 19 per 100,000 persons per day* (*6*). To assess local COVID-19 contact tracing implementation, data from two counties in North Carolina were analyzed during a period of high incidence. Health department staff members investigated 5,514 (77%) persons with COVID-19 in Mecklenburg County and 584 (99%) in Randolph Counties. No contacts were reported for 48% of cases in Mecklenburg and for 35% in Randolph. Among contacts provided, 25% in Mecklenburg and 48% in Randolph could not be reached by telephone and were classified as nonresponsive after at least one attempt on 3 consecutive days of failed attempts. The median interval from specimen collection from the index patient to notification of identified contacts was 6 days in both counties. Despite aggressive efforts by health department staff members to perform case investigations and contact tracing, many persons with COVID-19 did not report contacts, and many contacts were not reached. These findings indicate that improved timeliness of contact tracing, community engagement, and increased use of community-wide mitigation are needed to interrupt SARS-CoV-2 transmission.

Routinely collected case investigation and contact tracing data from June 1–30, 2020, for Mecklenburg, and from June 15–July 12, 2020, for Randolph counties were analyzed. Case investigations were conducted for persons with laboratory-confirmed COVID-19, including the elicitation of persons potentially exposed to the index patient (*3*). Contact tracing was performed for persons identified as close contacts and included inquiry about COVID-19–compatible symptoms† and instructions to self-quarantine for 14 days since last exposure (*3*). Health department staff members monitored contacts for new-onset symptoms. SARS-CoV-2 diagnostic testing was encouraged for all close contacts (*3*). Persons with COVID-19 and contacts were classified as lost to follow-up if they did not respond after three failed attempts to contact them at different times on consecutive days or if contact information was missing or invalid. COVID-19 case-based surveillance data are maintained within the North Carolina Electronic Disease Surveillance System; contact-based information is maintained within the state-supported COVID-19 Community Team Outreach tool. Mecklenburg County uses a commercial information management system, HealthSpace Data Systems Ltd., for case management. This activity was determined to be public health surveillance as defined in 45 CFR 46.102(l).§

Mecklenburg County has an estimated population of 1,110,356 persons (*6*) most of whom live in the city of Charlotte. In June, Mecklenburg County conducted 61,979 SARS-CoV-2 tests resulting in 8,097 (13%) positive results. Among these, 7,116 (88%) were confirmed as new COVID-19 cases in county residents (Table); the remaining were in residents of other jurisdictions or retests. During the assessment period, an average of 24 cases per 100,000 persons occurred per day. The median interval from specimen collection to reported results was 2 days (range = 0–29 days); 23% (1,602 of 7,116) of laboratory-confirmed cases were lost to follow-up. Overall, 5,514 (77%) persons with positive test results were reached for case investigation and elicitation of contacts; the median interval from specimen collection to case investigation was 4 days (range = 0–38 days). Among COVID-19 patients interviewed, 2,624 (48%) reported no contacts. Among those who did report contacts, 13,401 contacts were named (average contacts per case = 4.6). The median interval from case investigation to contact notification was 1 day (range = 0–25 days). Among reported contacts, 3,331 (25%) were lost to follow-up. An additional 255 (2%) contacts were reached and counseled to quarantine but declined monitoring by the health department. Therefore, 9,815 (73%) reported contacts were reached, assessed for current symptoms, counseled to quarantine, and monitored daily by the health department. The median interval between specimen collection and contact notification was 6 days (range = 1–38 days). The total number of contacts tested was not available because contact

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* https://covid19.ncdhhs.gov/dashboard/cases.

† https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html.

§ U.S. Department of Health and Human Services, Title 45 Code of Federal Regulations 46, Protection of Human Subjects.

TABLE. COVID-19 contact tracing metrics in two counties — North Carolina, June–July 2020

Metrics	Mecklenburg County[*]	Randolph County[*]
No. of specimens tested	61,979	6,292
Case investigation, no. (%)		
Positive laboratory reports received[†]	8,097 (13)	707 (11)
Laboratory-confirmed COVID-19 cases	7,116 (88)[§]	589 (83)[§]
Laboratory-confirmed COVID-19 cases lost to follow-up	1,602 (23)[¶]	5 (1)[**]
Laboratory-confirmed COVID-19 cases with initial investigation	5,514 (77)	584 (99)
Laboratory-confirmed COVID-19 cases with initial investigation with no contacts named	2,624 (48)	202 (35)
Laboratory-confirmed COVID-19 cases with named contacts	2,890 (52)	382 (66)
Contact tracing, no. (%)		
No. of Identified contacts	13,401[††]	1,146
Identified contacts lost to follow-up	3,331 (25)[¶]	544 (47)[¶]
Identified contacts opted out of health department daily monitoring	255 (2)	50 (4)
Identified contacts who agreed to self-quarantine and 14-day monitoring	9,815 (73)[§§]	552 (48)[§§]
Identified contacts who agreed to self-quarantine and subsequently had a positive test result	137[¶¶]	69[***]
Time intervals, no. of days (range)		
From specimen collection to reported results	2 (0–29)	3 (0–15)
From specimen collection to case investigation	4 (0–38)	3 (0–36)
From case investigation to contact notification	1 (0–25)	3 (0–26)
From specimen collection to contact notification and presumed start of quarantine	6 (1–38)	6 (0–58)

Abbreviation: COVID-19 = coronavirus disease 2019.

[*] In some cases, column percentages within a category might not sum to 100% because of rounding.

[†] Difference between positive laboratory reports received and laboratory-confirmed cases (981 in Mecklenburg County and 118 in Randolph County) reflects testing of residents from other jurisdictions or repeat testing.

[§] Cases in county residents; the remaining cases were in residents of other jurisdictions or retests.

[¶] Could not be reached via phone after 3 consecutive days of failed attempts, or if contact information was missing or invalid.

[**] Could not be reached via phone after 3 consecutive days of failed attempts and a visit by local law enforcement to the residential address provided, or if contact information was missing or invalid.

[††] Does not include contacts identified during investigations of congregate settings or large workplace investigations.

[§§] Contacts were monitored by the health department.

[¶¶] The total number of contacts who volunteered to be tested is unknown.

[***] In total, 293 contacts volunteered to be tested.

status was not a required variable on the laboratory requisition form; however, during follow-up, 137 contacts had laboratory-confirmed COVID-19.

Randolph County has an estimated population of 143,667 (*6*). During June 15–July 12, Randolph County conducted 6,292 SARS-CoV-2 tests, resulting in 707 positive results. Among these, 589 (83%) were confirmed as new COVID-19 cases among county residents (Table). During the assessment period, an average of 15 cases per 100,000 persons occurred per day. The median interval from specimen collection to reported results was 3 days (range = 0–15 days). Among persons with reported cases, 584 (99%) were reached for case investigation and elicitation of contacts; five (1%) were lost to follow-up, even after dispatching law enforcement to the residential address provided. The median interval from specimen collection date to case investigation date was 3 days (range = 0–36 days). Among COVID-19 patients interviewed, 202 (35%) reported no contacts. Among those who did report contacts, 1,146 were named (average = three contacts per case). An increasing trend in the percentage of cases not reporting contacts was observed, from 26% during week 1 (June 1–7) to 48% during week 4 (June 22–28) of the assessment. The median interval from case investigation to contact notification was 3 days (range = 0–26 days). Among 1,146 reported contacts, 544 (47%) were lost to follow-up. An additional 50 (4%) contacts were reached and counseled to quarantine but declined monitoring by the health department. Thus, 552 (48%) reported contacts were reached, assessed for current symptoms, counseled to quarantine, and monitored daily. The median duration between specimen collection and contact notification was 6 days (range = 0–58 days). A total of 293 (53%) contacts who started quarantine received a SARS-CoV-2 test during follow-up; 69 (24%) results were positive.

Discussion

Health department staff members began investigation of 77% to 99% of new COVID-19 cases within a median of 3–4 days from specimen collection. However, 35% (Randolph County) to 48% (Mecklenburg County) of patients with COVID-19 did not report contacts. This proportion is high relative to proportions noted for other infectious diseases before the COVID-19 pandemic in the United States (*1*,*7*). There are a few probable reasons for this. First, limiting contact tracing to a telephone conversation might have inhibited the ability of public health workers to establish a rapport and elicit contacts. Second, persons with COVID-19 might

Summary

What is already known about this topic?

Successful SARS-CoV-2 contact tracing requires timeliness and community engagement to encourage participation and cooperation.

What is added by this report?

During periods of high COVID-19 incidence in North Carolina, 48% of COVID-19 patients reported no contacts, and 25% of contacts were not reached in Mecklenburg County. In Randolph County, 35% of COVID-19 patients reported no contacts, and 48% of contacts were not reached. Median interval from index patient specimen collection to contact notification was 6 days.

What are the implications for public health practice?

Despite aggressive efforts by health departments, many COVID-19 patients do not report contacts, and many contacts cannot be reached. Improved timeliness of contact tracing, community engagement, and community-wide mitigation are needed to reduce SARS-CoV-2 transmission.

have sought to avoid subjecting their contacts to quarantine control measures, including potential loss of work and related economic consequences. Despite efforts to reach all elicited contacts, one quarter of contacts in Mecklenburg and nearly one half in Randolph County were not reachable. Contacts might have been reluctant to answer phone calls from unknown numbers; 2%–4% who were reached declined health department monitoring. Finally, the high volume of work might have contributed to staff members' ability to trace contacts (*8*).

These results are comparable to COVID-19 data reported from other U.S. states. Data from Maryland[¶] and New Jersey[**] indicate that 50% and 52% of reported cases, respectively, reported no contacts. Similarly, the proportion of contacts reached in Maryland (50%) and New Jersey (54%) were comparable. The relatively low participation and cooperation with contact tracing suggests a lack of community support and engagement with contact tracing. This, coupled with delays in testing results are contributing to ongoing transmission. To increase the timeliness and completeness of contact tracing, the North Carolina Department of Health and Human Services hired additional staff members to support local health departments, enhanced data systems, and pursued new technologies such as a single statewide caller identification number.

The findings in this report are subject to at least three limitations. First, both study locations were experiencing high and increasing COVID-19 incidence during the review period; high caseload volumes stress the system and can result in delays for testing, cases investigation, and contact tracing. Second, data drawn from county health department information systems are self-reported by patients or contacts, which could affect data validity. For example, a social desirability bias could have led to the underreporting of contacts because it is understood that contact with more persons increases risk for transmission. Finally, information about why so many persons with COVID-19 reported no contacts and why so many contacts were not reached was not available. This failure to comply with public health recommendations might reflect the various, and at times conflicting, messages about the importance of COVID-19 mitigations strategies[††] (*9*).

This assessment revealed that, although these two county health departments investigated the majority of index cases, a high proportion of persons with COVID-19 did not report contacts, many contacts were not reached, and the time needed to notify contacts likely reduced the impact of contact tracing as a mitigation strategy. Improved timeliness of contact tracing, community engagement, and community-wide mitigation are needed to interrupt SARS-CoV-2 transmission (*4*,*6*).

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[¶] https://coronavirus.maryland.gov/pages/contact-tracing.

[**] https://www.nj.gov/health/cd/topics/covid2019_dashboard.shtml.

[††] https://www.theguardian.com/us-news/2020/jun/28/north-carolina-coronavirus-reopening-cases-businesses.

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Update: Characteristics of Health Care Personnel with COVID-19 — United States, February 12–July 16, 2020

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As of September 21, 2020, the coronavirus disease 2019 (COVID-19) pandemic had resulted in 6,786,352 cases and 199,024 deaths in the United States.* Health care personnel (HCP) are essential workers at risk for exposure to patients or infectious materials (*1*). The impact of COVID-19 on U.S. HCP was first described using national case surveillance data in April 2020 (*2*). Since then, the number of reported HCP with COVID-19 has increased tenfold. This update describes demographic characteristics, underlying medical conditions, hospitalizations, and intensive care unit (ICU) admissions, stratified by vital status, among 100,570 HCP with COVID-19 reported to CDC during February 12–July 16, 2020. HCP occupation type and job setting are newly reported. HCP status was available for 571,708 (22%) of 2,633,585 cases reported to CDC. Most HCP with COVID-19 were female (79%), aged 16–44 years (57%), not hospitalized (92%), and lacked all 10 underlying medical conditions specified on the case report form† (56%). Of HCP with COVID-19, 641 died. Compared with nonfatal COVID-19 HCP cases, a higher percentage of fatal cases occurred in males (38% versus 22%), persons aged ≥65 years (44% versus 4%), non-Hispanic Asians (Asians) (20% versus 9%), non-Hispanic Blacks (Blacks) (32% versus 25%), and persons with any of the 10 underlying medical conditions specified on the case report form (92% versus 41%). From a subset of jurisdictions reporting occupation type or job setting for HCP with COVID-19, nurses were the most frequently identified single occupation type (30%), and nursing and residential care facilities were the most common job setting (67%). Ensuring access to personal protective equipment (PPE) and training, and practices such as universal use of face masks at work, wearing masks in the community, and observing social distancing remain critical strategies to protect HCP and those they serve.

Data from laboratory-confirmed and probable COVID-19 cases, voluntarily reported to CDC from state, local, and territorial health departments during February 12–July 16, 2020, were analyzed. COVID-19 cases are reported using a standardized case report form, which collects information on demographic characteristics, whether the case occurred in a U.S. health care worker (HCP status), symptom onset date, underlying medical conditions, hospitalization, ICU admission, and death. HCP occupation type and job setting were added to the case report form in May, enabling prospective and retrospective entry of these elements. Case surveillance data were enriched with additional cases from a COVID-19 mortality-focused supplementary surveillance effort in three jurisdictions§ (*3*). Descriptive analyses were used to examine characteristics by vital status. HCP occupation type and job setting were reported by a subset of jurisdictions with at least five HCP cases for each variable. Analyses were conducted using Stata (version 15.1; StataCorp) and SAS (version 9.4; SAS Institute).

Among 2,633,585 U.S. COVID-19 cases reported individually to CDC during February 12–July 16, HCP status was available for 571,708 (22%) persons, among whom 100,481 (18%) were identified as HCP. Data completeness for HCP status varied by jurisdiction; among jurisdictions that included HCP status on ≥70% of cases and reported at least one HCP case (11), HCP accounted for 14% (14,938 of 109,293) of cases with HCP status available and 11% (14,938 of 132,340) of all reported cases. Case report form data were enriched with 89 additional HCP cases using supplementary mortality data; thus, the final HCP case total for analysis was 100,570 (Table 1).

Among HCP with COVID-19 overall, the median age was 41 years (interquartile range = 30–53 years); 79% of cases were in females. Among 69,678 (69%) HCP cases with data on race and ethnicity, 47% were in non-Hispanic Whites (Whites), 26% were in Blacks, 12% were in Hispanics or Latinos of any race (Hispanics), and 9% were in Asians. Of persons with

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* https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html; https://www.cdc.gov/coronavirus/2019-ncov/covid-data/faq-surveillance.html; https://www.cdc.gov/coronavirus/2019-ncov/php/reporting-pui.html.

† Underlying medical condition status was classified as "known" if any of these 10 conditions, specified on the standard case report form, were reported as present or absent: diabetes mellitus; cardiovascular disease (includes hypertension); severe obesity (body mass index ≥40 kg/m^2); chronic renal disease; chronic liver disease; chronic lung disease; immunosuppressive condition; autoimmune condition; neurologic condition (including neurodevelopmental, intellectual, physical, visual, or health impairment); and psychologic/psychiatric condition.

§ The supplementary mortality surveillance effort, which included persons with laboratory-confirmed COVID-19 who died during February 12–April 24, 2020, identified 89 additional HCP and two additional deaths among known HCP from three jurisdictions: Michigan, New Jersey, and New York City.

TABLE 1. Demographics, underlying medical conditions, hospitalization status, and intensive care unit (ICU) status among health care personnel (HCP) with COVID-19, by vital status — United States, February 12–July 16, 2020

	No. (%)				
Characteristic[*]	**Total**	**Alive**	**Deceased[†]**	**Unknown**	**Case fatality ratio,[§] no./total no.**
Total	**100,570**	**67,105**	**641**	**32,824**	**0.95 (641/67,746)**
Age group (yrs)	**N = 100,432**	**N = 67,023**	**N = 641**	**N = 32,768**	—
16–44	**57,742 (57)**	39,018 (58)	57 (9)	18,667 (57)	0.15 (57/39,075)
45–54	**20,981 (21)**	13,836 (21)	99 (15)	7,046 (22)	0.71 (99/13,935)
55–64	**17,052 (17)**	11,264 (17)	205 (32)	5,583 (17)	1.79 (205/11,469)
≥65	**4,657 (5)**	2,905 (4)	280 (44)	1,472 (4)	8.79 (280/3,185)
Sex	**N = 99,741**	**N = 66,796**	**N = 639**	**N = 32,306**	—
Female	**78,328 (79)**	52,366 (78)	395 (62)	25,567 (79)	0.75 (395/52,761)
Male	**21,413 (21)**	14,430 (22)	244 (38)	6,739 (21)	1.66 (244/14,674)
Race/Ethnicity	**N = 69,678**	**N = 45,104**	**N = 552**	**N = 24,022**	—
American Indian/Alaska Native, non-Hispanic	**253 (0)**	186 (0)	0 (0)	67 (0)	—
Asian, non-Hispanic	**6,010 (9)**	4,083 (9)	111 (20)	1,816 (8)	2.65 (111/4,194)
Black, non-Hispanic	**18,117 (26)**	11,172 (25)	177 (32)	6,768 (28)	1.56 (177/11,349)
Hispanic/Latino[¶]	**8,030 (12)**	4,262 (9)	49 (9)	3,719 (15)	1.14 (49/4,311)
Multiple/Other, non-Hispanic	**4,195 (6)**	2,662 (6)	13 (2)	1,520 (6)	0.49 (13/2,675)
Native Hawaiian/Other Pacific Islander, non-Hispanic	**422 (1)**	314 (1)	4 (1)	104 (0)	1.26 (4/318)
White, non-Hispanic	**32,651 (47)**	22,425 (50)	198 (36)	10,028 (42)	0.88 (198/22,623)
Underlying medical conditions[**]	**N = 40,582**	**N = 26,868**	**N = 378**	**N = 13,336**	—
Any underlying medical condition	**17,838 (44)**	11,012 (41)	348 (92)	6,478 (49)	3.06 (348/11,360)
Any chronic lung disease	**6,422 (16)**	4,064 (15)	89 (24)	2,269 (17)	2.14 (89/4,153)
Any cardiovascular disease	**7,348 (18)**	4,331 (16)	229 (61)	2,788 (21)	5.02 (229/4,560)
Diabetes mellitus	**5,466 (13)**	3,314 (12)	198 (52)	1,954 (15)	5.64 (198/3,512)
Immunosuppressing condition	**1,504 (4)**	1,070 (4)	24 (6)	410 (3)	2.19 (24/1,094)
Severe obesity	**1,101 (3)**	453 (2)	27 (7)	621 (5)	5.63 (27/480)
Chronic renal disease	**503 (1)**	279 (1)	45 (12)	179 (1)	13.89 (45/324)
Neurologic/Neurodevelopmental disability	**528 (1)**	333 (1)	34 (9)	161 (1)	9.26 (34/367)
Chronic liver disease	**242 (1)**	148 (1)	10 (3)	84 (1)	6.33 (10/158)
Autoimmune condition	**479 (1)**	262 (1)	3 (1)	214 (2)	1.13 (3/265)
Psychologic/psychiatric condition	**353 (1)**	191 (1)	4 (1)	158 (1)	2.05 (4/195)
Admission to hospital	**N = 83,202**	**N = 55,415**	**N = 591**	**N = 27,196**	—
Yes	**6,832 (8)**	4,207 (8)	518 (88)	2,107 (8)	10.96 (518/4,725)
Admission to ICU	**N = 33,694**	**N = 22,545**	**N = 377**	**N = 10,772**	—
Yes	**1,684 (5)**	662 (3)	295 (78)	727 (7)	30.83 (295/957)

Abbreviation: COVID-19 = coronavirus disease 2019.

[*] Variable completeness varied by case characteristic: age (>99%), sex (99%), race and ethnicity (69%), hospitalization status (83%), ICU admission status (34%); characteristic-specific sample size for cases with available information are presented for each grouping. N = number with available information.

[†] Death outcomes were known for 67,746 (67%) HCP cases; of these, 91 additional new fatal cases were included based on data from the supplementary mortality project (89 newly identified as HCP and two newly identified deaths among known HCP). Additional available data for these 91 cases were incorporated if missing in the national case surveillance data.

[§] Deaths per 100 HCP cases with known death status.

[¶] Cases reported as Hispanic were categorized as "Hispanic or Latino persons of any race" regardless of availability of race data.

[**] Underlying medical condition status was classified as "known" if any of these 10 conditions, specified on the standard case report form, were reported as present or absent: diabetes mellitus, cardiovascular disease (includes hypertension), severe obesity (body mass index ≥40 kg/m^2), chronic renal disease, chronic liver disease, chronic lung disease, immunosuppressing condition, autoimmune condition, neurologic condition (including neurodevelopmental, intellectual, physical, visual, or health impairment), or psychologic/psychiatric condition. Status for these conditions was "known" for 40,582 persons. Responses include data from standardized fields supplemented with data from the free text field for "other chronic disease/underlying condition" for the 10 specific medical conditions, if not originally specified.

known hospitalization or ICU admission status, 8% (6,832 of 83,202) were hospitalized and 5% (1,684 of 33,694) were treated in an ICU. Vital status was known for 67% (67,746) of HCP with COVID-19; among those, 641 (1%) died. Deaths among HCP with COVID-19 were reported in 22 jurisdictions. Compared with those who survived, decedents tended to be older (median age = 62 versus 40 years), male (38% versus 22%), Asian (20% versus 9%), or Black (32% versus 25%).

Among HCP cases with data on one or more of 10 underlying medical conditions specified on the case report form, 17,838 (44%) persons had at least one condition. The most common were cardiovascular disease (18%), chronic lung disease (16%), and diabetes mellitus (13%). The vast majority (92%) of fatal HCP cases were among HCP with an underlying medical condition. More than one half had cardiovascular disease (61%) or diabetes mellitus (52%), conditions known to increase the risk for severe COVID-19[¶]; 32% were reported to have both conditions (Table 1).

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

Six jurisdictions reported the occupation type[**] or job setting[††] for at least five HCP with COVID-19 (Table 2). Among HCP with COVID-19 in these jurisdictions, occupation type was available for 59% (5,913 of 9,984) and job setting for 41% (6,955 of 17,052). Health care support workers accounted for the largest overall group of occupation types (32%), and nurses constituted the largest single occupation type (30%) (Table 2). Within this subset of HCP cases, two thirds (67%) were in persons reported to work in nursing and residential care facilities.

TABLE 2. Occupation type and job setting of health care personnel (HCP) with COVID-19 — six jurisdictions,[*] February 12–July 16, 2020

Characteristic (no. with available information)[†]	No. (%)
Occupation type (5,913)[§]	
Health care support worker[¶]	1,895 (32.1)
Nurse[**]	1,742 (29.5)
Administrative staff member	581 (9.8)
Environmental services worker	330 (5.6)
Physician	190 (3.2)
Medical technician	135 (2.3)
Behavioral health worker	128 (2.2)
First responder	113 (1.9)
Dietary services worker	113 (1.9)
Dental worker	98 (1.7)
Laboratorian	68 (1.2)
Occupational, physical, or speech therapist	65 (1.1)
Pharmacy worker	62 (1.1)
Respiratory therapist	44 (0.7)
Phlebotomist	25 (0.4)
Physician assistant	13 (0.2)
Other	311 (5.3)
Job setting (6,955)[§]	
Nursing and residential care facility[††,§§]	4,649 (66.8)
Hospital	1,231 (17.7)
Ambulatory health care service[¶¶]	804 (11.6)
Other	271 (3.9)

Abbreviation: COVID-19 = coronavirus disease 2019.

[*] Alaska, Kansas, Michigan, Minnesota, North Carolina, and Utah.

[†] Occupation type data are included for five jurisdictions (Alaska, Kansas, Minnesota, North Carolina, and Utah) that reported occupation type for at least five HCP COVID-19 cases; occupation type data were known for 59% (5,913 of 9,984) of HCP cases in those jurisdictions. Job setting data are included for five jurisdictions (Alaska, Kansas, Michigan, Minnesota, and Utah) that reported job setting for at least five HCP COVID-19 cases; job setting data were known for 41% (6,955 of 17,052) of HCP cases in those jurisdictions.

[§] Occupation type and job setting categories were determined either by inclusion on the CDC case report form or by manual review and categorization of free-text entries within "other, specify" fields. Free-text data were used to supplement existing categories for occupation (nurse, environmental services worker, physician, respiratory therapist) and setting (long-term care facility [including nursing home/assisted living facility], hospital, rehabilitation facility) and create new categories.

[¶] Includes nursing assistant (1,444), medical assistant (123), and other care provider or aide (328); free-text fields were used to create new categories.

[**] Includes data from standardized fields (1,724) supplemented with data from free-text fields (18); types of nurses or nursing specialties are not specified.

[††] Includes long-term care facility (including nursing home/assisted living facility) (4,424), rehabilitation facility (131), and group home (94).

[§§] Michigan provides job setting data only for cases identified from long-term care facilities (2,800).

[¶¶] Includes outpatient care center (422), home health care service (317), and dental facility (65); free-text fields were used to create new categories.

Discussion

State, local, and territorial health departments voluntarily submit COVID-19 case notification data to CDC, and these critical data help provide a national picture of cases. The first report on HCP with COVID-19 using national case surveillance data in April 2020 (*2*) described characteristics of 9,282 HCP cases and 27 deaths among approximately 315,000 total cases. As of July 16, 2020, among approximately 2.5 million reported U.S. COVID-19 cases, 100,570 cases in HCP and 641 deaths among HCP with COVID-19 have been reported to CDC. Continued national surveillance is vital to evaluate the effect of the pandemic on HCP, and this update emphasizes the ongoing impact on this essential working population.

Among reported HCP with COVID-19, age and sex distributions remain comparable to those of the overall U.S. HCP workforce[§§]; however, compared with nonfatal COVID-19 cases in HCP, fatal HCP cases were more common among older persons and males. Similar to findings described in the overall population (*4*,*5*), HCP with underlying medical conditions who developed COVID-19 were at increased risk for death. Almost all reported HCP with COVID-19 who died had at least one of 10 underlying conditions listed on the case report form, compared with fewer than one half of those who survived. Asian and Black HCP were also more prevalent among fatal cases; disproportionate mortality of persons from some racial and ethnic groups among cases has also been described in the general population (*3*). Long-standing inequities in social determinants of health can result in some groups being at increased risk for illness and death from COVID-19, and these factors must also be recognized and addressed when protecting essential workers in the workplace, at home, and in the community. Ensuring adequate allocation of PPE to all HCP in the workplace is one important approach to mitigating systemic inequalities in COVID-19 risk (*6*). As the COVID-19 pandemic continues in the United States, HCP are faced with increasing fatigue, demands, and stressors. HCP who are at higher risk for severe illness and death from COVID-19 should maintain ongoing communication with their personal health

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[**] Seventeen HCP occupation type categories: health care support worker (includes nursing assistant, medical assistant, and other care provider or aide); nurse; administrative staff member; environmental services worker; physician; medical technician; behavioral health worker; first responder; dietary services worker; dental worker; laboratorian; occupational, physical, or speech therapist; pharmacy worker; respiratory therapist; phlebotomist; physician assistant; and other; data were reported in five jurisdictions (Alaska, Kansas, Minnesota, North Carolina, and Utah).

[††] Three HCP job setting categories: nursing and residential care facility (includes long-term care facility [nursing home/assisted living facility], rehabilitation facility, and group home); hospital; ambulatory health care service (includes outpatient care center, home health care service, and dental facility); data were reported in five jurisdictions (Alaska, Kansas, Michigan, Minnesota, and Utah).

[§§] https://www.bls.gov/cps/tables.htm#charemp.

Summary

What is already known about this topic?

Health care personnel (HCP) are essential workers at risk for COVID-19.

What is added by this report?

HCP with COVID-19 who died tended to be older, male, Asian, Black, and have an underlying medical condition when compared with HCP who did not die. Nursing and residential care facilities were the most commonly reported job setting and nursing the most common single occupation type of HCP with COVID-19 in six jurisdictions.

What are the implications for public health practice?

Continued surveillance is vital to understand the impact of COVID-19 on essential workers. Ensuring access to personal protective equipment and training, and practices such as universal use of face masks at work, wearing masks in the community, and observing social distancing remain critical strategies to protect HCP and those they serve.

care providers and occupational health services to manage their risks at work and in the community.

In this update, most HCP with COVID-19 were reported to work in nursing and residential care facilities. Large COVID-19 outbreaks in long-term care facilities suggest that transmission occurs among residents and staff members (*7*,*8*). During the COVID-19 pandemic, multiple challenges in long-term care settings have been identified, including inadequate staffing and PPE, and insufficient training in infection prevention and control. As the pandemic continues, it is essential to meet the health and safety needs of HCP serving populations requiring long-term care. Importantly, HCP cases were also identified from a variety of other health care settings. Therefore, increased access to resources, appropriate training, and ongoing support are needed across the health care spectrum to protect all HCP and their patients.

HCP with COVID-19 were reported among a diverse range of occupations. Nurses represented 30% of HCP cases with known occupation type, but account for only approximately 15% of the total U.S. health care and social assistance workforce.[¶¶] Nurses and health care support workers often have frequent, close contact with patients and work in settings that might increase their risk for acquiring SARS-CoV-2, the virus that causes COVID-19. HCP who do not provide direct patient care, such as administrative staff members and environmental service workers, were also reported to have COVID-19. Risk to HCP can occur through pathways other than direct patient care, such as exposure to coworkers, household members, or persons in the community. HCP who acquire SARS-CoV-2 can similarly introduce the virus to patients, coworkers, or persons outside the workplace. Thus, practices such as universal use of face masks at work, wearing masks in the community, observing social distancing, and practicing good hand hygiene remain critical strategies to protect HCP and the populations they serve. Screening HCP for illness before workplace entry and providing nonpunitive sick leave options remain critical practices.

The findings in this report are subject to at least five limitations. First, although reporting completeness increased from 16% in April to 22% in July (*2*), HCP status remains missing for most cases reported to CDC. HCP might be prioritized for testing, but the actual number of cases in this population is most certainly underreported and underdetected, especially in asymptomatic persons (*9*,*10*). Second, the amount of missing data varied across demographic groups, underlying medical conditions, and health outcomes; persons with known HCP status and other information might differ systematically from those for whom this information is not available. Third, details of HCP occupation type and job setting were not included on the CDC case report form until May 2020, and only six jurisdictions reported these data. Fourth, testing strategies and availability can vary by jurisdiction and health care setting, influencing the numbers and types of HCP cases detected. Finally, this report does not include information on whether exposure to SARS-CoV-2 among HCP cases occurred in the workplace or in other settings, such as the household or community.

As of July 16, 2020, 100,570 COVID-19 cases in HCP and 641 deaths among HCP with COVID-19 were reported in the United States. Information on COVID-19 among essential workers, including HCP, can inform strategies needed to protect these populations and those they serve, including decisions related to COVID-19 vaccination, when available. Factors such as demographics, including race and ethnicity, underlying health conditions, occupation type, and job setting can contribute to the risk of HCP acquiring COVID-19 and experiencing severe outcomes, including death. Given the evidence of ongoing COVID-19 infections among HCP and the critical role these persons play in caring for others, continued protection of this population at work, at home, and in the community remains a national priority.[***]

[¶¶] https://data.bls.gov/projections/nationalMatrix?queryParams=620000&ioType=i.

[***] https://www.cdc.gov/coronavirus/2019-nCoV/hcp/index.html.

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Disparities in COVID-19 Incidence, Hospitalizations, and Testing, by Area-Level Deprivation — Utah, March 3–July 9, 2020

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Coronavirus disease 2019 (COVID-19) has had a substantial impact on racial and ethnic minority populations and essential workers in the United States, but the role of geographic social and economic inequities (i.e., deprivation) in these disparities has not been examined (*1*,*2*). As of July 9, 2020, Utah had reported 27,356 confirmed COVID-19 cases. To better understand how area-level deprivation might reinforce ethnic, racial, and workplace-based COVID-19 inequities (*3*), the Utah Department of Health (UDOH) analyzed confirmed cases of infection with SARS-CoV-2 (the virus that causes COVID-19), COVID-19 hospitalizations, and SARS-CoV-2 testing rates in relation to deprivation as measured by Utah's Health Improvement Index (HII) (*4*). Age-weighted odds ratios (weighted ORs) were calculated by weighting rates for four age groups (≤24, 25–44, 45–64, and ≥65 years) to a 2000 U.S. Census age-standardized population. Odds of infection increased with level of deprivation and were two times greater in high-deprivation areas (weighted OR = 2.08; 95% confidence interval [CI] = 1.99–2.17) and three times greater (weighted OR = 3.11; 95% CI = 2.98–3.24) in very high-deprivation areas, compared with those in very low-deprivation areas. Odds of hospitalization and testing also increased with deprivation, but to a lesser extent. Local jurisdictions should use measures of deprivation and other social determinants of health to enhance transmission reduction strategies (e.g., increasing availability and accessibility of SARS-CoV-2 testing and distributing prevention guidance) to areas with greatest need. These strategies might include increasing availability and accessibility of SARS-CoV-2 testing, contact tracing, isolation options, preventive care, disease management, and prevention guidance to facilities (e.g., clinics, community centers, and businesses) in areas with high levels of deprivation.

Confirmed COVID-19 cases reported by local health departments and UDOH to the Utah National Electronic Disease Surveillance System during March 3–July 9, 2020, were included in the analysis. Addresses were used to assign cases to one of 99 Utah small statistical areas,* each with an HII score ranging from 72 to 160 (*4*). HII is a composite index calculated using nine indicators from the Utah Behavioral Risk Factor Surveillance System (BRFSS) (*5*): 1) median family income; 2) income disparity (a logarithmic ratio of households with <$10,000 income to ≥$50,000 income); 3) percentage of home ownership; 4) percentage of unemployment; 5) percentage of families below poverty threshold; 6) percentage of single-parent households with children aged <18 years; 7) percentage of population aged ≥25 years with <9 years of education; 8) percentage of population aged ≥25 years with at least a high school diploma; and 9) percentage of population at <150% of the poverty threshold (*6*). HII is categorized into quintiles: very low (least deprived), low, average, high, and very high (most deprived). Lower-deprivation areas are concentrated in many urban and suburban parts of northern Utah (e.g., Salt Lake, Davis, and Wasatch counties); higher-deprivation areas are generally in rural central and southern Utah, western Salt Lake City metropolitan area, and parts of other cities (e.g., Ogden and Logan).

COVID-19 incidence by HII quintile was calculated as the number of COVID-19 cases confirmed by real-time reverse transcription–polymerase chain reaction (RT-PCR) testing per 100,000 persons during March 3–July 9, 2020. Hospitalization rates were calculated as the number of patients with confirmed COVID-19 cases admitted to hospitals per 1,000 COVID-19 patients. SARS-CoV-2 testing rates were calculated as the number of persons whose specimens were tested by real-time RT-PCR at least once per 100,000 persons. Percent positivity was calculated as the percentage of persons who received a positive SARS-CoV-2 test result among those tested. Binary logistic regression was used to calculate unadjusted odds ratios (ORs) for incidence, hospitalization, and testing in each HII quintile, with the very low (least deprived) quintile as the referent. Rates for four age groups (≤24, 25–44, 25–64, and ≥65 years) were weighted to a U.S. Census 2000 age-standardized population to calculate age-weighted rates and weighted ORs. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†

HII quintiles were further characterized by 10 variables. Four variables came from BRFSS, constituting percentages of residents who 1) identified as a race other than White (non-White),

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* Utah's small statistical areas are areas delineated by the state to facilitate community-level reporting for the smallest units with enough data to be reliable. https://ibis.health.utah.gov/ibisph-view/pdf/resource/Algorithm.pdf.

† 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.

2) identified as Hispanic or Latino (Hispanic); 3) were food insecure; or 4) were uninsured. Another six variables came from 2018 American Community Survey 5-year estimate data (*7*) on percentages of workers in high-risk sectors in Utah (*3*) including 1) food preparation and serving; 2) building and grounds cleaning and maintenance; 3) production; 4) construction and extraction; and 5) transportation and material moving; and 6) the percentage living in residences with one or more persons per room. SAS software (version 9.4; SAS Institute) was used for all analyses.

Incidence of confirmed COVID-19 increased with area deprivation level, from 545 in very low-deprivation areas to 674 in low-, 811 in average-, 1,124 in high-, and 1,674 in very high-deprivation areas (Table 1). Age-weighted incidences were slightly higher in all HII quintiles.

Hospitalization rates were similar in very high- (70 per 1,000 cases) and average- (70) deprivation areas and <60 in very low- (51), low- (58), and high- (59) deprivation areas. Age-weighting resulted in higher hospitalization rates, especially in higher deprivation quintiles.

Testing rates also increased with deprivation level; the rate in very high-deprivation areas (13,374 per 100,000 persons) was approximately 25% higher than that in very low-deprivation areas (10,723). Age-weighted testing rates were higher than were unadjusted rates. Percentage test positivity increased with deprivation level, from 5.0% in very low-deprivation areas to 12.0% in very high areas.

Compared with persons living in very low-deprivation areas, age-weighted odds of having confirmed SARS-CoV-2 infection were significantly higher for persons in low- (weighted OR = 1.23), average- (1.49), high- (2.08), or very high- (3.11) deprivation areas (Table 2). Compared with patients living in very low-deprivation areas, the odds of hospitalization were significantly higher for those residing in low- (1.22), average- (1.52), high- (1.37), or very high- (1.64) deprivation areas. Odds of testing were similar among persons in low- (1.05) or average- (1.03) deprivation areas, compared with those in very low-deprivation areas, and were slightly higher among those in high- (1.23) and very high-deprivation areas (1.31).

Area-level demographic and socioeconomic characteristics were also correlated with deprivation level (Table 3). The population percentages of Hispanic (22.5%) and non-White (22.0%) residents in very high-deprivation areas were more than four and three times as high as those in very low-deprivation areas (5.1% and 7.0%, respectively). The proportion of food-insecure residents living in very high-deprivation areas (22.6%) was approximately twice that of those in very low-deprivation areas (13.5%), as was the proportion employed in a higher-risk sector (35.9% versus 17.7%). Similarly, proportions of uninsured residents and those living in residences with more than one occupant per room were four times as high (16.9% and 6.6%, respectively) in very high-deprivation areas as they were in very low-deprivation areas (4.2% and 1.5%, respectively).

TABLE 1. Characteristics of COVID-19 outbreak, by quintiles of health improvement index areas — Utah, March 3–July 9, 2020

	Level of deprivation				
Characteristic	**Very low (least deprived)**	**Low**	**Average**	**High**	**Very high (most deprived)**
Population in 2018	**585,696**	**853,813**	**625,971**	**578,836**	**516,702**
Cases					
No. of cases	3,119	5,585	4,943	6,324	8,177
Incidence[*] (95% CI)	533 (514–552)	654 (637–6725)	790 (768–812)	1,093 (1,066–1,121)	1,583 (1,548–1,617)
Incidence,[*] weighted[†] (95% CI)	545 (905–927)	674 (656–692)	811 (788–834)	1,124 (1,096–1,153)	1,674 (1,637–1,712)
Hospitalization					
No. of hospitalizations	160	324	346	375	576
Hospitalization rate[§] (95% CI)	51 (44–60)	58 (52–65)	70 (63–78)	59 (53–66)	70 (65–76)
Hospitalization rate,[§] weighted[†] (95% CI)	51 (43–60)	62 (55–69)	76 (68–84)	69 (61–76)	81 (74–89)
Testing					
No. of persons tested for COVID-19	62,801	94,926	70,151	74,994	69,103
Testing rate[¶] (95% CI)	10,723 (10,639–10,807)	11,118 (11,047–11,189)	11,207 (11,124–11,290)	12,956 (12,863–13,049)	13,374 (13,274–13,474)
Testing rate,[¶] weighted[†] (95% CI)	11,143 (11,055–11,230)	11,614 (11,540–11,690)	11,438 (11,353–11,523)	13,433 (13,336–13,530)	14,164 (14,056–14,271)
Percentage positive [**]	5.0	6.0	7.2	8.6	12.0

Abbreviations: CI = confidence interval; COVID-19 = coronavirus disease 2019.

[*] Cases per 100,000 population during March 3–July 9, 2020.

[†] Calculated by weighting rates for four age groups (≤24, 25–44, 25–64, and ≥65 years) to a U.S. Census 2000 age-standardized population.

[§] Hospitalizations per 1,000 cases.

[¶] Determined by number of persons tested at least once per 100,000 persons.

[**] Percentage of persons who received a positive SARS-CoV-2 test result among all those tested.

TABLE 2. Unadjusted odds ratios (ORs), weighted* ORs, and 95% confidence intervals (CIs) for COVID-19 infection, hospitalization, and testing, by quintiles of health improvement index areas — Utah, March 3–July 9, 2020

Characteristic	Level of deprivation				
	Very low (least deprived)	Low	Average	High	Very high (most deprived)
Cases					
OR (95% CI) for confirmed SARS-CoV-2 infection	Referent	1.23 (1.17–1.29)	1.49 (1.42–1.56)	2.06 (1.98–2.15)	3.00 (2.88–3.13)
Weighted OR (95% CI) for confirmed SARS-CoV-2 infection	Referent	1.23 (1.19–1.29)	1.49 (1.43–1.56)	2.08 (1.99–2.17)	3.11 (2.98–3.24)
Hospitalization					
OR (95% CI) for hospitalization of a patient with a confirmed case	Referent	1.14 (0.94–1.38)	1.39 (1.15–1.69)	1.16 (0.96–1.41)	1.40 (1.17–1.68)
Weighted OR (95% CI) for hospitalization of a patient with a confirmed case	Referent	1.22 (1.00–1.47)	1.52 (1.26–1.84)	1.37 (1.14–1.65)	1.64 (1.38–1.97)
Testing					
OR (95% CI) for having been tested	Referent	1.04 (1.03–1.05)	1.05 (1.04–1.06)	1.24 (1.23–1.25)	1.29 (1.27–1.30)
Weighted OR for having been tested	Referent	1.05 (1.04–1.06)	1.03 (1.02–1.04)	1.23 (1.22–1.25)	1.31 (1.30–1.33)

Abbreviation: COVID-19 = coronavirus disease 2019.

* Weighted ORs were calculated by estimating the number of persons with the outcome of interest based on the age-weighted rates for each Health Improvement Index quintile. Confidence intervals that do not span 1.0 are considered significant

TABLE 3. Demographic, socioeconomic, and occupational characteristics, by quintiles of health improvement index areas — Utah, March 3–July 9, 2020

Characteristic	% of population				
	Level of deprivation				
	Very low (least deprived)	Low	Average	High	Very high (most deprived)
Population in 2018	**585,696**	**853,813**	**625,971**	**578,836**	**516,702**
Demographic					
Hispanic or Latino	5.1	9.9	10.4	13.5	22.5
Non-White	7.0	10.1	12.5	13.8	22.0
Socioeconomic					
Food insecure*	13.5	17.3	20.1	23.7	26.6
Uninsured	4.2	6.9	10.2	10.5	16.9
Living in residence with >1 occupant per room	1.5	2.6	3.3	3.9	6.6
Occupational					
Food preparation and serving related	3.4	4.7	4.9	5.8	6.7
Building and grounds cleaning and maintenance	2.1	2.6	3.9	3.7	5.7
Construction and extraction	3.4	4.6	6.4	5.8	6.9
Production	3.9	5.6	6.7	8.3	8.4
Transportation and material moving	4.9	6.0	7.9	7.6	8.2
Any of the above occupational categories	17.7	23.5	29.8	31.2	35.9

* Determined based on households in which the head indicated insufficient balanced meals, portion sizes, or food availability or participation in food assistance programs because of socioeconomic circumstances.

Discussion

During March 3–July 9, 2020, odds of SARS-CoV-2 infection among residents living in areas of very high deprivation were three times higher than those of residents of areas of very low deprivation. The difference in incidence between residents of high- and very high-deprivation areas was as large as that between residents of very low- and high-deprivation areas, suggesting that extreme deprivation could compound transmission. Odds of hospitalization among residents of very high-deprivation areas were 1.6 times those among residents of very low-deprivation areas. Odds of testing varied less with deprivation than did incidence or hospitalization. Age-weighting generally amplified odds ratios, reflecting the younger age profile among persons in high-deprivation area populations (e.g., younger Hispanic and Pacific Islander families).

Area-level deprivation could exacerbate the ethnic and racial inequalities in COVID-19 morbidity and mortality observed in previous studies (*1*–*3*). A recent New York City study found that odds of infection were lower among pregnant women living in neighborhoods with higher median incomes and higher among women living in neighborhoods with more densely populated households (*8*). The unexpectedly high odds of hospitalization in average-deprivation areas could reflect more

Summary

What is already known about this topic?

COVID-19 has disproportionately affected socially disadvantaged groups.

What is added by this report?

During March 3–June 9, 2020, odds of SARS-CoV-2 infection in very high-deprivation areas of Utah were three times higher than those in very low-deprivation areas; rates of hospitalization and testing were also higher in higher-deprivation areas. These areas were characterized by larger proportions of Hispanic and non-White residents, persons working in manual, essential, and public-facing sectors, more crowded housing, and food and health care insecurity.

What are the implications for public health practice?

Enhanced mitigation strategies might include increasing availability and accessibility of SARS-CoV-2 testing, contact tracing, isolation options, preventive care, disease management, and prevention guidance in more deprived areas.

health care–seeking behavior and access to health insurance in those areas compared with more deprived areas (*1*,*9*). Risk factors for COVID-19 might cluster within geographic areas. For example, persons living in deprived areas might be both more likely to work in settings where they could become infected (*3*) and to live in higher-density settings where household members could become secondarily infected (*8*). They might also be unable to adhere to isolation protocols because of work requirements, higher-density dwellings, or lack of private transportation (*10*).

The findings in this report are subject to at least six limitations. First, incidence and testing could be underestimated because of presymptomatic transmission of SARS-CoV-2 and mild disease, which might be unrecognized. Second, HII is a composite measure of deprivation, and it is difficult to know which of its constituent factors are driving associations or the degree to which HII is a stronger predictor than individual factors. Third, Utah's small areas might not match up precisely with communities; some areas might have a higher HII score because of a transient student population with lower incomes, whereas areas with overall low scores might still have clusters of underserved communities, such as American Indians. Fourth, characterization of HII quintiles was limited to area-level variables from BRFSS and American Community Survey; other potentially influential variables (e.g., overall dwelling density) were not available. Fifth, area-level population data are drawn from estimates before the pandemic, and pertinent measures such as unemployment might have changed more recently. Finally, occupational sectors included were not exhaustive of all high-risk work, and professions (e.g., frontline workers versus managers) might better characterize risk across deprivation areas.

Public health agencies should use social determinants of health such as deprivation to assess area-level COVID-19 disparities and implement interventions to address those disparities exacerbated by living and working conditions (*9*). These interventions might include increasing availability and accessibility of SARS-CoV-2 testing, contact tracing, isolation options, and preventive care and disease management in more deprived areas and distributing prevention guidance to facilities (e.g., clinics, community centers, and businesses) in these areas. In addition, public health agencies should prepare linguistically and culturally appropriate materials in the first language of ethnocultural communities at risk located in deprived areas and build partnerships with organizations that could facilitate outreach to those communities (*9*). Such place-focused strategies could constitute novel approaches to reducing the disproportionate incidence of COVID-19 in socioeconomically and materially disadvantaged communities.

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Utah's local health department case investigators; COVID-19 surveillance staff members.

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Rabies in a Dog Imported from Egypt — Kansas, 2019

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Although canine rabies virus variant (CRVV) was successfully eliminated from the United States after approximately 6 decades of vaccination campaigns, licensing requirements, and stray animal control, dogs remain the principal source of human rabies infections worldwide. A rabies vaccination certificate is required for dogs entering the United States from approximately 100 countries with endemic CRVV, including Egypt (*1*). On February 25, 2019, rabies was diagnosed in a dog imported from Egypt, representing the third canine rabies case imported from Egypt in 4 years (*2*,*3*). This dog and 25 others were imported by a pet rescue organization in the Kansas City metropolitan area on January 29. Upon entry into the United States, all 26 dogs had certificates of veterinary inspection, rabies vaccination certificates, and documentation of serologic conversion from a government-affiliated rabies laboratory in Egypt. CDC confirmed that the dog was infected with a CRVV that circulates in Egypt, underscoring the continued risk for CRVV reintroduction and concern regarding the legitimacy of vaccine documentation of dogs imported from countries considered at high risk for CRVV. Vaccination documentation of dogs imported from these countries should be critically evaluated before entry into the United States is permitted, and public health should be consulted upon suspicion of questionable documents.

Investigation and Findings

On January 28, 2019, 26 dogs arrived at the Pearson International Airport in Toronto, Canada, from Cairo, Egypt. The dogs were driven from Canada to the Kansas City metropolitan area through Port Huron, Michigan. The dogs' documentation was reviewed by Canadian authorities, the United States Border Patrol, and the Kansas Department of Agriculture and met entry requirements. The dogs were immediately adopted or fostered by persons in Kansas and Missouri upon arrival.

On February 20, a fostered 2-year-old dog from this cohort (dog A) developed polydipsia, polyphagia, and diarrhea. The next evening, it began vomiting, ingested a blanket, and developed ataxia, hypersalivation, and abnormal vocalization. After transport to veterinary hospital A on February 21, dog A displayed abnormal aggression and bit a technician. The dog was transferred to veterinary hospital B on February 22 and exhibited bilateral protruding third eyelids and on February 23 was observed biting at the air as if trying to catch a fly (i.e., fly-biting behavior), both of which are considered neurologic abnormalities consistent with rabies virus infection. The dog continued to decline as it became laterally recumbent and developed increased aggression. Veterinary staff members at hospital B suspected rabies, and the dog was humanely euthanized and submitted for rabies testing on February 24.

On February 25, the Kansas State University Rabies Laboratory (KSU-RL) confirmed rabies infection by direct fluorescent antibody test. On March 1, CDC identified the cosmopolitan canine rabies virus lineage by sequencing the complete nucleoprotein (N) gene. The sequence was nearly identical to virus from a rabid dog imported into Connecticut from Egypt in 2017, with six nucleotides substituted (99.5% identical) across the entire N gene.

Public Health Response

After KSU-RL confirmed rabies, the Kansas Department of Health and Environment (KDHE), Johnson County Department of Health and Environment, Missouri Department of Health and Senior Services, Kansas Department of Agriculture, Missouri Department of Agriculture, United States Department of Agriculture, and CDC initiated an investigation to implement prevention and control measures.

KDHE, Missouri Department of Health and Human Services, and Johnson County Department of Health and Environment interviewed dog A's caretakers, pet rescue director, and staff members of veterinary hospitals A and B to assess potential human and animal exposures. Overall, 44 persons elected to receive rabies postexposure prophylaxis (PEP), 38 (86%) of whom were veterinary staff members who initiated PEP before assessment by public health. After assessments were conducted, the departments of health recommended that only 19 of those persons receive PEP, including 13 veterinary staff members, five pet rescue employees, and one household contact. Eighteen (95%) of the 19 were nonbite exposures.

Dog A had been fostered with 12 other dogs and two cats from the United States. Two of the 12 dogs were not immunized against rabies (one was pregnant at the time it was acquired by the pet rescue so did not receive rabies vaccination and the other was not vaccinated for unknown reasons). These two dogs were placed in a 6-month quarantine at the pet rescue. The other 10 dogs were administered rabies booster vaccinations and observed for 45 days. The two cats were never exposed to dog A.

Serologic assays (rapid fluorescent focus inhibition test [RFFIT] and enzyme-linked immunosorbent assay [ELISA]) were performed by KSU-RL on serum drawn from dog A before euthanasia to determine if it had evidence of past vaccination. RFFIT, which measures neutralizing function of antibodies, was positive (0.8 IU/mL). ELISA, which measures binding immunoglobulin (Ig) G antibodies to viral antigens, was negative (<0.125 EU/mL), indicating that the neutralizing antibody detected with RFFIT was IgM. Vaccination was reported to have occurred >2 months earlier; since IgM response occurs shortly after antigen exposure, and IgG response is detectable after Ig class-switching and is long-lived, these results indicate dog A had no history of vaccination but was in the early stage of development of rabies infection at the time it was euthanized.

Because of uncertainty about the validity of documentation or efficacy of rabies vaccine administered in Egypt, KDHE required the remaining 25 dogs to be quarantined or euthanized. All 25 dogs were returned to the pet rescue, which was approved by the Kansas Department of Agriculture's Animal Facilities Inspection Program, for quarantine by March 1. Length of quarantine was determined through prospective serologic monitoring, which is recognized by the National Association of State Public Health Veterinarians as a testing method to evaluate whether a healthy dog or cat without valid rabies vaccine documentation has been previously vaccinated (*4*). Prospective serologic monitoring utilizes RFFIT on paired serum specimens collected on days 0 and 5–7. Rabies vaccine is administered after collection of the first specimen. If the first titer is ≥0.5 IU/mL or a statistically significant rise in titer (1.8-fold increase) occurs between collection of the first and second specimen, and the second titer is ≥0.5 IU/mL, then the animal is considered to have been previously vaccinated.

All 26 imported dogs had documentation of recent receipt of rabies vaccine from three different manufacturers (Table). These manufacturers confirmed that all vaccine products listed on the certificates were valid products based on lot numbers. KSU-RL performed prospective serologic monitoring. Seven dogs (B, D, G, H, J, N, and Z) had serologic evidence of previous vaccination and were quarantined for 4 months. The remaining 18 dogs had no evidence of previous vaccination and required a 6-month quarantine. Quarantine release dates were calculated from the dogs' arrival in North America (January 28); all dogs survived and were released on May 29 or July 29, 2019. The other dogs considered to have been exposed to the rabid dog at the foster home also survived their quarantine/observation periods.

Discussion

CDC estimates that 1.06 million dogs enter the United States each year; 107,100 from areas considered to be high risk for endemic CRVV (*5*). Countries are considered high risk for exporting a dog infected with CRVV when the virus is enzootic anywhere within the country and their rabies surveillance and dog vaccination programs do not meet the standards developed by the World Organisation for Animal Health (*6*).

Each imported case of CRVV represents a risk of reintroduction of the virus into the United States canine population and exhausts public health resources. Each response to an imported dog with CRVV is estimated to consume 800 hours in resources and cost nearly $214,000 in personnel time and PEP (*7*). During this investigation, an average of $9,290* was spent per person for PEP, excluding administration and exam charges, totaling $176,510 for 19 persons who were recommended to receive PEP or $408,760 for all 44 persons who received PEP.

Federal regulation requires that dogs imported into the United States from CRVV high-risk countries have a valid rabies vaccination certificate documenting receipt of vaccine at least 28 days before travel (*1*). Kansas regulation requires dogs to have a certificate of veterinary inspection issued 30 days before movement and proof of rabies vaccination in animals aged >3 months (*8*). These documents were examined at the Canada–United States and Kansas borders for all dogs, and vaccine lot numbers were verified with manufacturers listed on the rabies certificates. Results from serologic testing performed in Egypt suggested that all dogs had mounted sufficient immune responses to a previous vaccination; however, prospective serologic monitoring results indicated that only seven of 25 dogs had evidence that they had responded to a prior rabies vaccination. Serology results were unable to be verified by the Egyptian laboratory because of invalid contact information.

This is the third importation of a rabid dog from Egypt in 4 years; the other two dogs were imported into Connecticut (*2*) and Virginia (*3*), and all three were rescue dogs with rabies vaccination certificates upon U.S. entry. It is not known if the insufficiency of dog A's rabies vaccination was a result of inadequate vaccine potency related to improper storage and handling, vaccination failure, or fraudulent documentation. Prospective serologic monitoring results of the remaining dogs confirm a systemic failure representing either the inability to appropriately deliver rabies vaccine or forgery of importation

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* Average rabies PEP cost per person was calculated using dose and price information provided by three health care facilities in Kansas for 17 persons who received PEP in response to this rabid dog investigation. Price only includes cost of the biologics themselves and does not include any additional fees (e.g., administration fee or emergency department fee).

TABLE. Vaccination dates and antibody titer results for dogs imported into the United States from Egypt (N = 26) — Kansas, 2019

			Egypt			Kansas State University Rabies Laboratory				
Dog	**Vaccine**	**Age, yrs**	**Date of rabies vaccine**	**Date of titer collection**	**Titer result (IU/mL)**	**First titer date of collection**	**First titer result (IU/mL)**	**Second titer date of collection**	**Second titer result (IU/mL)**	**Evidence of previous vaccination**
A*	V1A	2.2	Dec 1, 2018	Jan 15, 2019	0.7	Feb 21, 2019	0.8	N/A	N/A	No
B	V1A	2.2	Nov 1, 2018	Jan 8, 2019	0.8	Mar 5, 2019	0.7	Mar 10, 2019	3.8	Yes
C	V1A	2.2	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
D	V1A	0.9	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	0.1	Mar 10, 2019	3.8	Yes
E	V1A	2.2	Dec 1, 2018	Jan 15, 2019	0.8	Mar 5, 2019	<0.1	Mar 10, 2019	0.3	No
F	V1A	2.2	Dec 1, 2018	Jan 15, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	0.1	No
G	V1A	1.2	Dec 1, 2018	Jan 15, 2019	0.7	Mar 5, 2019	0.2	Mar 10, 2019	0.6	Yes
H	V1A	4.2	Dec 1, 2018	Jan 15, 2019	0.8	Mar 5, 2019	3.1	Mar 10, 2019	4.8	Yes
I	V1B	2.1	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	0.1	No
J	V1B	8.0	Nov 1, 2018	Jan 8, 2019	1.0	Mar 5, 2019	0.6	Mar 10, 2019	0.7	Yes
K	V1B	1.7	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
L	V1B	3.8	Nov 1, 2018	Jan 8, 2019	1.0	Mar 5, 2019	<0.1	Mar 10, 2019	0.1	No
M	V1B	2.3	Dec 1, 2018	Jan 15, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	0.1	No
N	V1B	1.9	Dec 1, 2018	Jan 15, 2019	0.7	Mar 5, 2019	2.8	Mar 10, 2019	3.3	Yes
O	V1C	3.5	Dec 1, 2018	Jan 16, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
P	V1C	1.1	Dec 1, 2018	Jan 17, 2019	0.8	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
Q	V1C	2.6	Dec 1, 2018	Jan 18, 2019	1.0	Mar 5, 2019	≤0.1	Mar 10, 2019	<0.1	No
R	V1C	1.1	Dec 1, 2018	Jan 19, 2019	0.7	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
S	V1C	1.3	Dec 1, 2018	Jan 20, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
T	V1C	4.2	Dec 1, 2018	Jan 21, 2019	0.8	Mar 5, 2019	0.1	Mar 10, 2019	0.1	No
U	V2	2.2	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
V	V2	0.7	Nov 1, 2018	Jan 8, 2019	0.8	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
W	V2	2.7	Nov 1, 2018	Jan 8, 2019	1.0	Mar 5, 2019	≤0.1	Mar 10, 2019	<0.1	No
X	V2	2.7	Nov 1, 2018	Jan 8, 2019	1.0	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
Y	V2	1.7	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	<0.1	Mar 10, 2019	<0.1	No
Z	V3	1.8	Nov 1, 2018	Jan 8, 2019	0.9	Mar 5, 2019	3.1	Mar 10, 2019	3.1	Yes

Abbreviation: N/A = not applicable.
* Dog had a positive test for rabies.

documents. The rabid dog in Virginia was determined to have an intentionally falsified rabies vaccination certificate (*3*). To prevent the importation of rabid dogs into the United States, CDC suspended dog importations from Egypt on May 10, 2019 (*7*). Given the frequency and high cost associated with these investigations, this event highlights the importance of thorough review of vaccination and serology documents for dogs imported from countries lacking robust veterinary safeguards and consultation with public health officials upon suspicion of fraudulent or inconsistent records.

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Summary

What is already known about this topic?

Canine rabies virus variant has been eliminated from the United States; however, importation of dogs from high-risk countries risks reintroduction. Investigation of an imported rabid dog from Egypt in Virginia in 2015 revealed the dog had a falsified rabies vaccination certificate.

What is added by this report?

Among 26 dogs imported into Kansas from Egypt in 2019, one had rabies; rabies vaccination certificates and certificates of veterinary inspection accompanied all dogs. U.S. serologic testing confirmed that most dogs had never received rabies vaccine.

What are the implications for public health practice?

The reason for inadequacy of the rabid dog's vaccination in unknown. Vaccination documentation of dogs imported from high-risk countries should be critically evaluated before dogs enter the United States.

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Notes from the Field

Travel-Associated Measles in a Person Born Before 1957 — Pinellas County, Florida, 2019

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Measles is a highly contagious respiratory disease; both locally acquired and travel-associated cases continue to occur across the United States (*1*). On April 19, 2019, the Pinellas County (Florida) Health Department (Pinellas CHD) Epidemiology Program was notified by a local hospital of a case of serologically confirmed measles in a man aged 72 years. The patient was evaluated in a hospital emergency department (ED) on April 15 with a 5-day history of fever, followed 2 days later by cough, and a maculopapular rash that started on his trunk on April 15. In the ED the patient experienced difficulty breathing and was admitted. In the hospital he received a diagnosis of pneumonia and subsequently developed sepsis and was transferred to the intensive care unit. Measles immunoglobulin (Ig) M and IgG were detected at commercial laboratories on April 15 and April 19, respectively.

The patient's wife reported that on April 12, she and her husband had returned from a month-long, multicountry trip to Asia. Their return trip included three flights on April 12, two of which landed at U.S. airports. After arriving home from the airport, the patient did not leave his house until seeking medical care at the ED on April 15. The patient's wife reported that he had measles as a child, and therefore, had not been vaccinated against measles; however, no documentation was available to support that her husband had a childhood measles infection. Urine and nasopharyngeal swab specimens were collected on April 19 for measles polymerase chain reaction testing at the Florida Department of Health, Bureau of Public Health Laboratories; both specimens tested positive.

After measles was diagnosed on April 19, the Florida Department of Health notified the CDC Miami Quarantine Station that the patient had flown during his infectious period. CDC identified 31 exposed contacts on the inbound international flight and the domestic flight and notified three countries and four U.S. state health departments for follow-up. No secondary cases associated with the flights were identified. CDC also notified the destination country of the third flight.

The patient's exposed close, personal contacts included his wife, his mother-in-law, and a friend; all were born before 1957 or had documented evidence of immunization or prior disease. While the patient was in the hospital ED, 432 other patients, visitors, and staff members were exposed. Line lists of patients, staff members, and other documented visitors were gathered in order to ascertain their measles immunity and begin the notification process. The hospital's infection control program notified contacts exposed in the hospital by telephone and mail. Two patients and one visitor, identified more than 72 hours after measles exposure, were advised to receive postexposure prophylaxis with immune globulin; two of these persons received it within 6 days of their exposure. One infant contact did not receive postexposure prophylaxis within 6 days of exposure, and for this child, temperature was monitored daily for one measles incubation period (21 days) after the exposure (*2*).

The patient recovered and was discharged home from the hospital on April 27. None of his contacts developed measles, and no additional cases were identified through heightened surveillance, which included monitoring ED syndromic surveillance data in ESSENCE-FL* and notifying health care providers to immediately report suspected measles cases during the 21-day monitoring period.

The Advisory Committee on Immunization Practices recommends that adults without documentation of measles immunity who are traveling internationally receive 2 documented doses of measles, mumps, and rubella virus vaccine (*3*,*4*) before departure. A review of measles cases internationally imported into the United States during 2001–2016 found that 20 of 553 (4%) such cases occurred in persons born before 1957 (*5*). Persons born before 1957 are presumed to be immune because of the likelihood of having been infected with measles during childhood; however, the occurrence of measles in a person born before 1957 suggests that these cases can occur. Health care providers should consider measles in all persons who returned from international travel and are evaluated with febrile rash illness, regardless of age.

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* http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-systems.html.

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Erratum

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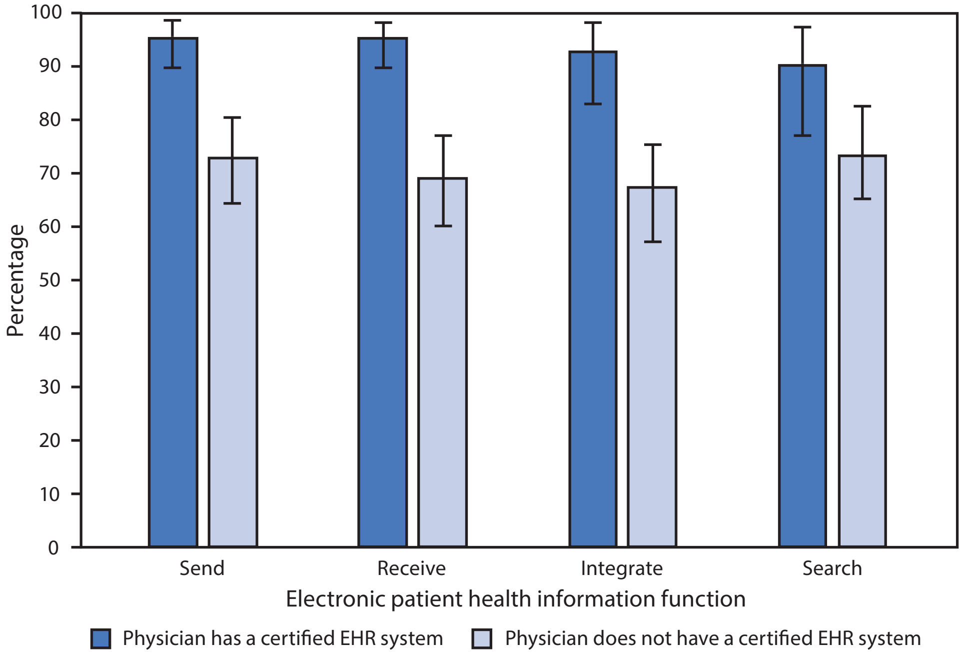
In the report "Community and Close Contact Exposures Associated with COVID-19 Among Symptomatic Adults ≥18 Years in 11 Outpatient Health Care Facilities — United States, July 2020," on page 1262, the e-mail for contact information has been updated to **eocevent101@cdc.gov**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Management of Patient Health Information Functions* Among Office-Based Physicians With and Without a Certified Electronic Health Record (EHR) System† — National Electronic Health Records Survey, United States, 2018



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* With 95% confidence intervals indicated with error bars.

† In 2018, 78.7% of office-based physicians had a certified electronic health record (EHR) system, defined by physicians answering "yes" to having a current system that "meets meaningful use criteria defined by the U.S. Department of Health and Human Services." https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Certification.

In 2018, 78.7% of office-based physicians had a certified electronic health record (EHR) system. A higher percentage of office-based physicians with a certified EHR system compared with those without a system electronically sent (95.5% versus 72.8%), received (95.3% versus 69.0%), integrated (92.8% versus 67.4%), or searched for (90.5% versus 73.3%) patient health information.

Source: National Electronic Health Records Survey, 2018. https://www.cdc.gov/nchs/nehrs/about.htm.

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