Please note: This report has been corrected. An erratum has been published.

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Racial and Ethnic Disparities in Breastfeeding Initiation — United States, 2019

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Breastfeeding is the optimal source of nutrition for most infants (*1*). Although breastfeeding rates in the United States have increased during the past decade, racial/ethnic disparities persist (*2*). Breastfeeding surveillance typically focuses on disparities at the national level, because small sample sizes limit examination of disparities at the state or territorial level. However, birth certificate data allow for assessment of breastfeeding initiation among nearly all newborn infants in the United States both nationally and at the state and territorial levels. To describe breastfeeding initiation by maternal race/ethnicity,* CDC analyzed 2019 National Vital Statistics System (NVSS) birth certificate data for 3,129,646 births from 48 of the 50 states (all except California and Michigan†), the District of Columbia (DC), and three U.S. territories (Guam, Northern Mariana Islands, and Puerto Rico). The prevalence of breastfeeding initiation was 84.1% overall and varied by maternal race/ethnicity, ranging from 90.3% among infants of Asian mothers to 73.6% among infants of Black mothers, a difference of 16.7 percentage points. Across states, the magnitude of disparity between the highest and lowest breastfeeding rates by racial/ethnic groups varied, ranging from 6.6 percentage points in Vermont to 37.6 percentage points in North Dakota, as did the specific racial/ethnic groups with the highest and lowest rates. These state/territory-specific data highlight the variation that exists in breastfeeding disparities across the United States and can help public health practitioners and health departments identify groups on which to focus efforts. Targeting breastfeeding promotion programs on populations with lower breastfeeding rates might help reduce racial/ethnic disparities in breastfeeding initiation and improve infant nutrition and health.

* All racial/ethnic groups are non-Hispanic unless otherwise noted.

† California does not report breastfeeding initiation data to NVSS. Michigan uses nonstandard wording for the breastfeeding initiation item on the birth certificate,which prevents comparison of data to other states.

Birth data from NVSS are a census of all live births in the United States collected by using the U.S. Standard Certificate of Live Birth.§ Birth certificate data include an infant nutrition item, determined from medical records, that indicates whether an infant received any breast milk or colostrum during the period between delivery and hospital discharge (*3*).¶ Data also include self-reported maternal race/ethnicity.**,†† Analysis

§ https://www.cdc.gov/nchs/data/dvs/birth11-03final-ACC.pdf

¶ Analyses were not limited to births occurring in hospitals. NVSS provides birth certificate completion instructions to facilities, but breastfeeding information is also collected for births occurring in other locations (e.g., freestanding birth centers, clinics, doctors' offices, and homes) via the birth certificate.

** https://www.cdc.gov/nchs/nvss/revisions-of-the-us-standard-certificates-and-reports.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fnchs%2Fnvss%2Fvital_certificate_revisions.htm

†† https://www.cdc.gov/nchs/data/dvs/moms-worksheet-2016-508.pdf

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was restricted to data on infants who were alive when the birth certificate was completed and who were not transferred to another facility within 24 hours of delivery. Births during 2019 in 48 states, DC, Northern Mariana Islands, Guam, and Puerto Rico were included; breastfeeding data were not available for births in California, Michigan, American Samoa, or the U.S. Virgin Islands. Births in 48 states and DC (hereafter referred to as a state), representing 85.2% of U.S. live births, contributed to nearly national estimates (hereafter referred to as national). Infants for whom maternal race/ethnicity data were missing (n = 16,827, 0.5%) were included in national, state, and territorial estimates but excluded from estimates stratified by race/ethnicity.

The percentage of infants for whom breastfeeding was initiated was calculated overall and by maternal race/ethnicity at the national, state, and territorial levels. Assessed racial/ethnic groups included infants born to Hispanic, White, Black, Asian, American Indian or Alaska Native (AI/AN), Native Hawaiian/Other Pacific Islander (NH/OPI), and multiracial mothers. Racial/ethnic disparities were calculated in each state/territory as the percentage point difference between breastfeeding initiation among the racial/ethnic group with the highest initiation prevalence and each of the other groups. Because birth data are a census, no statistical tests were conducted. Data were suppressed for any racial/ethnic group with a denominator <50. Estimates for Guam, Northern Mariana Islands, and Puerto Rico were not considered in comparisons because each territory was excluded from national estimates and had data suppressed for three or more racial/ethnic groups. SAS (version 9.4; SAS Institute) was used for all data analyses.

The prevalence of initiation of breastfeeding for newborn infants was 84.1%, ranging from 94.8% in Oregon to 64.7% in Mississippi. Initiation rates varied by maternal race/ethnicity, ranging from 90.3% among infants of Asian mothers to 73.6% among infants of Black mothers. In 26 states (including DC), the breastfeeding initiation rate was lowest among infants of Black mothers; in 13 states, the rate was lowest among infants of AI/AN mothers (including in Maine, where rates were equally low among infants of multiracial mothers). Prevalence of breastfeeding initiation was highest among infants of Asian mothers in 36 states (including Vermont, where rates were equally high among infants of Black mothers) and highest among infants of White mothers in 10 states (including DC) (Table).

Generally, racial/ethnic disparities in breastfeeding initiation were larger in states with lower overall breastfeeding initiation rates (Figure 1). Nationally, the largest racial/ethnic disparity in breastfeeding initiation was 16.7 percentage points (higher for infants of Asian mothers than for infants of Black mothers) and ranged from 6.6 percentage points in Vermont (higher for infants of Black and Asian mothers than for infants of White mothers) to 37.6 percentage points in North Dakota (higher for infants of Asian mothers than for infants of AI/AN mothers). The largest disparity exceeded 20 percentage points in 22 states (including DC) and exceeded 30 percentage points

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TABLE. Percentage of live infants not transferred to another facility for whom breastfeeding was initiated,* by state/territory and maternal race/ethnicity[†] — National Vital Statistics System, 48 states,[§] District of Columbia, Guam, Northern Mariana Islands, and Puerto Rico, 2019

Jurisdiction	No. of infants[¶] (% initiating breastfeeding)								Largest disparity**
	Overall	Hispanic	White	Black	Asian	AI/AN	NH/OPI	Multiracial	
United States[††]	**3,129,646 (84.1)**	**665,584 (87.4)**	**1,686,505 (85.5)**	**492,852 (73.6)[§§]**	**164,602 (90.3)[¶¶]**	**25,807 (76.6)**	**7,843 (80.2)**	**69,626 (83.1)**	**16.7**
Alabama	56,054 (69.6)	4,730 (64.2)	32,031 (77.2)	17,285 (56.1)[§§]	863 (84.6)[¶¶]	140 (73.6)	—***	971 (71.5)	28.5
Alaska	9,492 (92.9)	761 (95.9)	4,685 (96.3)[¶¶]	288 (94.4)	569 (81.0)	1,812 (88.5)	293 (76.1)[§§]	919 (94.7)	20.2
Arizona	78,613 (88.9)	33,426 (87.9)	31,629 (91.1)	4,489 (84.5)	2,846 (93.3)[¶¶]	3,739 (84.7)	218 (80.7)[§§]	1,842 (86.6)	12.6
Arkansas	34,123 (73.7)	3,769 (81.9)	21,994 (78.0)	6,052 (52.3)[§§]	698 (85.0)[¶¶]	218 (72.9)	506 (67.0)	654 (74.3)	32.7
Colorado	62,552 (92.8)	18,032 (90.4)	35,906 (94.6)[¶¶]	3,009 (88.4)	2,552 (93.3)	375 (85.1)[§§]	167 (91.0)	1,532 (92.3)	9.5
Connecticut	34,558 (87.4)	8,861 (85.5)	18,616 (88.4)	4,096 (84.0)[§§]	2,253 (93.1)[¶¶]	—	—	687 (84.6)	9.1
Delaware	10,717 (80.5)	1,723 (83.8)	5,332 (82.2)	2,687 (72.7)	608 (93.8)[¶¶]	—	—	329 (72.6)[§§]	21.2
DC	13,092 (84.2)	1,846 (82.5)	4,799 (97.1)[¶¶]	5,313 (71.2)[§§]	808 (95.5)	—	—	300 (88.7)	25.9
Florida	215,942 (87.2)	67,193 (91.1)	91,783 (87.7)	46,750 (79.6)[§§]	6,944 (92.9)[¶¶]	224 (81.7)	161 (88.8)	2,839 (86.6)	13.3
Georgia	124,711 (83.1)	18,259 (90.1)	53,889 (84.5)	43,241 (77.0)[§§]	5,777 (93.9)[¶¶]	93 (83.9)	99 (81.8)	2,472 (84.6)	16.9
Hawaii	16,583 (89.6)	2,567 (92.1)	3,182 (96.8)[¶¶]	422 (96.2)	4,287 (86.3)	—	1,671 (78.2)[§§]	4,387 (90.3)	18.6
Idaho	21,463 (92.2)	3,653 (90.1)	16,448 (92.8)	258 (94.6)	347 (93.7)	224 (78.6)[§§]	74 (97.3)[¶¶]	401 (91.8)	18.7
Illinois	134,795 (83.1)	29,555 (86.4)	70,731 (85.2)	22,406 (67.7)[§§]	9,091 (93.1)[¶¶]	74 (81.1)	—	1,904 (81.5)	25.4
Indiana	80,077 (82.9)	8,316 (85.4)[¶¶]	57,777 (84.1)	10,077 (74.1)[§§]	2,250 (84.0)	58 (75.9)	59 (79.7)	1,516 (81.1)	11.3
Iowa	36,876 (83.1)	3,821 (81.0)	28,030 (84.9)	2,861 (69.6)[§§]	1,102 (85.5)[¶¶]	259 (73.7)	156 (73.7)	645 (78.3)	15.9
Kansas	36,442 (89.6)	6,290 (87.1)	25,216 (90.9)	2,626 (84.3)	1,250 (93.4)[¶¶]	131 (84.7)	66 (77.3)[§§]	797 (85.3)	16.1
Kentucky	49,321 (71.7)	3,216 (82.1)	39,288 (71.1)	4,650 (67.0)[§§]	1,007 (86.8)[¶¶]	—	58 (79.3)	924 (69.9)	19.8
Louisiana	56,966 (71.0)	4,851 (82.2)	28,945 (78.9)	21,027 (56.5)[§§]	1,136 (87.0)[¶¶]	239 (70.7)	—	705 (74.3)	30.5
Maine	11,148 (89.4)	237 (85.2)	9,844 (89.4)	514 (92.0)	211 (93.4)[¶¶]	87 (83.9)[§§]	—	249 (83.9)[§§]	9.5
Maryland	66,056 (87.1)	12,166 (94.1)	27,898 (86.4)	19,537 (82.0)[§§]	4,547 (95.4)[¶¶]	67 (83.6)	—	1,582 (84.5)	13.4
Massachusetts	68,897 (88.4)	14,027 (86.9)	39,346 (88.3)	6,776 (90.5)	6,197 (91.4)[¶¶]	78 (84.6)[§§]	—	1,491 (85.5)	6.8
Minnesota	62,276 (89.7)	4,867 (90.2)	42,110 (91.9)[¶¶]	7,690 (87.5)	5,032 (78.9)	858 (67.5)[§§]	52 (86.5)	1,545 (85.8)	24.4
Mississippi	35,022 (64.7)	1,620 (71.7)	17,195 (74.5)	15,270 (52.5)	437 (83.3)[¶¶]	219 (49.3)[§§]	—	255 (70.6)	34.0
Missouri	69,799 (79.7)	4,228 (81.0)	50,967 (82.2)	10,019 (65.5)[§§]	1,731 (88.9)[¶¶]	150 (72.0)	219 (74.0)	2,224 (78.6)	23.4
Montana	10,929 (90.6)	611 (90.0)	8,737 (93.1)[¶¶]	61 (86.9)	116 (89.7)	1,050 (70.2)[§§]	—	324 (88.6)	22.9
Nebraska	24,724 (88.6)	4,145 (85.5)	17,316 (90.5)	1,570 (78.6)	835 (91.1)[¶¶]	218 (74.3)[§§]	—	617 (84.1)	16.8
Nevada	33,410 (80.0)	12,610 (81.9)	11,895 (84.2)[¶¶]	4,263 (64.1)[§§]	2,542 (81.2)	241 (83.4)	363 (72.2)	1,386 (77.4)	20.1
New Hampshire	11,609 (90.8)	728 (90.1)	9,979 (90.6)	253 (94.9)	454 (96.5)[¶¶]	—	—	129 (85.3)[§§]	11.2
New Jersey	95,969 (79.7)	26,746 (80.9)	43,923 (81.0)	12,877 (70.9)[§§]	10,317 (83.2)[¶¶]	64 (73.4)	—	1,075 (78.4)	12.3
New Mexico	21,040 (86.1)	11,503 (84.8)	5,728 (88.9)	332 (81.6)[§§]	374 (91.2)[¶¶]	2,688 (86.1)	—	370 (84.9)	9.6
New York	219,529 (87.9)	49,898 (90.4)[¶¶]	107,699 (87.4)	31,926 (84.4)	24,683 (89.8)	358 (82.1)	71 (81.7)[§§]	3,195 (82.3)	8.7
North Carolina	119,198 (81.6)	19,084 (88.1)	62,586 (84.6)	27,785 (70.8)	4,957 (89.0)[¶¶]	1,429 (52.1)[§§]	127 (82.7)	3,130 (79.4)	36.9
North Dakota	11,702 (85.0)	733 (83.8)	8,499 (88.2)	756 (86.0)	251 (91.6)[¶¶]	847 (54.0)[§§]	—	358 (81.3)	37.6
Ohio	128,555 (76.0)	7,428 (77.8)	91,498 (77.2)	21,415 (68.8)[§§]	4,237 (87.1)[¶¶]	98 (78.6)	101 (72.3)	3,600 (70.9)	18.3
Oklahoma	46,523 (81.8)	7,284 (81.8)	25,823 (84.7)	3,961 (71.6)	1,215 (85.8)[¶¶]	4,485 (74.8)	218 (62.4)[§§]	3,478 (80.2)	23.4
Oregon	41,473 (94.8)	8,019 (94.7)	27,456 (94.9)	1,006 (94.9)	2,374 (97.1)[¶¶]	398 (88.4)[§§]	336 (91.1)	1,599 (93.7)	8.7
Pennsylvania	128,439 (82.2)	16,017 (81.8)	84,758 (83.0)	16,922 (76.9)[§§]	6,002 (91.1)[¶¶]	77 (79.2)	—	3,073 (77.7)	14.2
Rhode Island	10,592 (67.7)	2,919 (56.3)	5,959 (75.2)	828 (54.5)[§§]	528 (76.1)[¶¶]	—	—	272 (56.6)	21.6
South Carolina	52,493 (78.1)	5,414 (86.5)	28,919 (82.8)	15,609 (66.0)[§§]	1,001 (90.6)[¶¶]	100 (68.0)	53 (73.6)	1,275 (77.1)	24.6
South Dakota	11,966 (80.7)	679 (77.5)	8,758 (84.7)[¶¶]	421 (79.1)	208 (72.6)	1,479 (61.2)[§§]	—	398 (76.1)	23.5
Tennessee	84,201 (81.1)	8,596 (85.3)	55,082 (83.0)	16,540 (71.3)[§§]	1,846 (92.0)[¶¶]	97 (87.6)	73 (87.7)	1,588 (83.2)	20.7
Texas	376,721 (88.5)	179,268 (88.4)	124,558 (90.4)	47,113 (81.5)[§§]	19,806 (95.2)[¶¶]	693 (87.6)	572 (86.5)	4,349 (87.8)	13.7
Utah	47,200 (86.2)	8,194 (81.8)	33,650 (88.8)[¶¶]	608 (73.4)	1,088 (85.1)	354 (75.7)	447 (69.1)[§§]	1,073 (88.6)	19.7
Vermont	5,062 (91.3)	124 (93.5)	4,555 (91.0)[§§]	126 (97.6)[¶¶]	123 (97.6)[¶¶]	—	—	82 (93.9)	6.6
Virginia	95,415 (86.2)	14,294 (92.1)	51,270 (87.3)	20,448 (76.3)[§§]	7,351 (94.5)[¶¶]	142 (88.0)	124 (89.5)	1,706 (87.7)	18.2
Washington	82,930 (94.6)	15,885 (92.8)	46,246 (95.3)	3,689 (94.4)	8,665 (96.7)[¶¶]	996 (88.8)[§§]	1,177 (91.0)	3,557 (94.7)	7.9
West Virginia	18,187 (64.8)	359 (77.4)	16,590 (64.6)	591 (59.4)[§§]	170 (86.5)[¶¶]	—	—	387 (64.6)	27.1
Wisconsin	60,439 (81.1)	6,270 (79.0)	42,876 (86.6)[¶¶]	6,357 (53.8)[§§]	2,851 (68.4)	581 (69.2)	—	1,329 (76.1)	32.8
Wyoming	5,765 (83.9)	762 (77.3)	4,504 (85.6)	52 (65.4)[§§]	65 (87.7)[¶¶]	170 (70.6)	—	106 (83.0)	22.3
NMI	669 (97.3)	—	—	—	252 (97.6)[¶¶]	—	377 (97.3)[§§]	—	0.3
Guam	2,661 (80.6)	—	175 (90.9)[¶¶]	—	721 (78.5)[§§]	—	1,607 (79.9)	86 (84.9)	12.4
Puerto Rico	19,910 (93.6)	19,432 (93.6)[¶¶]	401 (92.3)[§§]	—	—	—	—	—	1.3

Abbreviations: AI/AN = American Indian/Alaska Native; DC = District of Columbia; NH/OPI = Native Hawaiian/Other Pacific Islander; NMI = Northern Mariana Islands.

* Excludes infants transferred to another facility within 24 hours of delivery and those who died before completion of the birth certificate.

† All racial/ethnic groups are non-Hispanic unless otherwise noted.

§ Includes all states except California and Michigan.

¶ Denominators might not sum to total because of missing maternal race/ethnicity data.

** Largest disparity is defined as the percentage point difference in breastfeeding initiation prevalence between the racial/ethnic groups with the highest and lowest initiation prevalence.

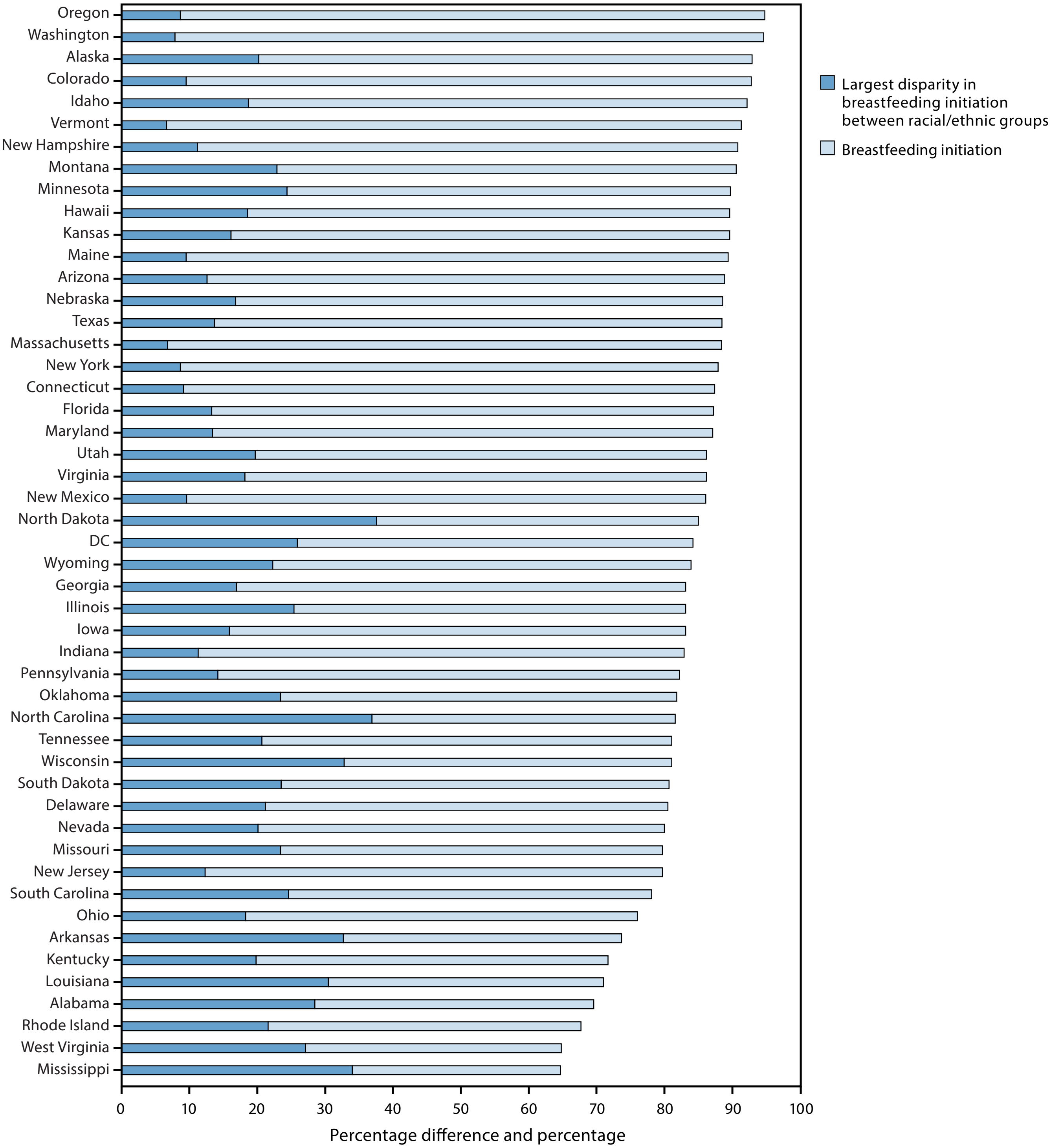
†† United States estimates include data from 48 states and the DC but exclude data from territories.

§§ Racial/ethnic group with the lowest breastfeeding initiation prevalence.

¶¶ Racial/ethnic group with highest breastfeeding initiation prevalence.

*** Data were suppressed for all racial/ethnic groups with denominators <50.

FIGURE 1. Breastfeeding initiation and largest disparity in breastfeeding initiation between racial/ethnic groups,* by state† — National Vital Statistics System, 48 states and the District of Columbia, 2019



Abbreviation: DC = District of Columbia.

* Breastfeeding initiation is measured as a percentage. Largest disparity in breastfeeding initiation between racial/ethnic groups is measured as a percentage difference.

† Includes all states except California and Michigan. California does not report breastfeeding initiation data to the National Vital Statistics System. Michigan uses nonstandard wording for the breastfeeding initiation item on the birth certificate, which prevents comparison of data to other states.

in six states (Table) (Figure 2). The racial/ethnic groups that corresponded to the largest disparity varied across states. The largest disparities were most commonly observed between infants of Asian mothers and infants of Black mothers (in 22 states) followed by infants of Asian mothers and infants of AI/AN mothers (in eight states) (Table).

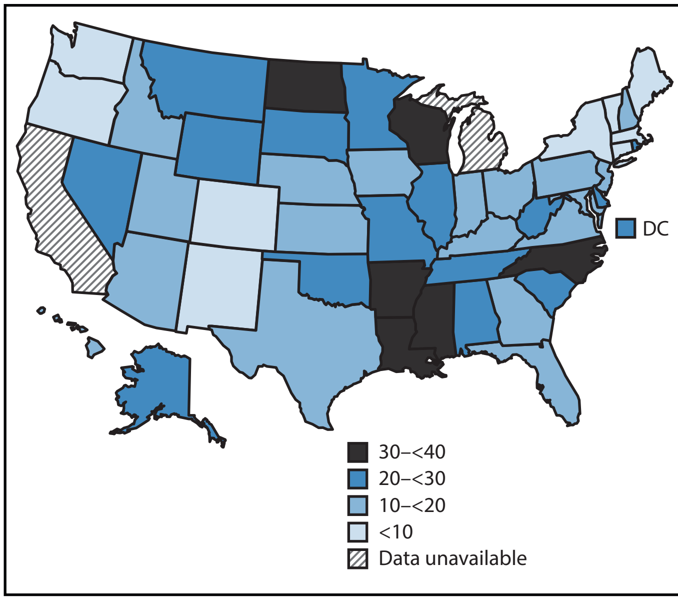
Discussion

Although most mothers in the United States initiated breastfeeding, approximately one in six infants born in 2019 did not receive any breast milk, and disparities in initiation existed. Initiation rates varied geographically, with large racial/ethnic disparities existing both nationally and at state and territorial levels. Furthermore, states with lower breastfeeding initiation rates generally had a higher prevalence of racial/ethnic breastfeeding disparities than did states with higher initiation rates. Although breastfeeding initiation rates were generally higher among infants of Asian and White mothers and lower among infants of AI/AN and Black mothers, this was not true in all states. Likewise, the magnitude of disparities in breastfeeding initiation between the highest and lowest initiating racial/ethnic groups varied considerably from state to state. These data show that disparities are often state-specific and suggest that efforts tailored to address each state's specific disparities might be needed.

Breastfeeding is associated with reduced risk for various infections, necrotizing enterocolitis, sudden infant death syndrome, type 1 diabetes, and obesity among infants, and with reduced risk for high blood pressure, type 2 diabetes, ovarian cancer, and breast cancer among mothers.[§§] Because Black and AI/AN populations are at increased risk for many of these health outcomes,[¶¶,***,†††,§§§,¶¶¶] lower rates of breastfeeding initiation among these groups are particularly concerning. Racial/ethnic disparities in meeting breastfeeding duration and exclusivity recommendations (*1*) can contribute to high disease prevalence and increased associated costs. For example, a recent study estimated that 1.3 times the number of excess cases of maternal hypertension among Black mothers compared with White mothers and 3.3 times the number of excess cases of necrotizing enterocolitis among Black infants compared with White infants can be attributed to lower rates of breastfeeding exclusivity and duration (*4*). Although this report includes data only on breastfeeding initiation, disparities in breastfeeding duration and exclusivity result, in part, from differences in breastfeeding initiation (*5*).

§§ https://www.cdc.gov/breastfeeding/about-breastfeeding/why-it-matters.html
¶¶ https://www.cdc.gov/sids/data.htm
*** https://www.cdc.gov/obesity/data/childhood.html
††† https://www.cdc.gov/bloodpressure/facts.htm
§§§ https://www.cdc.gov/diabetes/basics/quick-facts.html
¶¶¶ https://gis.cdc.gov/Cancer/USCS/DataViz.html

FIGURE 2. Largest disparity in breastfeeding initiation between racial/ethnic groups, by percentage point difference — National Vital Statistics System, 48 states and the District of Columbia, 2019



Abbreviation: DC = District of Columbia.

Efforts are needed to increase overall breastfeeding initiation and reduce racial/ethnic disparities at the national, state, and territorial levels. Hospitals can implement evidence-based maternity care policies and practices that support breastfeeding. Research has found that implementation of programs such as the Ten Steps to Successful Breastfeeding improves overall breastfeeding outcomes and decreases racial/ethnic inequities (*6,7*). Further, state and territorial health departments could consider developing culturally relevant initiatives or refocusing current breastfeeding promotion efforts to better target their populations at highest risk. CDC currently funds efforts in 16 states[****] to implement evidence-based strategies to improve nutrition and physical activity, including breastfeeding.[††††] In partnership with the Association of State and Territorial Health Officials, CDC is supporting nine of these states[§§§§] in efforts to develop and implement innovative strategies to promote equity and reduce disparities in breastfeeding (*8*).

CDC uses the National Immunization Survey (NIS) for routine surveillance of breastfeeding initiation, duration, and exclusivity.[¶¶¶¶] However, relatively small sample sizes prohibit

**** Alaska, Arkansas, California, Colorado, Connecticut, Illinois, Kentucky, Minnesota, Missouri, New York, North Carolina, Ohio, Pennsylvania, Texas, Utah, and Washington.
†††† https://www.cdc.gov/nccdphp/dnpao/state-local-programs/span-1807/index.html
§§§§ Alaska, Arkansas, Colorado, Illinois, Missouri, Ohio, Pennsylvania, Utah, and Washington.
¶¶¶¶ https://www.cdc.gov/breastfeeding/data/nis_data/

Summary

What is already known about this topic?

Although rates of breastfeeding initiation have increased during the past decade, racial/ethnic disparities in breastfeeding persist.

What is added by this report?

Birth certificate data indicate that the magnitude of racial/ethnic disparities in breastfeeding initiation varies across states as do the racial/ethnic groups corresponding to each state's largest disparity.

What are the implications for public health practice?

Efforts are needed to increase breastfeeding initiation and reduce racial/ethnic disparities. Because disparities are state-specific, efforts tailored to address each state's disparities might be needed. Maternity care policies and practices supportive of breastfeeding and breastfeeding programs that target highest risk populations might help increase initiation, reduce disparities, and improve infant nutrition.

routine estimation of breastfeeding by race/ethnicity at the state and territorial levels. NVSS has data only on breastfeeding initiation, but as a census of all births, it has a robust sample size, which allows examination of breastfeeding disparities at the state and territorial levels. National breastfeeding initiation rates calculated from 2019 birth certificate data are comparable to rates estimated from NIS survey data (84.1% among infants born in 2017). Initiation rates are also generally similar across both data sources for most states and racial/ethnic groups.*****

The findings in this report are subject to at least four limitations. First, birth certificates do not include information on exclusivity and duration of breastfeeding, which are important indicators of optimal infant nutrition. Second, breastfeeding initiation data might be misclassified. Although a comparison of birth certificates to medical records across eight hospitals in two states found high sensitivity for breastfeeding initiation (90.7% and 96.2%), moderate false discovery rates (19% and 16%) suggest that discrepancies might exist between medical records and birth certificates (*9*); however, overall rates are generally consistent with other national data sources. Further, no true gold standard exists for comparison to birth certificate data, and data from which previous comparisons have been made are limited and nearly a decade old. Third, birth certificate data reliability and validity are not known to have been assessed across racial/ethnic groups. Misclassification of breastfeeding data might vary by race/ethnicity. Finally, estimates are not nationally representative because births from California and Michigan (representing 14.8% of U.S. births) were not included in analyses.

Although breastfeeding can help reduce risks for several maternal and infant health conditions, infants from some racial/ethnic minorities who are already at the highest risk for these conditions are often among the least likely to be breastfed. These data might be useful to state and territorial public health practitioners in identifying specific racial/ethnic disparities on which to focus efforts to improve breastfeeding support. Implementation of evidence-based maternity care policies and practices supportive of breastfeeding and targeted breastfeeding programs focusing on populations at highest risk for low breastfeeding initiation might help reduce racial/ethnic disparities in breastfeeding initiation, improve infant nutrition, and reduce maternal and infant.

***** https://www.cdc.gov/breastfeeding/data/nis_data/results.html

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HIV Viral Load Monitoring Among Patients Receiving Antiretroviral Therapy — Eight Sub-Saharan Africa Countries, 2013–2018

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One component of the Joint United Nations Programme on HIV/AIDS (UNAIDS) goal to end the HIV/AIDS epidemic by 2030, is that 95% of all persons receiving antiretroviral therapy (ART) achieve viral suppression.[†] Thus, testing all HIV-positive persons for viral load (number of copies of viral RNA per mL) is a global health priority (*1*). CDC and other U.S. government agencies, as part of the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), together with other stakeholders, have provided technical assistance and supported the cost for multiple countries in sub-Saharan Africa to expand viral load testing as the preferred monitoring strategy for clinical response to ART. The individual and population-level benefits of ART are well understood (*2*). Persons receiving ART who achieve and sustain an undetectable viral load do not transmit HIV to their sex partners, thereby disrupting onward transmission (*2*,*3*). Viral load testing is a cost-effective and sustainable programmatic approach for monitoring treatment success, allowing reduced frequency of health care visits for patients who are virally suppressed (*4*). Viral load monitoring enables early and accurate detection of treatment failure before immunologic decline. This report describes progress on the scale-up of viral load testing in eight sub-Saharan African countries from 2013 to 2018 and examines the trajectory of improvement with viral load testing scale-up that has paralleled government commitments, sustained technical assistance, and financial resources from international donors. Viral load testing in low- and middle-income countries enables monitoring of viral load suppression at the individual and population level, which is necessary to achieve global epidemic control. Although there has been substantial achievement in improving viral load coverage for all patients receiving ART, continued engagement is needed to reach global targets.

Scale-up of HIV viral load testing has been a global priority following release of the World Health Organization (WHO) 2013 ART guidelines, which recommended using viral load instead of CD4 counts as the preferred approach to monitoring ART effectiveness (*5*). In 2016, the ART guidelines were revised to recommend viral load testing (rather than CD4 cell counts) for all HIV-positive persons to monitor effectiveness (*1*). These guidelines promote the UNAIDS goal to end the HIV/AIDS epidemic by 2030, with 95% of patients receiving ART having viral suppression by 2030 (*1*). Global ART expansion has increased demand for viral load monitoring. In 2018, 23.3 million persons were receiving ART, an increase of nearly 200%, compared with 8 million in 2010 (*6*). Country viral load testing capacity continues to grow. For example, the total number of health facilities in Kenya offering viral load testing increased approximately 180%, from 722 (in 218 districts) in 2012 to approximately 2,000 (in approximately 300 districts) in 2016 (*7*).

Globally, approximately two thirds of the HIV-infected persons reside in Africa.[§] To evaluate progress in scale-up of HIV viral load testing, investigators assessed activities and expansion in eight sub-Saharan African countries (Côte d'Ivoire, Kenya, Lesotho, Malawi, Namibia, South Africa, Tanzania, and Uganda) during 2013–2018. Data from an earlier assessment of annual progress of viral load scale-up for all the countries except Lesotho were published in 2015 and 2016 (*8*,*9*). For this assessment, the questionnaire used for the previous reports was updated to obtain annual data for Lesotho from 2013 through 2018 and data from 2016 through 2018 for all other countries. Countries were selected based on availability of data and agreement with their ministries of health. Data were collected for each calendar year. Country guidelines called for viral load testing at 6 months after ART initiation, followed by testing at 12 months and annually thereafter (except Malawi, which recommended viral load testing every 2 years). Ministry of health officials and CDC program officers jointly collected information from the laboratory information system on the cumulative number of ART patients, the number of ART patients with at least one viral load test result, the percentage of viral load tests results showing viral suppression (defined as ≤1,000 HIV RNA copies per mL), and the mean turnaround time from sample collection to release of viral load test results.

As of early 2019, South Africa had the largest number of patients receiving ART (4.57 million) among all countries studied (Table), representing approximately 59% of

* Deceased.

† https://aidstargets2025.unaids.org

§ https://www.afro.who.int/health-topics/hivaids

TABLE. Selected indicators for viral load monitoring before and after scale-up*,† of viral load testing, by country — eight sub-Saharan African countries, 2013–2014 and 2018

Country	Cumulative no. of patients§ receiving ART		Avg. interval from sample collection to return of VL test results to referring facility, days		% of ART VL tests indicating viral suppression	
	Before scale-up†	2018 (% change)	Before scale-up†	2018 (% change)	Before scale-up†	2018 (% change)
Côte d'Ivoire	129,993	248,194 (91)	10	15 (50)	66	78 (18)
Kenya	631,503	1,069,451 (69)	18	8 (−56)	64	90 (41)
Lesotho	111,322	218,493 (96)	56	28 (−50)	75	93 (24)
Malawi	472,865	805,323 (70)	18	18 (0)	86	86 (0)
Namibia	126,779	180,584 (42)	5	6 (20)	74	94 (28)
South Africa¶	2,609,275	4,551,331 (74)	3	4 (33)	75	85 (13)
Tanzania¶	600,886	999,628 (66)	10	27 (170)	80	85 (6)
Uganda	507,663	1,167,107 (130)	18	14 (−22)	90	88 (−2)
Total	**5,190,275**	**9,240,111 (78)**	—	—	—	—

Abbreviations: ART = antiretroviral therapy; VL = viral load; WHO = World Health Organization.
* Scale-up refers to the beginning of monitoring patients on ART with HIV viral load testing rather than CD4 cell testing as recommended in WHO guidelines as the preferred monitoring strategy. Because countries were not monitoring HIV patients with viral load testing, it was necessary to start viral load testing and scale-up to test all patients on ART.
† Period before scale-up was 2014 in Côte d'Ivoire and 2013 in all other countries.
§ Adult and pediatric patients.
¶ South Africa and Tanzania reported through June 2018.

persons in South Africa living with HIV based on UNAIDS estimates (*10*). From 2013 to 2018, the total number of patients receiving ART increased by 78% across all eight countries, from 5,190,275 before scale-up to 9,240,111 in 2018, increasing the demand for viral load testing. During this period, the average turnaround time from sample collection to release of test results decreased in Kenya (55.6%), Lesotho (50%), and Uganda (22.2%). However, turnaround time increased in Côte d'Ivoire, Namibia, South Africa, and Tanzania; the turnaround time in Malawi did not change.

During 2013–2018, the proportion of ART patients who had at least one viral load test result increased 1,850% in Côte d'Ivoire (from 3.8% to 74.1%), 921% in Kenya (from 8.4% to 85.8%), 959% in Lesotho (from 4.9% to 51.9%), 755% in Malawi (from 6% to 51.3%), 65% in Namibia (from 60.5% to 99.9%), and 1,716% in Uganda (from 4.9% to 89%) (Figure 1). South Africa and Tanzania were excluded from this analysis because 2018 data were only available for January through June.

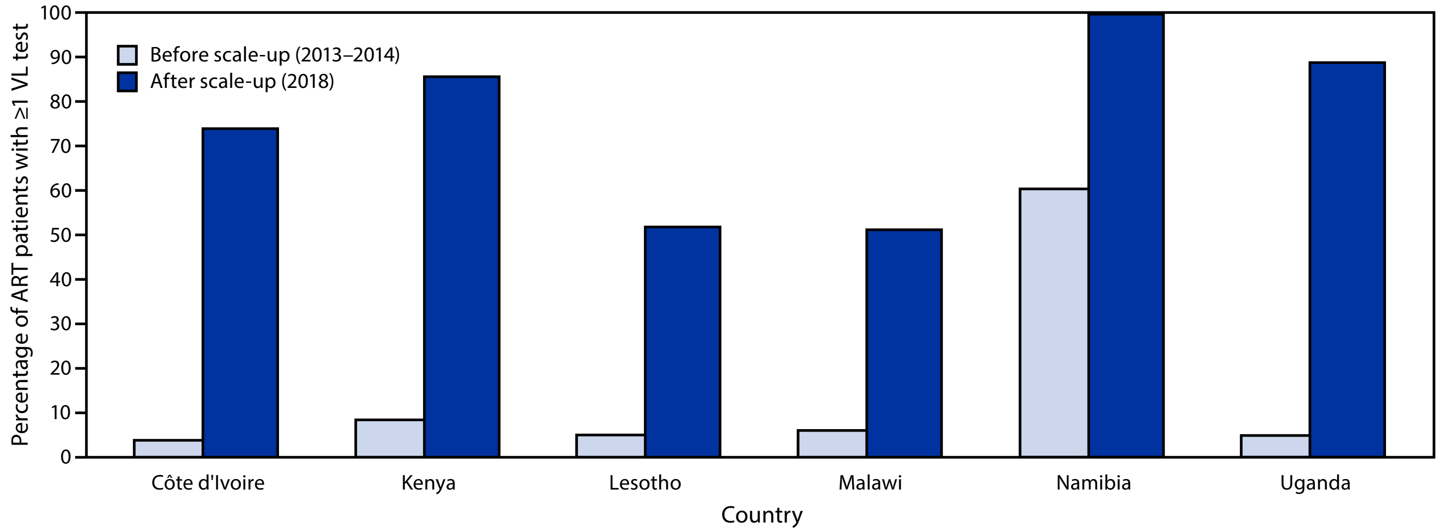
Before the scale-up, the rate of viral suppression, was ≥80% in only three of the eight countries: Uganda (90%), Malawi (86%), and Tanzania (80%) (Figure 2). By the end of 2018, all countries except Côte d'Ivoire reported viral suppression rates of ≥85%. The highest prevalence of viral suppression (94.4%) was reported by Namibia. The largest increase in viral suppression rate from 2013 to 2018 occurred in Kenya (40%), followed by Namibia (28%), and Lesotho (24%); rates increased by <20% in Côte d'Ivoire, South Africa, and Tanzania. Viral suppression rate was unchanged in Malawi, and in Uganda the rate decreased by 2.4%, while the number of viral load tests increased.

Discussion

This review of scale-up of HIV viral load testing during 2013–2018 in eight sub-Saharan African countries documents successful efforts to increase access to viral load monitoring for patients receiving ART. Early in the process, many sub-Saharan African countries were just initiating viral load testing to monitor treatment success. Transitioning from using CD4 counts to molecular-based viral load testing as a national strategy required educating health care providers and patients to increase the demand for viral load testing, training laboratorians to improve the quality and efficiency of molecular testing, optimizing the laboratory network, and strengthening clinical services for effective patient management. Some of the challenges identified early in 2013 and 2014 remain, including difficulties with specimen transport, equipment breakdown, and delays in development of a skilled workforce (*8*). However, efforts by officials and health care workers to overcome these difficulties and each country's determination to reach the UNAIDS goal of 95% of ART patients achieving viral suppression has led to continued progress in viral load monitoring. Seven of the eight countries achieved viral load suppression rates of ≥85% for all viral load tests performed during 2018; Côte d'Ivoire reported significant improvement in rates, from 53% in 2015 to 78% in 2018 (*7*).

Test result turnaround time decreased in only three countries (Kenya, Lesotho, and Uganda); turnaround time increased in four countries, highlighting the need for increased efficiency. The increased turnaround time could be explained by 1) increased testing volume and the inability of existing systems to meet this demand; 2) an increased number of facilities or service delivery points collecting specimens, leading to a more

FIGURE 1. Percentage of HIV-positive patients receiving antiretroviral therapy who had ≥1 viral load test before and after scale-up of viral load testing — six sub-Saharan African countries,* 2013–2014† and 2018



Abbreviations: ART = antiretroviral therapy; VL = viral load.
* Two countries not shown (South Africa and Tanzania) because data were only provided through June 2018.
† Period before scale-up was 2014 in Côte d'Ivoire and 2013 in all other countries.

complex transport network; 3) prolonged sample storage times until pickup at facilities or hub sites; or 4) inadequate number of personnel to process the increased number of specimens at viral load laboratories. Continued capacity building is needed to address these issues.

The findings in this report are subject to at least two limitations. First, viral suppression was defined as a viral load test result of ≤1,000 HIV RNA copies per mL; prevalence cannot be determined from viral load test results for individual patients, as some data sources have patient-level duplication. Second, Malawi's guidelines for viral load testing every 2 years were different from those in all other countries. Less frequent testing for persons in Malawi resulted in fewer viral load tests.

Effective partnerships between ministries of health and multiple international stakeholders such as PEPFAR, the Global Fund, WHO, the Clinton Health Access Initiative, the African Society for Laboratory Medicine, and others have contributed to progress in viral load monitoring. Ongoing engagement with ministries of health and finance and with officials in financial and technical areas, at national, subnational, and community levels will be required to sustain and improve current gains. Implementing best practices and data-driven program improvement strategies should assist countries to move beyond the third "95" UNAIDS goal (95% of persons on ART achieve viral suppression) to reach HIV epidemic control.

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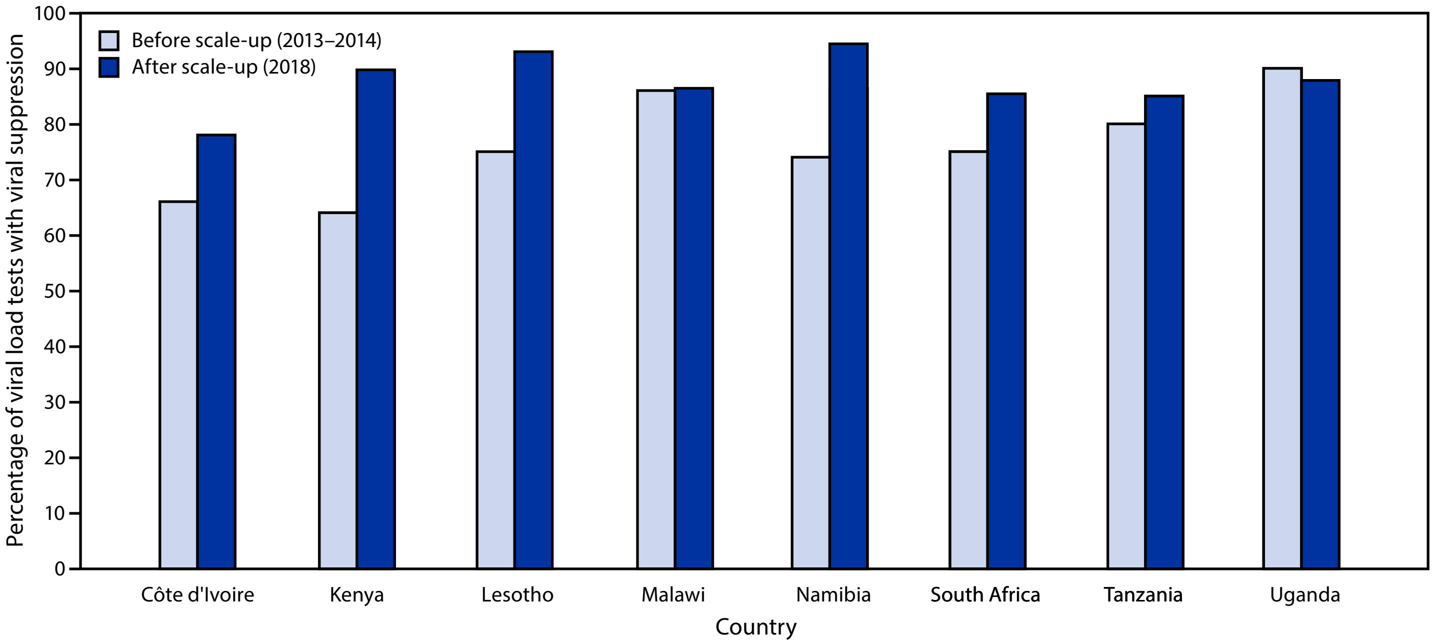
FIGURE 2. Percentage of HIV viral load tests indicating viral suppression* before and after viral load testing scale-up — eight sub-Saharan African countries,† 2013–2014§ and 2018



* Viral suppression is <1,000 copies of HIV RNA per mL of blood.
† Two countries not shown (South Africa and Tanzania) because data were only provided through June 2018.
§ Period before scale-up was 2014 in Côte d'Ivoire and 2013 in all other countries.

Summary

What is already known about this topic?

HIV viral load monitoring is recommended to assess antiretroviral treatment success; however, low- and middle-income countries face financial, operational, and country-specific challenges that must be overcome to adequately scale up viral load monitoring for all HIV-positive persons.

What is added by this report?

Sub-Saharan African countries have overcome challenges to initiate and scale up HIV viral load testing to monitor patients receiving ART. By 2018, seven of eight assessed countries reported viral load suppression rates of ≥85%. Logistical problems remain in several countries.

What are the implications for public health practice?

Viral load testing in low- and middle-income countries enables monitoring of viral load suppression at the individual and population level, which is necessary to achieve global epidemic control.

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Mask Use and Ventilation Improvements to Reduce COVID-19 Incidence in Elementary Schools — Georgia, November 16–December 11, 2020

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To meet the educational, physical, social, and emotional needs of children, many U.S. schools opened for in-person learning during fall 2020 by implementing strategies to prevent transmission of SARS-CoV-2, the virus that causes COVID-19 (*1*,*2*). To date, there have been no U.S. studies comparing COVID-19 incidence in schools that varied in implementing recommended prevention strategies, including mask requirements and ventilation improvements* (*2*). Using data from Georgia kindergarten through grade 5 (K–5) schools that opened for in-person learning during fall 2020, CDC and the Georgia Department of Public Health (GDPH) assessed the impact of school-level prevention strategies on incidence of COVID-19 among students and staff members before the availability of COVID-19 vaccines.† Among 169 K–5 schools that participated in a survey on prevention strategies and reported COVID-19 cases during November 16–December 11, 2020, COVID-19 incidence was 3.08 cases among students and staff members per 500 enrolled students.§ Adjusting for county-level incidence, COVID-19 incidence was 37% lower in schools that required teachers and staff members to use masks, and 39% lower in schools that improved ventilation, compared with schools that did not use these prevention strategies. Ventilation strategies associated with lower school incidence included methods to dilute airborne particles alone by opening windows, opening doors, or using fans (35% lower incidence), or in combination with methods to filter airborne particles with high-efficiency particulate absorbing (HEPA) filtration with or without purification with ultraviolet germicidal irradiation (UVGI) (48% lower incidence). Multiple strategies should be implemented to prevent transmission of SARS-CoV-2 in schools (*2*); mask requirements for teachers and staff members and improved ventilation are important strategies that elementary schools could implement as part of a multicomponent approach to provide safer, in-person learning environments. Universal and correct mask use is still recommended by CDC for adults and children in schools regardless of vaccination status (*2*).

Beginning in fall 2020, many Georgia schools opened for in-person learning. At that time, GDPH required all Georgia schools to submit weekly data on the aggregate number of COVID-19 cases among students and staff members.¶ School-associated cases were self-reported by parents and guardians of students, or staff members, or those reported by local public health officials. On November 16, 2020, the Georgia Department of Education and local health districts emailed an online survey on behalf of CDC and GDPH to all Georgia public K–5 school district superintendents (1,321 schools) and private school leaders (140 schools) to assess school and student characteristics and COVID-19 prevention strategies implemented at the time of the survey. Weekly reminders were sent for 3 additional weeks. Surveys were completed by principals (67.0%), nurses (12.0%), assistant principals (4.7%), or other school representatives (16.4%). School characteristics assessed included school type,** urban-rural classification,†† and instructional model.§§ Student characteristics assessed included racial/ethnic distribution¶¶ and percentages of students who received in-person instruction. Prevention strategies assessed included mask requirements for teachers, staff members, and

* Ventilation strategies include dilution methods (opening doors, opening windows, and using fans to improve circulation from open windows); filtration methods (installation of high-efficiency particulate absorbing [HEPA] filters); and purification methods (installation of ultraviolet germicidal irradiation [UVGI] units, installed in upper room areas and shielded from persons or installed in the heating, ventilation, and air conditioning [HVAC] system). https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html

† https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html

§ This denominator closely represents the size of elementary schools included in this study (median = 532).

¶ COVID-19 cases among staff members and students are defined as laboratory-confirmed reverse transcription–polymerase chain reaction or rapid antigen positive test results self-reported to the school by staff members and parents or guardians of students or by local public health officials. Schools report aggregate counts of cases among students and staff members weekly to GDPH and are required to report even if they have no cases.

** Public school; public charter, magnet, or alternative school; private, parochial, or independent school.

†† Based on the 2013 National Center for Health Statistics classification. Metro counties include large metro (county population ≥1,000,000), medium metro (250,000–999,999), and small metro (<250,000); nonmetro counties include micropolitan (10,000–49,999) and noncore (nonmetropolitan counties that did not qualify as micropolitan).

§§ For schools that are 100% in-person, students attend in-person for the full school week; for hybrid models, a combination of in-person and remote learning occurs on an alternating schedule.

¶¶ White, African American or Black, Hispanic, Asian, American Indian or Alaska Native, Other Pacific Islander, and Multiracial.

Summary

What is already known about this topic?

Kindergarten through grade 5 schools educate and address the students' physical, social, and emotional needs. Preventing SARS-CoV-2 transmission in schools is imperative for safe in-person learning.

What is added by this report?

COVID-19 incidence was 37% lower in schools that required teachers and staff members to use masks and 39% lower in schools that improved ventilation. Ventilation strategies associated with lower school incidence included dilution methods alone (35% lower incidence) or in combination with filtration methods (48% lower incidence).

What are the implications for public health practice?

Mask requirements for teachers and staff members and improved ventilation are important strategies in addition to vaccination of teachers and staff members that elementary schools could implement as part of a multicomponent approach to provide safer, in-person learning environments.

students; ventilation improvements***; physical distancing of desks (≥6 ft apart); barriers on student desks; class size (number of students in a classroom); cohort size (small groups of students who stay together throughout the day during in-person learning); and number and locations of available handwashing stations. Survey data were collected by CDC and stored in REDCap (version 9.7; Vanderbilt University).

Reported COVID-19 cases submitted to GDPH and online survey data collected during November 16–December 11, 2020, were linked by school to examine associations between prevention strategies and COVID-19 incidence, defined as number of cases among students and staff members per 500 enrolled students during the study period. Rate ratios (RRs) and 95% confidence intervals (CIs) were estimated with negative binomial regression models, adjusted for county-level 7-day incidence (cases per 100,000 population) on December 1, 2020.††† Rate ratios with 95% CIs excluding 1.0 were considered statistically significant. Analyses were conducted in R (version 4.0.2; The R Foundation). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§§§

Representatives from 169 (11.6%) of 1,461 schools in 51 (32.1%) of 159 Georgia counties (median = two schools per county) completed the survey and also had available COVID-19 case data (Figure).¶¶¶ Schools reporting 100% virtual learning were excluded. Among the 169 schools, 162 (95.9%) were public, representing 47 (26.0%) of 181 public school districts in Georgia (median = two schools per district). Schools had a median of 532 enrolled students (attending virtually and in-person), 91.1% were publicly funded, 71.0% were located in metropolitan areas, and 82.2% used hybrid learning (Table 1). Median class size was 19.0 students (interquartile range [IQR] = 15.0–21.0); median cohort size was 20.0 students (IQR = 15.0–21.0). Among all schools, the proportion of students receiving at least some in-person instruction ranged from 8.5% to 100% (median = 84.7%); 3.0%–100% (median = 64.0%) were eligible for free or reduced-cost meal plans, and approximately one half of students were White (median = 55.1%), followed by Black (median = 17.0%), Hispanic (median = 9.0%), multiracial (median = 4.5%), and Asian (median = 1.0%).****

Prevention strategies implemented at participating schools included requiring masks for teachers and staff members (65.1%) or students (51.5%), flexible medical leave for teachers (81.7%), improved ventilation (51.5%), spacing all desks ≥6 ft apart (18.9%), and using barriers on all desks (22.5%). Schools reported a median of 9.0 (IQR = 8.0–9.0) locations with handwashing stations (Table 1).

During the 26 days from November 16 through December 11, 2020, participating schools reported a median of two COVID-19 cases (range = 0–15); COVID-19 incidence for all schools combined was 3.08 cases among students and staff members per 500 enrolled students. Community incidence in counties with participating schools during the same period was 1,055 per 100,000 persons of all ages, or approximately 5.28 per 500 population.†††† Mask requirements

*** Schools reported "Yes" or "No" to the question, "Are steps being taken to improve air quality and increase the ventilation in the school?" Schools that responded "Yes" were asked to select from the following options: opening doors, opening windows, using fans to increase effectiveness of open windows, installation of HEPA filtration systems in high-risk areas, or installation of UVGI in high-risk areas. Multiple choices were allowed.

††† County incidence was calculated as the 7-day cumulative sum of COVID-19 cases reported to GDPH on December 1, 2020, divided by the county population multiplied by 100,000. Population estimates for 2019 were provided by the Annual Estimates of the Resident Population for Counties in Georgia from April 1, 2010, to July 1, 2019. Data were obtained from the U.S. Census Bureau on October 1, 2020.

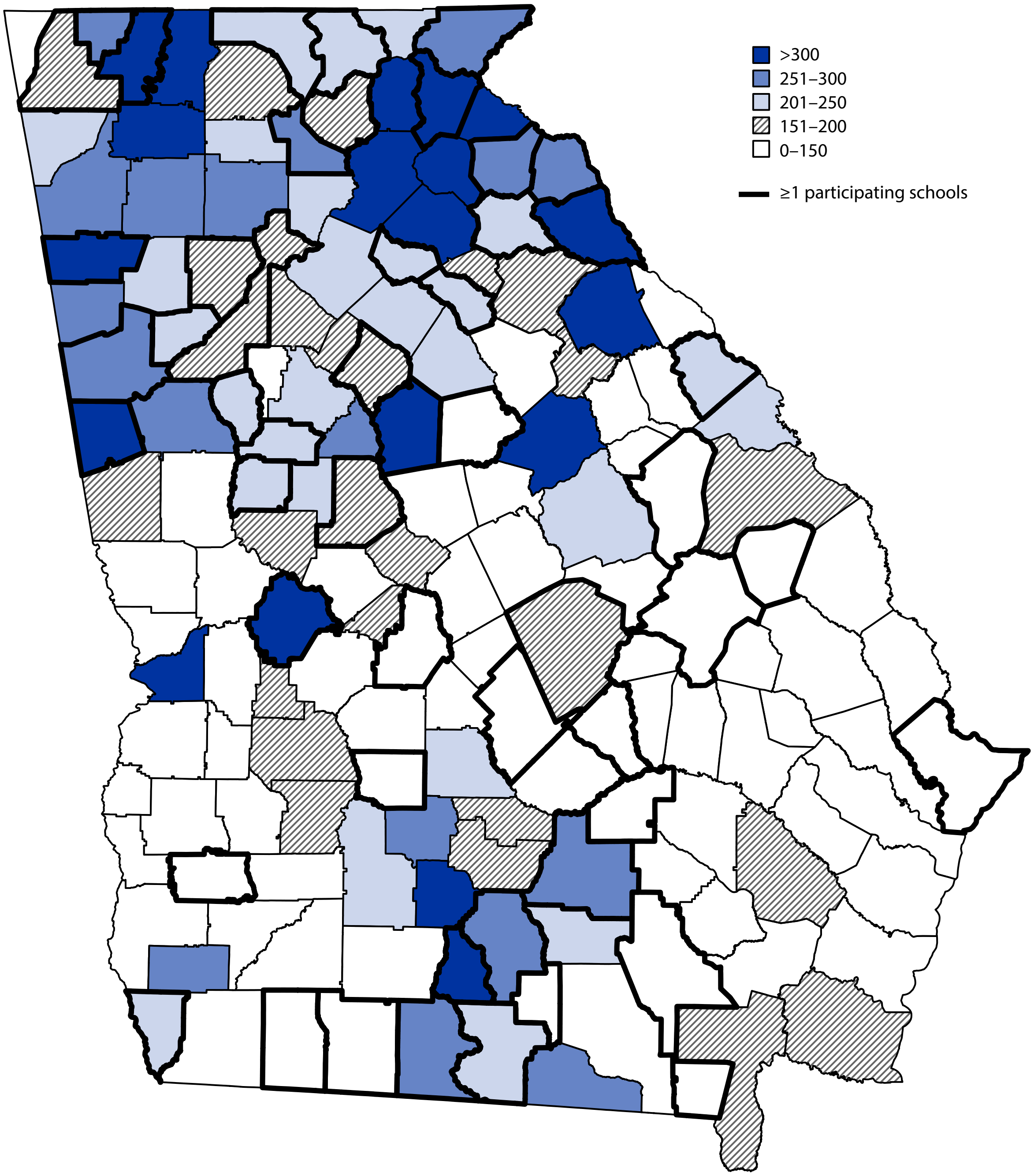
§§§ 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

¶¶¶ "Available case data" refers to the weekly aggregate COVID-19 case reports provided by schools to GDPH. Not all schools that completed the survey reported during the study period. Sixty-one schools that completed the survey but did not provide GDPH any weekly COVID-19 reports during the study period were excluded.

**** Median proportions of American Indian or Alaska Native and Native Hawaiian or Other Pacific Islander were <1%. Each school reported the proportion of students who identified within the different racial and ethnic groups. The cumulative proportions could not exceed 100%.

†††† Community incidence was calculated for the survey period November 16–December 11, 2020, to allow comparison to school-level incidence during the same period. County-level incidence used for RR estimation and the figure are 7-day cumulative cases per 100,000 population as reported on December 1, 2020.

FIGURE. County-level COVID-19 incidence* on December 1, 2020, among counties with one or more participating elementary schools† and counties without participating schools — Georgia, November 16–December 11, 2020



Abbreviations: GDPH = Georgia Department of Public Health; K–5 = kindergarten through grade 5.

* County incidence was calculated as the 7-day cumulative sum of COVID-19 cases reported to GDPH divided by the county population multiplied by 100,000 on December 1, 2020. Population estimates for 2019 were provided by the Annual Estimates of the Resident Population for Counties in Georgia from April 1, 2010, to July 1, 2019.

† GDPH and Georgia Department of Education contacted all public Georgia K–5 superintendents (1,321 schools) and private school leaders (140 schools). Representatives from 169 schools with available case data completed the survey (11.6% of schools contacted).

TABLE 1. COVID-19 incidence* and rate ratios in 169 elementary schools,† by county COVID-19 incidence, school characteristics, and COVID-19 prevention strategies — Georgia, November 16–December 11, 2020

Characteristic	No. (%) of schools	No. of enrolled students	No. of cases§	Cases per 500 students enrolled (95% CI)	RR¶ (95% CI)
Total	**169 (100)**	**91,893**	**566**	**3.08 (2.84–3.34)**	—
County COVID-19 incidence**					
0–150	25 (14.8)	12,358	52	2.10 (1.61–2.76)	Ref
151–200	54 (32.0)	32,399	169	2.61 (2.24–3.03)	1.21 (0.75–1.96)
201–250	45 (26.6)	24,482	106	2.16 (1.79–2.62)	1.00 (0.60–1.66)
251–300	21 (12.4)	11,556	122	5.28 (4.42–6.30)	2.55 (1.47–4.47)
>300	24 (14.2)	11,098	117	5.27 (4.40–6.31)	2.26 (1.32–3.88)
School type					
Public	154 (91.1)	86,878	536	3.08 (2.84–3.36)	Ref
Public charter/Magnet/Alternative	8 (4.7)	4,645	27	2.91 (2.00–4.22)	0.97 (0.50–1.97)
Private/Parochial/Independent	7 (4.1)	370	3	4.05 (1.38–11.78)	1.46 (0.31–5.33)
Urban–rural setting††					
Metropolitan	120 (71.0)	65,501	386	2.95 (2.67–3.25)	Ref
Nonmetropolitan	49 (29.0)	26,392	180	3.41 (2.95–3.94)	1.14 (0.83–1.58)
Instructional model§§					
100% in-person	30 (17.8)	14,538	106	3.65 (3.02–4.41)	Ref
Hybrid	139 (82.2)	77,355	460	2.97 (2.71–3.26)	0.91 (0.60–1.36)
Mask requirements for teachers and staff members¶¶					
Optional	57 (33.7)	29,881	264	4.42 (3.92–4.98)	Ref
Required	110 (65.1)	61,190	298	2.44 (2.17–2.73)	0.63 (0.47–0.85)
Mask requirements for students					
Optional	82 (48.5)	42,761	326	3.81 (3.42–4.25)	Ref
Required	87 (51.5)	49,132	240	2.44 (2.15–2.77)	0.79 (0.50–1.08)
Flexible medical leave policies for teachers					
Not offered	31 (18.3)	17,194	137	3.98 (3.37–4.71)	Ref
Offered	138 (81.7)	74,699	429	2.87 (2.61–3.16)	0.81 (0.56–1.17)
Ventilation improvements					
No***	37 (21.9)	21,844	183	4.19 (3.63–4.84)	Ref
Yes	87 (51.5)	44,771	234	2.61 (2.30–2.97)	0.61 (0.43–0.87)
Don't know	45 (26.6)	25,278	149	2.95 (2.51–3.46)	0.63 (0.42–0.95)
Desks or tables separated ≥6 ft					
Some/No classrooms	137 (81.1)	76,348	472	3.09 (2.83–3.38)	Ref
All classrooms	32 (18.9)	15,545	94	3.02 (2.47–3.70)	0.97 (0.66–1.45)
Desks or tables with barriers					
Some/No classrooms	131 (77.5)	71,163	445	3.13 (2.85–3.43)	Ref
All classrooms	38 (22.5)	20,730	121	2.92 (2.44–3.48)	0.98 (0.69–1.41)
Students per classroom, median (IQR)	19 (15–21)	—	—	—	1.02 (0.98–1.06)
Cohort size,††† median (IQR)	20 (15–21)	—	—	—	1.00 (1.00–1.00)
Handwashing stations, median (IQR)	9 (8–9)	—	—	—	0.88 (0.76–1.01)

Abbreviations: CI = confidence interval; IQR = interquartile range; GDPH = Georgia Department of Public Health; K–5 = kindergarten through grade 5; RR = rate ratio; Ref = referent.

* Case incidence in schools was calculated as the sum of cases reported to GDPH during November 16–December 11, 2020, divided by the number of students enrolled multiplied by 500.

† GDPH and Georgia Department of Education contacted all public Georgia K–5 superintendents (1,321 schools) and private school leaders (140 schools); 169 schools with available case data completed the survey (response rate 11.6%).

§ Number includes both students and staff members with a case of COVID-19 during the study period.

¶ All RR estimates except for county COVID-19 incidence were adjusted for county-level 7-day case incidence per 100,000 population on December 1, 2020. RRs that exclude 1 are statistically significant.

** Per 100,000 population. County incidence was calculated as the 7-day cumulative sum of COVID-19 cases reported to GDPH on December 1, 2020, divided by the county population multiplied by 100,000. Population estimates for 2019 were provided by the Annual Estimates of the Resident Population for Counties in Georgia from April 1, 2010, to July 1, 2019.

†† Based on the 2013 National Center for Health Statistics classification. Metro counties include large metro (county population ≥1,000,000), medium metro (250,000–999,999), and small metro (<250,000); nonmetro counties include: micropolitan (10,000–49,999) and noncore (nonmetropolitan counties that did not qualify as micropolitan).

§§ For schools that are 100% in-person, students attend in-person for the full school week; for hybrid models, a combination of in-person and remote learning occurs on an alternating schedule.

¶¶ Two schools had discordant mask requirements for teachers and other staff members (i.e., one school required mask use among teachers, but not other staff members, and one school required mask use among other staff members, but not teachers). These were excluded from the calculation of the RR for mask requirements for teachers and staff members. All other schools either required masks for both teachers and staff members or allowed for optional mask use among both groups.

*** Includes schools that reported "No" to improving ventilation and six schools that reported decreasing room occupancy as the only ventilation improvement.

††† Small groups of students who stay together throughout the day during in-person learning.

for teachers and staff members (RR = 0.63) and improved ventilation (RR = 0.61) were associated with lower incidence (Table 1). Among 123 schools that reported on ventilation improvements, dilution methods (opening doors, opening windows, or using fans) alone (RR = 0.65), or in combination with filtration (installation of HEPA filters) with or without purification (installation of UVGI) (RR = 0.52) were associated with lower COVID-19 incidence (Table 2).

Discussion

During November 16–December 11, 2020, many K–5 schools in Georgia had resumed in-person instruction,[§§§§] necessitating implementation of strategies to prevent SARS-CoV-2 transmission within schools, including mask use and improved ventilation. This study found that before the availability of COVID-19 vaccines, the incidence of COVID-19 was 37% lower in schools that required mask use among teachers and staff members and was 39% lower in schools that reported implementing one or more strategies to improve classroom ventilation. Preventing transmission of SARS-CoV-2 in schools should be multifaceted (*2*). Mask requirements for teachers and staff members and improved ventilation are important strategies that elementary schools could implement as part of a multicomponent approach to provide safer, in-person learning environments until vaccines are available for children aged <12 years.

CDC recommends implementing multiple prevention strategies (*2*) (e.g., physical distancing, masking, improved ventilation, and contact tracing) that have been associated with lower SARS-CoV-2 transmission in kindergarten through grade 12 settings (*3*–*5*). Since the completion of this study, COVID-19 vaccines have become widely available, and CDC recommends vaccination for teachers, staff members, and students aged ≥12 years (*2*). Until vaccines are available for children aged <12 years, universal and correct mask use is a critical prevention strategy CDC recommends that schools prioritize regardless of vaccination status for in-person learning (*2*). In the current study, the lower incidence in schools requiring mask use among teachers and staff members is consistent with research on mask effectiveness (*6*), and investigations that have identified school staff members as important contributors to school-based SARS-CoV-2 transmission (*7*). The 21% lower incidence in schools that required mask use among students was not statistically significant compared with schools where mask use was optional. This finding might be attributed to higher effectiveness of masks among adults, who are at higher risk for SARS-CoV-2 infection but might also result from differences in mask-wearing behavior among students in schools with optional requirements. Mask use requirements were limited in this sample; 65.1% of schools required teacher and staff member mask use and approximately one half (51.5%) required student mask use. Because universal and correct use of masks can reduce SARS-CoV-2 transmission (*6*) and is a relatively low-cost and easily implemented strategy, findings in this report suggest universal and correct mask use is an important COVID-19 prevention strategy in schools as part of a multicomponent approach.

In schools that improved ventilation through dilution methods alone, COVID-19 incidence was 35% lower, whereas in schools that combined dilution methods with filtration, incidence was 48% lower. Ventilation can be improved in simple, cost-effective ways by keeping doors and windows open and using fans to increase air flow from open windows (*8*). In rooms that are difficult to ventilate or have an increased likelihood

§§§§ Based on data reported to GDPH as part of COVID-19 surveillance in schools.

TABLE 2. COVID-19 incidence* and rate ratios in 123 elementary schools,† by type of ventilation improvement as a COVID-19 prevention strategy — Georgia, November 16–December 11, 2020

Ventilation improvement	No. (%) of schools	No. of enrolled students	No. of cases§	Cases per 500 students enrolled (95% CI)	RR¶ (95% CI)
Total	**123 (100)**	**66,499**	**417**	**3.13 (2.84–3.44)**	—
None**	37 (30.1)	21,844	183	4.19 (3.63–4.84)	Ref
Dilution only††	39 (31.7)	21,562	127	2.94 (2.48–3.50)	0.65 (0.43–0.98)
Filtration ± purification only§§	16 (13.0)	9,133	45	2.46 (1.84–3.29)	0.69 (0.40–1.21)
Dilution and filtration ± purification¶¶	31 (25.2)	13,960	62	2.22 (1.73–2.84)	0.52 (0.32–0.83)

Abbreviations: CI = confidence interval; GDPH = Georgia Department of Public Health; HEPA = high-efficiency particulate absorbing; RR = rate ratio; UVGI = ultraviolet germicidal irradiation; ± = with or without.

* Case incidence in schools was calculated as the sum of cases reported to GDPH during November 16–December 11, 2020, divided by the number of students enrolled multiplied by 500.

† Excludes schools from the original 169 that reported "Don't know" to improving ventilation (n = 45) and one school that reported only using an air purification strategy.

§ Number includes both students and staff members with a case of COVID-19 during the study period.

¶ Adjusted for county-level 7-day case incidence per 100,000 population on December 1, 2020.

** Includes schools that reported "No" to improving ventilation and six schools that reported decreasing room occupancy as the only ventilation improvement.

†† Opening doors, opening windows, or using fans.

§§ Using HEPA filters with or without using UVGI and not opening doors, opening windows, or using fans.

¶¶ Opening doors, opening windows, or using fans, and using HEPA filters with or without using UVGI.

of being occupied by persons with COVID-19 (e.g., nurse's office), installation of HEPA filters or UVGI should be considered (*8,9*). However, only approximately one half (51.5%, 87 of 169) of school representatives reported being sure that ventilation was improved in school classrooms, and 18.0% (31 of 169) reported that their school implemented dilution methods in combination with filtration. These findings suggest that there are opportunities for many schools to reduce SARS-CoV-2 transmission through improved ventilation. Schools in lower-resourced communities might face barriers to installation of air filtration and purification devices; however, improvements can be made through dilution methods alone. CDC recommends improving ventilation through dilution, filtration, and purification methods, consistent with the school's safety protocols (*8*).

The findings in this report are subject to at least four limitations. First, many COVID-19 cases were self-reported by staff members and parents or guardians, and prevention strategies reported by administrators or nurses might not reflect day-to-day activities or represent all school classrooms, and did not include an assessment of compliance (e.g., mask use). Second, the study had limited power to detect lower incidence for potentially effective, but less frequently implemented strategies, such as air filtration and purification systems; only 16 schools reported implementing this ventilation improvement. Third, the response rate was low (11.6%), and some participating schools had missing information about ventilation improvements. However, incidence per 500 students was similar between participating (3.08 cases) and nonparticipating (2.90 cases) schools, suggesting any systematic bias might be low. Finally, the data from this cross-sectional study cannot be used to infer causal relationships.

This study highlighted the importance of masking and ventilation for preventing SARS-CoV-2 transmission in elementary schools and revealed important opportunities for increasing their use among schools. A multicomponent approach to school COVID-19 prevention efforts is recommended (*2*), and requirements for universal and correct mask use among teachers and staff members and improved ventilation are two important strategies that could reduce SARS-CoV-2 transmission as schools continue, or return to, in-person learning.

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COVID-19 Testing to Sustain In-Person Instruction and Extracurricular Activities in High Schools — Utah, November 2020–March 2021

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Cessation of kindergarten through grade 12 in-person instruction and extracurricular activities, which has often occurred during the COVID-19 pandemic, can have negative social, emotional, and educational consequences for children (*1,2*). Although preventive measures such as masking, physical distancing, hand hygiene, and improved ventilation are commonly used in schools to reduce transmission of SARS-CoV-2, the virus that causes COVID-19, and support in-person instruction (*3*–*6*), routine school-based COVID-19 testing has not been as widely implemented. In addition to these types of standard preventive measures, Utah health and school partners implemented two high school testing programs to sustain extracurricular activities and in-person instruction and help identify SARS-CoV-2 infections: 1) Test to Play,* in which testing every 14 days was mandated for participation in extracurricular activities; and 2) Test to Stay,† which involved school-wide testing to continue in-person instruction as an alternative to transitioning to remote instruction if a school crossed a defined outbreak threshold (3). During November 30, 2020–March 20, 2021, among 59,552 students tested through these programs, 1,886 (3.2%) received a positive result. Test to Play was implemented at 127 (66%) of Utah's 193 public high schools and facilitated completion of approximately 95% of scheduled high school extracurricular winter athletics competition events.§ Test to Stay was conducted at 13 high schools, saving an estimated 109,752 in-person instruction student-days.¶ School-based COVID-19 testing should be considered as part of a comprehensive prevention strategy to help identify SARS-CoV-2 infections in schools and sustain in-person instruction and extracurricular activities.

For both the Test to Play and Test to Stay programs, the Utah Department of Health (UDOH) provided training and rapid antigen test kits** to school staff members, who performed school-based rapid antigen testing (e.g., in school gymnasiums), supported by UDOH and local health departments. Parental permission was required for students to receive school-based testing. Schools were required to report all test results to UDOH. In lieu of school-based testing, students could participate in these programs by receiving testing elsewhere (e.g., via community testing). Students who had a negative test result were allowed to continue to participate in in-person instruction and extracurricular activities; students who had a positive test result were required to isolate for 10 days from the date of the test, and close contacts were required to quarantine†† (*3*). For Test to Stay events, schools were advised that students who opted out of testing should transition to remote instruction for 10 days from the date of event.

The UDOH COVID-19 surveillance system was used to evaluate trends in COVID-19 incidence among children aged 5–17 years and Test to Play and Test to Stay results.§§ In addition, UDOH administered a survey to school representatives in February 2021 to identify facilitators of and barriers to

* Test to Play, which required testing every 14 days for participants in high school extracurricular activities, is described in the Utah COVID-19 School Manual (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf) and was mandated by Utah State Public Health Order 2020-25 (https://coronavirus-download.utah.gov/Health/UPHO_2020-25_Statewide_COVID-19_Restrictions.pdf), effective November 30, 2020.

† Beginning August 2020, schools were advised to transition to remote instruction for 14 days when the number of school-associated cases among students and staff members crossed a specified outbreak threshold. During August–December 2020, the outbreak threshold was 15 school-associated cases during the previous 14 days. Under Test to Stay (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf), which began January 4, 2021, the outbreak threshold of cases during the previous 14 days changed to 1% of the school population for schools with >1,500 students and staff members and 15 cases for schools with ≤1,500 students and staff members, and the period of advised remote instruction after crossing the outbreak threshold changed to 10 days. Beginning March 24, 2021 (after the study period), per Utah Senate Bill 107 (https://le.utah.gov/~2021/bills/static/SB0107.html), the outbreak threshold changed again, such that a school would be required to conduct Test to Stay if student cases during the previous 14 days reached 2% of the school's student population for schools with ≥1,500 students and 30 students for schools with <1,500 students.

§ Of the 11,379 competition events scheduled for winter athletics sanctioned by the Utah High School Activities Association during November 30, 2020–February 20, 2021, a total of 10,812 (95%) occurred, including approximately 861 after being rescheduled. The Utah High School Activities Association recommended COVID-19 preventive behaviors during these extracurricular activities, including mask use and physical distancing. https://www.uhsaa.org/sportsmedicine/UHSAA%20Return%20to%20Play%20Document%20Winter%20Sport-by-Sport%20USSA%20UHSAA%20Plan.pdf

¶ Assumes that an average of 8 learning days were lost during each school transition to remote learning and that all 13,719 students who received negative test results during Test to Stay events at these 13 schools continued to participate in in-person instruction.

** Abbott BinaxNOW rapid antigen nasal swab test kits were provided at no cost to UDOH by the U.S. Department of Health and Human Services. https://www.fda.gov/media/141570/download

†† The required quarantine period for persons in close contact with an infected person changed from 14 days to 10 days beginning December 4, 2020.

§§ Persons aged 14–18 years whose Test to Play or Test to Stay test results were reported from a public high school, school district, or private school were considered to be high school students.

conducting Test to Stay and to collect information on testing events. In March 2021, UDOH also collected data from all school districts on outbreak threshold crossings and transitions to remote instruction. These activities were reviewed by CDC and were conducted consistent with applicable federal law and CDC policy.¶¶

Beginning August 2020, 40 of 41 Utah school districts opened for in-person instruction.*** In September 2020, COVID-19 incidence in Utah among persons aged 14–17 years rose rapidly, followed by similar but smaller increases among persons aged 5–13 years (Figure 1). On November 9, statewide COVID-19 restrictions were ordered, including a cessation of extracurricular activities except high school football.††† In mid-November, Test to Play was piloted among participants in high school football state championships. Beginning November 30, Test to Play was mandated for participants in all high school extracurricular activities (Figure 2).

During August–December 2020, schools crossing the defined outbreak threshold were recommended to transition temporarily to remote instruction, in consultation with their local health departments. During this period, Utah school districts reported 78 high school transitions to remote instruction after crossing the outbreak threshold. In December 2020, Test to Stay was piloted at two high schools. Beginning January 4, 2021, schools crossing the outbreak threshold could choose to implement Test to Stay as an alternative to transitioning to remote instruction (Figure 2).

During November 30, 2020–March 20, 2021, a total of 165,078 tests among high school students were reported in Test to Play and Test to Stay. Among 59,552 students receiving testing at least once, including one third (34%) of Utah's public high school students, 1,886 (3.2%) had a positive result.§§§

During the same period, public and private schools and school districts, including 127 (66%) of Utah's 193 public high schools, reported 148,262 Test to Play tests among high school students.¶¶¶ Among 50,400 students receiving testing at least once, representing an estimated two thirds (67%) of all high school students participating in extracurricular activities, 1,771 (3.5%) had a positive result.**** During January 3–March 20, 2021, the percentage of positive tests declined (Figure 2), consistent with decreasing statewide incidence among school-aged children during this period (Figure 1). Test to Play allowed extracurricular activities to occur in the context of mandated testing; during November 30, 2020–February 20, 2021, approximately 95% of the 11,379 scheduled competition events for high school extracurricular winter athletics were completed.

School districts reported 29 outbreak threshold crossings in 28 high schools during January 4–March 5, 2021; 16 of these schools chose not to conduct Test to Stay and transitioned to remote instruction. During January 4–March 20, 2021, 13 high schools conducted 14 Test to Stay events, performing 14,531 tests among students (Figure 2). Among 13,809 students receiving testing at least once during these events, representing an estimated 70% of students participating in in-person instruction at these 13 schools,†††† 90 (0.7%) had a positive result (range of test positivity among events = 0.0%–2.7%). After testing events, these 13 schools continued in-person instruction, collectively saving an estimated 109,752 in-person instruction student-days.

Among the 303 Utah public and private schools and school districts included in the UDOH survey, representatives from 144 (48%) responded. Identified facilitators of Test to Stay included promoting student participation through pre-event parental

¶¶ 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.

*** Each Utah local education authority could choose whether to open for in-person instruction for fall 2020. Among the 40 school districts that chose to open for in-person instruction, 39 began in August 2020, and one began in September 2020. One school district offered only remote instruction during fall 2020 and early 2021 and opened for in-person instruction in February 2021.

††† Utah State Capitalize Public Health Order 2020-21 (https://coronavirus-download.utah.gov/Health/UPHO-2020-21-Temporary-Statewide-COVID-19-Restrictions.pdf). Because the order occurred at the end of its season, high school football was excepted to allow completion of state championship games.

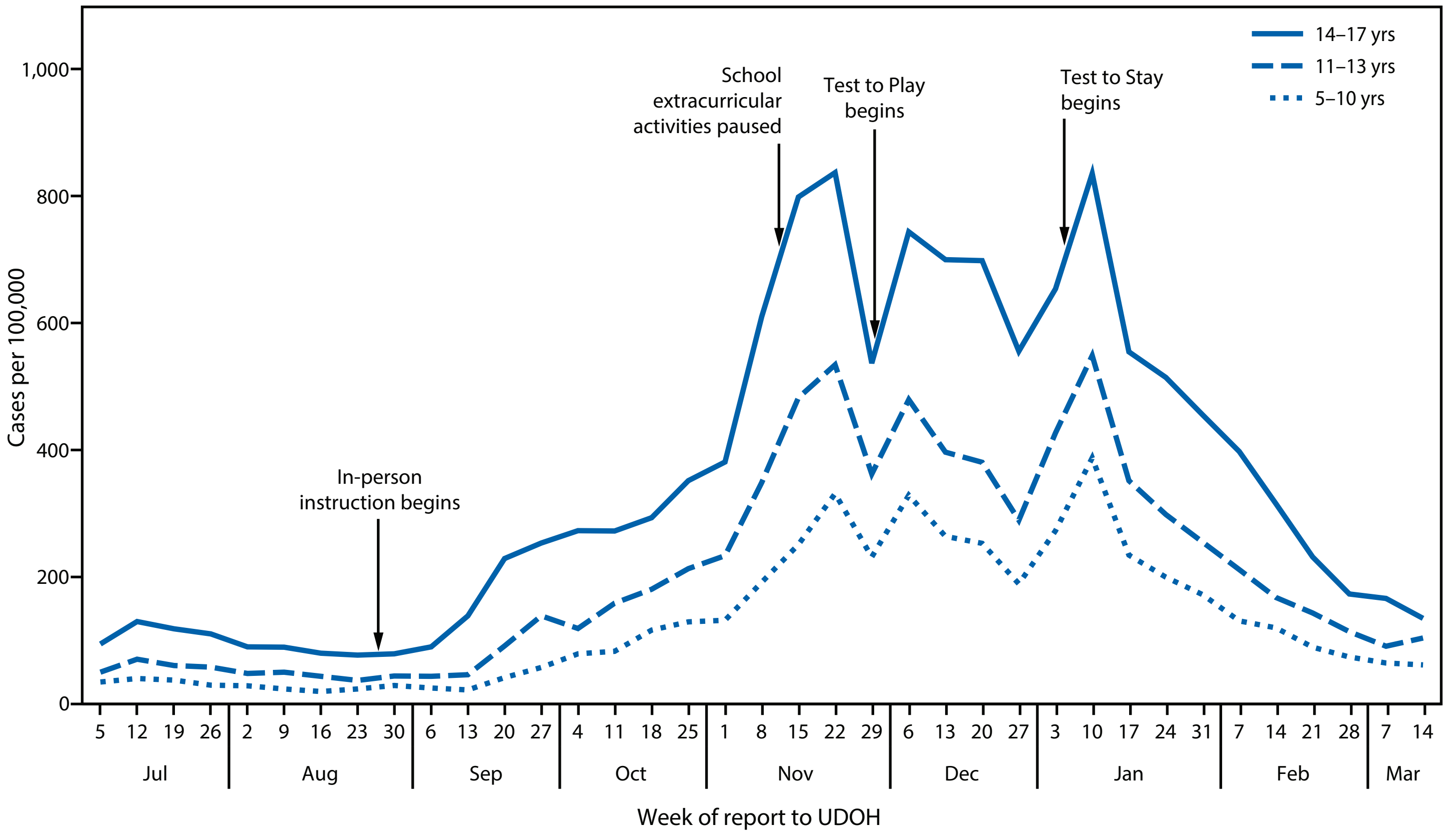
§§§ Includes data from the December 2020 Test to Stay pilot, in which 2,285 students received testing and 26 (1.1%) had a positive result. Of 59,552 students tested in Test to Play and Test to Stay, 6,940 received testing in both programs, including two who received testing at two different Test to Stay events and one who had a positive result in both Test to Play and Test to Stay. In addition to those performed among students, 22,374 tests were performed among school staff members; of 9,688 school staff members who received testing at least once, 693 (7.2%) had a positive result. Of 59,552 students who received testing, 58,373 were public school students, representing 34% of the 172,260 students enrolled in Utah public high schools according to Utah State Board of Education fall 2020 enrollment data.

¶¶¶ High schools from which UDOH did not receive a report of Test to Play testing likely did not offer extracurricular activities, offered testing to extracurricular activity participants but did not report such testing, reported it under the school district rather than the school, reported it in a manner not identifiable as Test to Play, or required extracurricular activity participants to receive testing separately from school-based testing (e.g., community testing). The number of public high schools in Utah was supplied by the Utah State Board of Education.

**** An estimated 75,510 high school students participated in extracurricular activities during late November 2020–early March 2021 according to the Utah High School Activities Association. The 67% Test to Play participation estimate does not account for possible underreporting of school-based student testing or those students who might have received testing separately from school-based testing (e.g., via community testing).

†††† According to fall 2020 high school enrollment data reported by the Utah State Board of Education and school district–level proportions of high school students participating in full-time remote instruction reported by school districts, an estimated 19,660 students were participating in in-person instruction at these 13 high schools. The 70% Test to Stay participation estimate does not account for possible underreporting of school-based student testing, students who might have received testing separately from school-based testing (e.g., via community testing), or those not eligible for testing (e.g., a person who had a positive COVID-19 test result <90 days before the testing event).

FIGURE 1. COVID-19 incidence* among children aged 5–10 years (N = 311,812), 11–13 years (N = 161,991), and 14–17 years (N = 209,578), by week — Utah, July 5, 2020–March 14, 2021†,§,¶,**



Abbreviation: UDOH = Utah Department of Health.

* Total new cases per 100,000 persons in the previous 7 days, calculated using 2018 population data. https://ibis.health.utah.gov

† In August 2020, Utah schools opened for in-person instruction in 40 of 41 school districts.

§ On November 9, 2020, Utah State Public Health Order 2020-21 limited participation in organized extracurricular activities to high school football practice or games. https://coronavirus-download.utah.gov/Health/UPHO-2020-21-Temporary-Statewide-COVID-19-Restrictions.pdf, https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf

¶ Test to Play, which required testing every 14 days for participants in high school extracurricular activities, is described in the Utah COVID-19 School Manual (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf) and was mandated by Utah State Public Health Order 2020-25 (https://coronavirus-download.utah.gov/Health/UPHO_2020-25_Statewide_COVID-19_Restrictions.pdf), effective November 30, 2020.

** Beginning August 2020, schools were advised to transition to remote instruction for 14 days when the number of school-associated cases among students and staff members crossed a specified outbreak threshold. During August–December 2020, the outbreak threshold was 15 school-associated cases during the previous 14 days. Under Test to Stay (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf), which began January 4, 2021, the outbreak threshold of cases during the previous 14 days changed to 1% of the school population for schools with >1,500 students and staff members and 15 cases for schools with ≤1,500 students and staff members, and the period of advised remote instruction after crossing the outbreak threshold changed to 10 days.

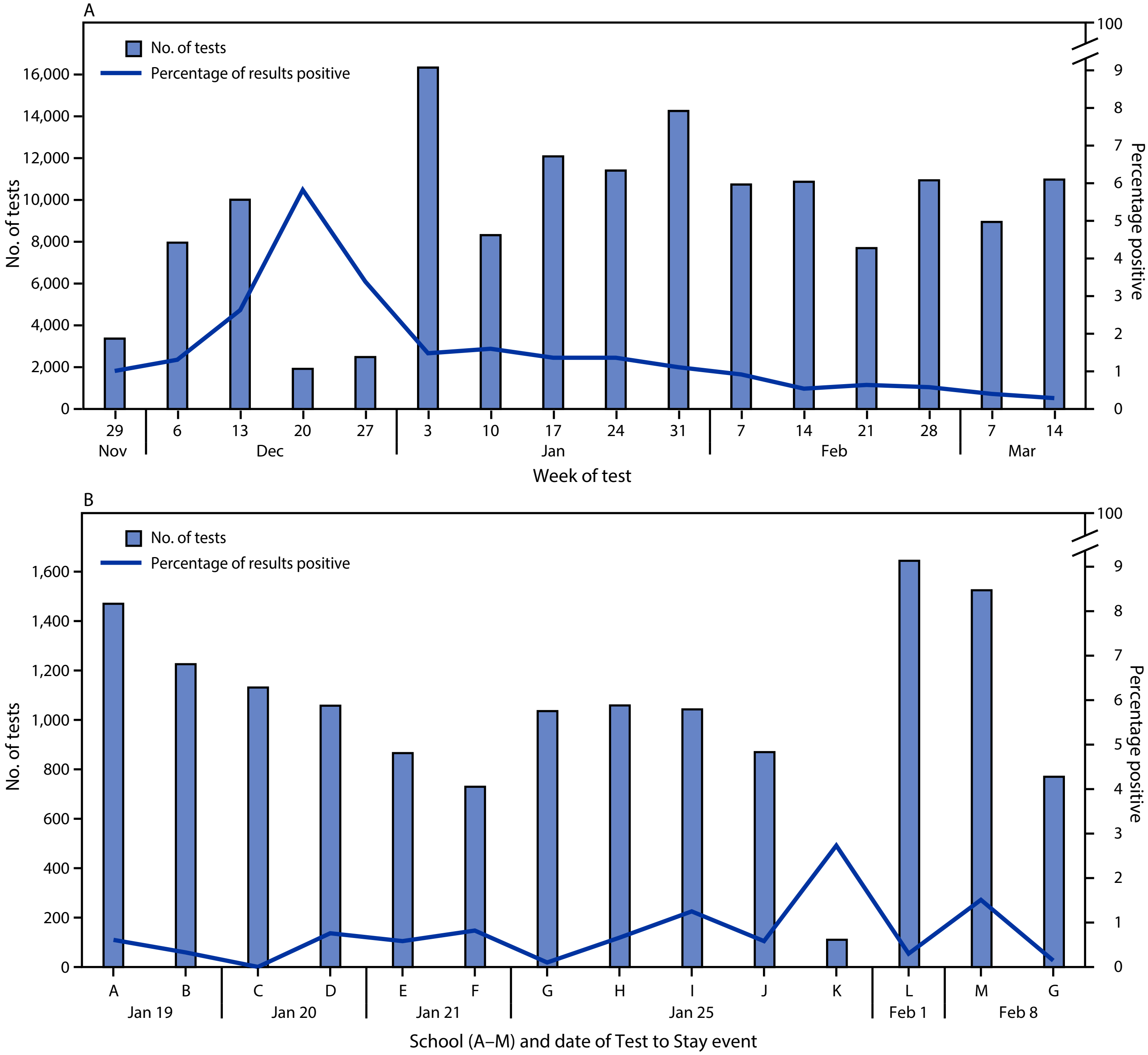
messaging and preregistration for testing, coordinating with health partners to increase testing capacity, and maintaining in-person instruction during testing. Barriers included lack of perceived community support and limited staffing capacity (Box).

Discussion

Utah's high school COVID-19 testing programs saved in-person instruction days and facilitated continuation of extracurricular activities in accordance with statewide public health policy during a period of high COVID-19 incidence among persons of high-school student age. Growing evidence suggests that when schools implement recommended prevention strategies, including consistent and correct use of masks, physical distancing, hand hygiene, and room ventilation improvements, in-school COVID-19 transmission is infrequent (*4,5,7*), while loss of in-person instruction can have detrimental effects on children's education and their social and emotional well-being (*1,2*). Consistent and correct mask use remains recommended by CDC for adults and children in schools, regardless of vaccination status.§§§§ Outcomes of Utah's Test to Play and Test to Stay programs are consistent with

§§§§ https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/k-12-testing.html, https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html#testing

FIGURE 2. Number of school-based SARS-CoV-2 rapid antigen tests* performed and percentage positive among students participating in Test to Play (A)† and Test to Stay (B),§ by week or date of testing event and high school (for Test to Stay) — Utah, November 30, 2020–March 20, 2021



* Abbott BinaxNOW rapid antigen nasal swab test kits were provided at no cost to the Utah Department of Health by the U.S. Department of Health and Human Services. https://www.fda.gov/media/141570/download

† Test to Play, which required testing every 14 days for participants in high school extracurricular activities, is described in the Utah COVID-19 School Manual (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf) and was mandated by Utah State Public Health Order 2020-25 (https://coronavirus-download.utah.gov/Health/UPHO_2020-25_Statewide_COVID-19_Restrictions.pdf), effective November 30, 2020.

§ Beginning August 2020, schools were advised to transition to remote instruction for 14 days when the number of school-associated cases among students and staff members crossed a specified outbreak threshold. During August–December 2020, the outbreak threshold was 15 school-associated cases during the previous 14 days. Under Test to Stay (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf), which began January 4, 2021, the outbreak threshold of cases during the previous 14 days changed to 1% of the school population for schools with >1,500 students and staff members and 15 cases for schools with ≤1,500 students and staff members, and the period of advised remote instruction after crossing the outbreak threshold changed to 10 days. Each of the 13 schools that conducted Test to Stay is represented by a unique letter (A–M). With the exception of the second high school G event, Test to Stay events were conducted over 1 or 2 days and all student testing reported by these schools during the events was counted as Test to Stay. Multiday Test to Stay events are indicated on the first day of the event. High school G conducted a Test to Stay event during January 25–26 after crossing the outbreak threshold. Subsequently, high school G conducted modified, follow-up Test to Stay testing during February 8–March 9; all Test to Stay testing among students reported by this school during this period is represented as a single, additional event. High school K conducted a Test to Stay event when the school was approaching, but had not reached, the outbreak threshold.

BOX. Important facilitators of and barriers to conducting Test to Stay* — survey of Utah schools and school districts, February 2021†

Facilitators

- Early planning and staff member training before a school reaches the outbreak threshold to maximize preparedness
- Delivery of messaging to students and parents or guardians before the event to promote student participation
- Encouraging students to preregister to save time during the event
- Leveraging existing school capacity for testing, such as Test to Play§
- Coordination with local and state health departments to increase testing capacity and facilitate a coordinated event
- Maintaining in-person instruction during the event

Barriers

- Lack of perceived support for student testing among school boards, student families, or community members
- Limited staffing capacity for large-scale testing
- Concern among teachers that testing will lead to dual-modality instruction (both in-person and virtual), particularly if low numbers of students participate in testing
- Difficulty reporting test results due to unreliable Internet access, school security firewalls, or user errors when generating registration links
- Mistaken belief that a school would be ineligible for Test to Stay if it did not participate in Test to Play

* Beginning August 2020, schools were advised to transition to remote instruction for 14 days when the number of school-associated cases among students and staff members crossed a specified outbreak threshold. During August–December 2020, the outbreak threshold was 15 school-associated cases during the previous 14 days. Under Test to Stay (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf), which began January 4, 2021, the outbreak threshold of cases during the previous 14 days changed to 1% of the school population for schools with >1,500 students and staff members and 15 cases for schools with ≤1,500 students and staff members, and the period of advised remote instruction after crossing the outbreak threshold changed to 10 days.

† The Utah Department of Health administered a survey of school representatives to determine facilitators of and barriers to conducting Test to Stay. Of 303 Utah public and private schools and school districts included in the survey, representatives from 144 (48%) responded.

§ Test to Play, which required testing every 14 days for participants in high school extracurricular activities, is described in the Utah COVID-19 School Manual (https://coronavirus-download.utah.gov/School/COVID-19_School_Manual_FINAL.pdf) and was mandated by Utah State Public Health Order 2020–25 (https://coronavirus-download.utah.gov/Health/UPHO_2020-25_Statewide_COVID-19_Restrictions.pdf), effective November 30, 2020.

Summary

What is already known about this topic?

COVID-19–associated cessation of kindergarten through grade 12 in-person instruction and extracurricular activities can have negative social, emotional, and educational consequences for children.

What is added by this report?

Utah implemented two high school COVID-19 testing programs to sustain in-person instruction and extracurricular activities. During November 30, 2020–March 20, 2021, among 59,552 students who received testing, 1,886 (3.2%) had a positive result. These programs facilitated the completion of approximately 95% of high school extracurricular competition events and saved an estimated 109,752 in-person instruction student-days.

What are the implications for public health practice?

School-based COVID-19 testing should be considered part of a comprehensive prevention strategy to identify SARS-CoV-2 infections in schools and sustain in-person instruction and extracurricular activities.

those from a screening program implemented in a New Jersey boarding school (*6*), suggesting that school-based COVID-19 screening can be a feasible component of a comprehensive, multicomponent prevention approach (*3*) that helps sustain in-person instruction and extracurricular activities.

By identifying 1,886 cases among students, Utah's testing programs likely helped reduce SARS-CoV-2 transmission in schools and communities through isolation of students with diagnosed infections and quarantine of contacts. Routine Test to Play testing also provided complementary community surveillance for SARS-CoV-2 infection among high school students, many of whom were likely not experiencing symptoms that would have prompted testing and diagnosis elsewhere. In addition, linking serial testing results to socially desirable activities, such as participation in extracurricular activities, might have incentivized masking and other preventive behaviors.

Although many cases of SARS-CoV-2 infection were diagnosed in the Test to Play and Test to Stay rapid antigen testing programs, strategies using more sensitive nucleic acid amplification tests would likely detect more cases (*6,8,9*). Rapid antigen testing, however, is less expensive, provides results in 15 minutes, and avoids burdening laboratories. Even though screening more than once every 2 weeks or at a lower outbreak threshold could also detect more cases, frequent rapid antigen testing in the context of low prevalence (<1.0%) would likely produce excess false-positive SARS-CoV-2 results at a high cost (*10*).¶¶ Utah's school-based testing programs were implemented using rapid antigen testing according to the parameters described in this report to balance resources and feasibility with test performance, and to enable timely isolation, investigation of cases, and quarantine of contacts.

Notably, even with the provision of free test kits, training, and testing assistance, fewer than one half of schools that crossed the outbreak threshold chose to sustain in-person instruction by implementing Test to Stay. To help overcome identified barriers to implementing Test to Stay, UDOH, with health and education partners, continues to provide community messaging materials and additional staffing to support testing events.

The findings in this study are subject to at least three limitations. First, test numbers are underestimated because all testing in these programs might not have been reported and results of testing performed separately from school-based testing (e.g., via community testing) were not classified as Test to Play or Test to Stay. Second, these testing programs did not include collection of data on the clinical status and isolation of students with diagnosed SARS-CoV-2 infection, number of close contacts identified and quarantined, or exposure settings. Finally, the impact of these testing programs or other interventions (e.g., masking) on COVID-19 transmission in schools was not assessed.

Because interruption of in-person instruction and extracurricular activities can negatively affect children, strategies that safely facilitate student participation in these activities are important. Additional research is needed to determine the optimal operational parameters for school-based COVID-19 screening, including testing frequency, outbreak threshold, and the role of screening in the context of vaccination. Utah's approach could serve as a framework for other jurisdictions considering school-based testing as part of a comprehensive prevention strategy to help identify SARS-CoV-2 infections while sustaining in-person instruction and extracurricular activities.

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¶¶¶¶ https://www.fda.gov/medical-devices/letters-health-care-providers/potential-false-positive-results-antigen-tests-rapid-detection-sars-cov-2-letter-clinical-laboratory

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COVID-19 Vaccine Breakthrough Infections Reported to CDC — United States, January 1–April 30, 2021

CDC COVID-19 Vaccine Breakthrough Case Investigations Team

On May 25, 2021, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

COVID-19 vaccines are a critical tool for controlling the ongoing global pandemic. The Food and Drug Administration (FDA) has issued Emergency Use Authorizations for three COVID-19 vaccines for use in the United States.* In large, randomized-controlled trials, each vaccine was found to be safe and efficacious in preventing symptomatic, laboratory-confirmed COVID-19 (*1*–*3*). Despite the high level of vaccine efficacy, a small percentage of fully vaccinated persons (i.e. received all recommended doses of an FDA-authorized COVID-19 vaccine) will develop symptomatic or asymptomatic infections with SARS-CoV-2, the virus that causes COVID-19 (*2*–*8*).

CDC is working with state and territorial health departments to investigate SARS-CoV-2 infections among persons who are fully vaccinated and to monitor trends in case characteristics and SARS-CoV-2 variants identified from persons with these infections. For this surveillance, a vaccine breakthrough infection is defined as the detection of SARS-CoV-2 RNA or antigen in a respiratory specimen collected from a person ≥14 days after receipt of all recommended doses of an FDA-authorized COVID-19 vaccine. State health departments voluntarily report vaccine breakthrough infections to CDC.† When possible, genomic sequencing is performed on respiratory specimens that test positive for SARS-CoV-2 RNA (*9*).

A total of 10,262 SARS-CoV-2 vaccine breakthrough infections had been reported from 46 U.S. states and territories as of April 30, 2021. Among these cases, 6,446 (63%) occurred in females, and the median patient age was 58 years (interquartile range = 40–74 years). Based on preliminary data, 2,725 (27%) vaccine breakthrough infections were asymptomatic, 995 (10%) patients were known to be hospitalized, and 160 (2%) patients died. Among the 995 hospitalized patients, 289 (29%) were asymptomatic or hospitalized for a reason unrelated to COVID-19. The median age of patients who died was 82 years (interquartile range = 71–89 years); 28 (18%) decedents were asymptomatic or died from a cause unrelated to COVID-19. Sequence data were available from 555 (5%) reported cases, 356 (64%) of which were identified as SARS-CoV-2 variants of concern,§ including B.1.1.7 (199; 56%), B.1.429 (88; 25%), B.1.427 (28; 8%), P.1 (28; 8%), and B.1.351 (13; 4%).

As of April 30, 2021, approximately 101 million persons in the United States had been fully vaccinated against COVID-19.¶ However, during the surveillance period, SARS-CoV-2 transmission continued at high levels in many parts of the country, with approximately 355,000 COVID-19 cases reported nationally during the week of April 24–30, 2021.** Even though FDA-authorized vaccines are highly effective, breakthrough cases are expected, especially before population immunity reaches sufficient levels to further decrease transmission. However, vaccine breakthrough infections occur in only a small fraction of all vaccinated persons and account for a small percentage of all COVID-19 cases (*5*–*8*). The number of COVID-19 cases, hospitalizations, and deaths that will be prevented among vaccinated persons will far exceed the number of vaccine breakthrough cases. To date, the age and sex distribution of reported vaccine breakthrough infections reflects the fully vaccinated U.S. population.†† The proportion of reported vaccine breakthrough infections attributed to variants of concern has also been similar to the proportion of these variants circulating throughout the United States. During March 28–April 10, 2021, the aforementioned variants of concern accounted for 70% of the weighted estimates of SARS-CoV-2 lineages submitted to CDC's national genomic surveillance.§§

The findings in this report are subject to at least two limitations. First, the number of reported COVID-19 vaccine breakthrough cases is likely a substantial undercount of all SARS-CoV-2 infections among fully vaccinated persons. The national surveillance system relies on passive and voluntary reporting, and data might not be complete or representative. Many persons with vaccine breakthrough infections, especially those who are asymptomatic or who experience mild illness, might not seek testing. Second, SARS-CoV-2 sequence data are available for only a small proportion of the reported cases.

Beginning May 1, 2021, CDC transitioned from monitoring all reported COVID-19 vaccine breakthrough infections to

* https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines

† https://www.cdc.gov/vaccines/covid-19/health-departments/breakthrough-cases.html

§ https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-surveillance/variant-info.html

¶ https://covid.cdc.gov/covid-data-tracker/#vaccinations

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

†† https://covid.cdc.gov/covid-data-tracker/#vaccination-demographic

§§ https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/variant-proportions.html investigating only those among patients who are hospitalized or die, thereby focusing on the cases of highest clinical and public health significance. CDC will continue to lead studies in multiple U.S. sites to evaluate vaccine effectiveness and collect information on all COVID-19 vaccine breakthrough infections regardless of clinical status. Additional information and resources to help public health departments and laboratories investigate and report COVID-19 vaccine breakthrough cases are available at https://www.cdc.gov/vaccines/covid-19/health-departments/breakthrough-cases.html.

FDA-authorized COVID-19 vaccines are safe and effective (*1–8*). CDC recommends that all persons aged ≥12 years be vaccinated with an FDA-authorized COVID-19 vaccine¶¶ (*10*).

¶¶ https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html

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Notes from the Field

Impact of the COVID-19 Response on Scale-Up of HIV Viral Load Testing — PEPFAR-Supported Countries, January–June 2020

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CDC and the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) are committed to maintaining an international response to the HIV epidemic even as countries face the challenge of controlling the COVID-19 pandemic (*1*). The Joint United Nations Programme on HIV/AIDS has set the following 95-95-95 targets for HIV infection control by 2030: 1) ensure that 95% of HIV-positive persons are aware of their HIV status, 2) ensure that 95% of these persons receive antiretroviral treatment (ART) and 3) facilitate viral load testing and suppression (viral load ≤1,000 HIV RNA copies per mL of blood) among 95% of persons with HIV infection (*2*). PEPFAR and international donors support 50 countries by investing in diagnostic testing, ART, and viral load testing to monitor treatment outcomes. Recent COVID-19–related stay-at-home orders and travel restrictions have affected essential HIV services worldwide. In the face of these challenges, CDC and PEPFAR are committed to sustaining the momentum necessary to achieve the target goal of facilitating testing and viral suppression among 95% of persons with HIV.

PEPFAR-supported countries,* some with financial resource and workforce limitations, have experienced stay-at-home orders, global flight restrictions, and border closings in response to the COVID-19 pandemic, interrupting supply chains and access to ART (*3*). Health facility mandates have restricted nonessential services, thereby decreasing the availability of ART services and the ability to monitor treatment outcomes with viral load testing (*1*). Early in the COVID-19 pandemic, skilled personnel supporting the HIV epidemic were shifted to the COVID-19 response. Manufacturers of viral load testing platforms developed molecular diagnostic capability for SARS-CoV-2, the virus that causes COVID-19, using the same equipment used for HIV viral load testing. Many laboratory staff members were shifted from molecular testing for HIV to testing for SARS-CoV-2 (*1*). In some countries, laboratory staff members and equipment continue to be shared between the HIV and COVID-19 responses.

Because the limited availability of skilled laboratory staff members and restricted ART access could decrease viral load testing, the effects of the pandemic on viral load testing were examined. The period reviewed was September 2019–June 2020. PEPFAR-supported countries provide quarterly reported data on indicators that monitor the number of patients receiving ART, including viral load testing coverage (the number of ART patients with a documented viral load result within the past 12 months) and HIV viral suppression rates (the proportion of adult and pediatric patients who have been on ART for at least 3 months who have achieved viral suppression). These data were reviewed for viral load testing coverage of ART patients and rates of viral suppression since the COVID-19 pandemic began in March 2020. Data from Uganda are presented as an example.

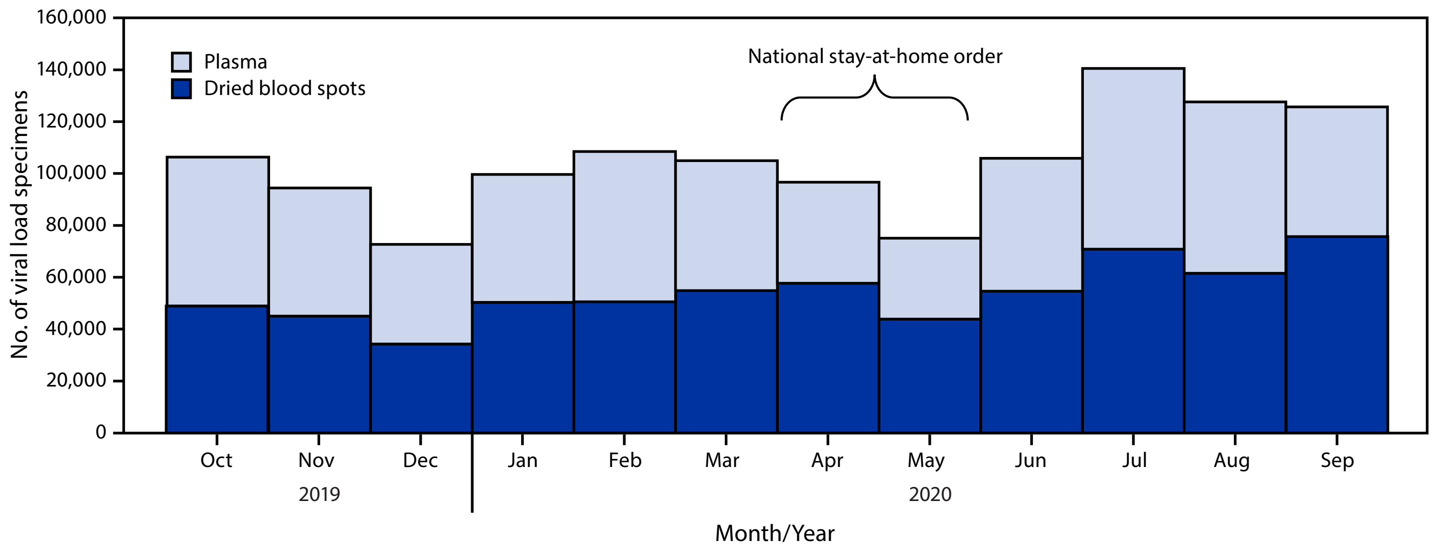
Viral load testing coverage for all PEPFAR-supported countries was stable at 78% during September–December 2019.† However, viral load testing coverage decreased to 71% during January–March 2020, likely the result of limited access to clinical and laboratory services during the pandemic. After routine services were reinstated (April–June 2020), viral load testing coverage increased to 75%. Among ART patients who received viral load testing, the percentage who were virally suppressed remained stable at 91% during October 2019–March 2020, and at 92% during April–June 2020. This stability in viral load suppression suggests that, although fewer patients on ART were tested (as indicated by decreased viral load testing coverage rates), those who did receive a viral load test had access to ART and were compliant with their ART regimen.

Ugandan government authorities declared a national stay-at-home order on April 1, 2020, in response to the COVID-19 pandemic (*4*). Viral load testing decreased during March–May 2020, with the largest decline occurring late in this period after the beginning of the COVID-19 pandemic (Figure) (*5*). As the government eased restrictions, services were adapted to restore viral load testing. Specific government measures to mitigate the impact of COVID-19 included providing guidance on continuing essential services, increasing the number of viral load specimen pick-ups at testing facilities, expanding collection of dried blood spot specimens (which can be stored and transported without refrigeration) relative to plasma specimens, mobilizing the network of persons with HIV infection to serve as community volunteers to assist others with HIV infection, directly delivering ART to communities, and integrating viral load testing with ART distribution (*4*). This swift response helped restore viral load testing coverage to levels higher than those before the pandemic.

* https://www.state.gov/where-we-work-pepfar/

† Data for PEPFAR countries were submitted by PEPFAR implementing partners to the U.S. Office of the Global AIDS Coordinator as part of routine program monitoring. The reporting range was July 1, 2019–June 30, 2020.

FIGURE. HIV viral load testing, by specimen type — Uganda,*,† October 2019–September 2020



* Data were obtained from the Uganda viral load dashboard (https://vldash.cphluganda.org).
† Stay-at-home order was declared by the government of Uganda on April 1, 2020, and included closure of borders, curfew, restriction of nonessential services, and restriction of public transportation.

During the COVID-19 pandemic, continuation of essential routine care of HIV patients and delivery of routine services will require innovative approaches to reduce the risk for COVID-19 among patients and health care workers. Implementing strategies to return viral load testing services to baseline,[§] such as clearing testing backlogs to increase the number of persons tested and sustaining services that provide adequate viral load testing to monitor ART patients for treatment success, can maintain HIV control. Access to viral load testing could be facilitated using point-of-care technology for special populations who need expedited testing, including pregnant and breastfeeding women, children with low viral suppression rates, and persons with presumptive ART failure, to prevent clinical deterioration. Despite the challenges of controlling the COVID-19 pandemic, PEPFAR-supported countries should continue advancing toward the 95-95-95 by 2030 goals with expansion of viral load testing for all persons with HIV infection who are receiving ART. Innovative approaches are needed to sustain the global progress made in recent years in response to the HIV epidemic.

[§] After viral load testing ceased in some countries and decreased in others, specimen backlogs increased during interruption of services. A resumption of testing and return to baseline is necessary before an increase can occur. The 95% is a target to be reached by 2030 as countries continue to scale up HIV viral load testing, which just started in most sub-Saharan countries 2013–2014.

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Erratum:

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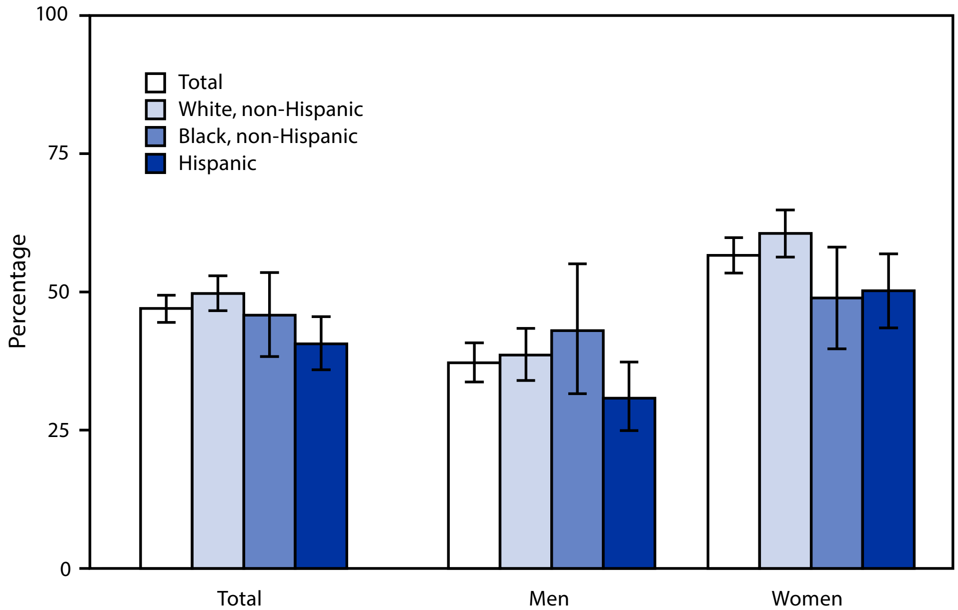
In the report "Association of State-Issued Mask Mandates and Allowing On-Premises Restaurant Dining with County-Level COVID-19 Case and Death Growth Rates — United States, March 1–December 31, 2020," on page 350, the third sentence in the first paragraph should have read, "Starting in April, **38** states and the District of Columbia (DC) issued mask mandates in 2020."

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged 18–26 Years Who Ever Received a Human Papillomavirus Vaccine,† by Race and Hispanic Origin§ and Sex — National Health Interview Survey, United States, 2019¶



Abbreviation: HPV = human papillomavirus.

* With 95% confidence intervals indicated by error bars.

† Based on a response to the question, "HPV is the Human Papillomavirus. Have you ever received an HPV shot or vaccine?"

§ Adults categorized as non-Hispanic White and non-Hispanic Black indicated one race only; respondents had the option to select more than one racial group. Hispanic respondents might be of any race or combination of races. Non-Hispanic adults of multiple or other races are not shown separately but are included in the total groups.

¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

Overall, in 2019, 47.0% of adults aged 18–26 years had ever received an HPV vaccination. Non-Hispanic White adults (49.7%) were more likely than Hispanic adults (40.6%) to have ever received an HPV vaccination; differences between non-Hispanic Black adults (45.8%) and the other two groups were not statistically significant. Overall, women were more likely than men to have been vaccinated (56.6% versus 37.2%), and this pattern was seen for non-Hispanic White women and men (60.6% versus 38.6%) and for Hispanic women and men (50.2% versus 30.8%). However, the difference between non-Hispanic Black women and men (48.9% versus 43.0%) was not statistically significant.

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

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