Anemia Among Pregnant Women Participating in the Special Supplemental Nutrition Program for Women, Infants, and Children — United States, 2008–2018

Florence A. Kanu, PhD[1]; Heather C. Hamner, PhD[2]; Kelley S. Scanlon, PhD[3]; Andrea J. Sharma, PhD[2]

Among pregnant women, anemia, a condition of low hemoglobin concentration, can increase risk for maternal and fetal morbidity and mortality, including premature delivery, and other adverse outcomes (*1*). Iron deficiency is a common cause of anemia, and during pregnancy, iron requirements increase (*2*). Surveillance of anemia during pregnancy in the United States is limited. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Participant and Program Characteristics (PC) data provide an opportunity to establish national and WIC state agency-level* anemia surveillance for WIC participants. National and state agency anemia prevalences among pregnant WIC participants at enrollment were examined using 2008–2018 WIC-PC data. Across all 90 WIC agencies (50 states, the District of Columbia [DC], five territories, and 34 Indian Tribal Organizations), anemia prevalence among pregnant WIC participants at enrollment increased significantly, from 10.1% in 2008 to 11.4% in 2018 (13% increase). Anemia prevalence increased significantly in 36 (64%) of the 56 agencies in states, DC, and territories, and decreased significantly in 11 (20%). Prevalence of anemia overall and by pregnancy trimester were higher among non-Hispanic Black or African American (Black) women than among other racial or ethnic groups. Anemia prevalence was higher among women assessed during the third trimester of pregnancy than among those assessed during first or second trimesters. Routine anemia surveillance using WIC enrollment anemia data can identify groups at higher risk for iron deficiency. Findings from this report indicate that anemia continues to be a problem among low-income women and reinforces the importance of efforts that ensure these women have access to healthier, iron-rich foods

before and during pregnancy. This includes ensuring that eligible women are enrolled in WIC early during pregnancy.

WIC-PC, conducted by the U.S. Department of Agriculture, is a biennial (even-year) census of all participants certified to receive WIC benefits (*3*). Federal regulations require that WIC applicants be assessed for anemia as part of their participation certification process (*4*). The following data were abstracted for pregnant women in the current study: participant hemoglobin measure, hemoglobin test date, expected delivery date, sociodemographic characteristics, and clinic zip code. Trimester at the time hemoglobin testing was performed was estimated based on the expected delivery date.† Data were excluded hierarchically

---

† Trimester at hemoglobin test was determined by calculating the gestational week of hemoglobin test (hemoglobin test date − [expected delivery date − 280 days] / 7 days). Hemoglobin test was categorized as before pregnancy if completed weeks ≤0, first trimester if completed weeks = 1–13 (1–90 days), second trimester if completed weeks = 14–27 (91–188 days), third trimester if completed weeks = 28–42 (189–293 days), and postpartum if completed weeks ≥43 weeks (≥294 days). If expected delivery date was missing, trimester at hemoglobin test was categorized as unknown.

Continuing Education examination available at https://www.cdc.gov/mmwr/mmwr_continuingEducation.html

---

* In 2018, there were 90 WIC agencies: the 50 states; the District of Columbia; five U.S. territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands); and 34 Indian Tribal Organizations.

from analysis in the following order: duplicate records, missing hemoglobin measure, missing hemoglobin test date, hemoglobin measure not performed during pregnancy, and implausible hemoglobin measure. Hemoglobin was corrected for elevation based on clinic zip code, but not corrected for current cigarette smoking, because smoking data were not available[§] (5). Anemia was defined as an elevation-corrected hemoglobin of <11.0 g/dL (first or third trimester) or <10.5 g/dL (second trimester) (5). The prevalence of anemia was calculated overall and by race and ethnicity, agency, and trimester.

Crude anemia prevalence for each year was calculated for all 90 WIC agencies combined, and for each individual agency. Estimates were flagged as "interpret with caution," where the anemia prevalence was determined to be an outlier based on data cleaning protocols; estimates were retained in the analysis if no other indicators of suspected poor data quality were observed.[¶] Joinpoint software (version 4.8.0.1;

National Cancer Institute) was used to identify the presence of a nonlinear trend in anemia prevalence among all jurisdictions combined; because no inflection was observed, only linear trends were examined. Using log binomial regression, overall and individual agency prevalence estimates were adjusted for age, race and ethnicity, and trimester of hemoglobin test to account for differences in population distributions across years.[**] To determine the significance of temporal trends in adjusted anemia prevalence, a linear contrast statement was used that included all years of available data. In addition, the magnitude of the difference in adjusted anemia prevalence during 2008–2018 was reported and considered statistically significant if the 95% CIs excluded zero.[††] Analyses were conducted using SAS software (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[§§]

_____
[§] Elevation data were available for 99.6% of records during 2008–2012 and 100% of records during 2014–2018. Less than 6% of pregnant women received WIC services at a clinic located ≥1,000 m (3,281 ft) above sea level.

[¶] Identification of outliers was determined using a Z-score method based on the absolute difference between a specific reporting year prevalence and the mean prevalence across the 6 reporting years within that agency compared with the average of the same calculation across all reporting years and agencies. A Z-score >3 should be automatically suppressed; none were identified. Z-scores >2 and ≤3 were flagged as "interpret with caution" provided the SD of hemoglobin concentrations and distribution of the last digit of hemoglobin were within expected limits defined as SD = 0.9–1.5 g/dL based on 1999–2018 NHANES data and last digit of 0 or 5 was <30%.

_____
[**] Race and ethnicity were dichotomized as American Indian or Alaska Native versus all other races and ethnicities among state agencies where >80% of women identified as American Indian or Alaska Native and dichotomized as non-Hispanic White versus all other races and ethnicities for state agencies where >80% of women identified as non-Hispanic White. No adjustments for race or ethnicity were made for agencies where >90% of women were in the same racial and ethnic group.

[††] Calculated as (prevalence at beginning of period) x (adjusted prevalence ratio) − (prevalence at beginning of period). The adjusted prevalence ratios that represent relative changes in anemia prevalence during 2008–2018 were calculated from log binomial regression models adjusted for age, race and ethnicity, and trimester at hemoglobin test.

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

The percentage of records excluded from analysis ranged from a high of 29.5% in 2008 to 9.7% in 2018 (Table 1). The mean age of pregnant WIC participants increased over time, from 24 years in 2008 to 26 years in 2018; the proportion who identified as Hispanic or Latino (Hispanic) and who participated in Medicaid increased, and the proportion who identified as non-Hispanic White (White) decreased. More than one half (59.2%) of women received hemoglobin testing during the first trimester of pregnancy, which was the most common period for WIC certification. The overall crude prevalence of anemia increased significantly from 10.1% in 2008 to 11.4% in 2018 (13% increase) (Figure). A similar trend was noted for White, Black, and Hispanic women, whereas anemia prevalence among American Indian or Alaska Native women declined significantly, from 11.9% in 2008 to 10.4% in 2018. The prevalence of anemia was higher among Black women than among other racial or ethnic groups overall and by trimester; prevalence was highest and more variable during the third trimester than during the first or second trimesters. In a sensitivity analysis excluding the four WIC agencies without data in 2008, the trends in anemia remained the same overall and by race and ethnicity.

Prevalence of anemia from 2008 to 2018 varied by WIC agency as did adjusted prevalence differences and trends; prevalence estimates for eight agencies should be interpreted with caution (Table 2). In approximately one half of WIC agencies, the prevalence of anemia among pregnant women in 2018 was significantly higher than it was in 2008, after accounting for differences in maternal age, race and ethnicity, and trimester at time of hemoglobin test (range = 0.6 to 18.6 percentage points; median = 2.7). Among the 56 state, DC, and territorial agencies, a significant linear increase in anemia prevalence was observed in 36 (64%) agencies and a significant decrease in 11 (20%) agencies across available reporting years.

TABLE 1. Proportion of records excluded, and distribution of sociodemographic characteristics among pregnant women enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children included in analyses, by year — United States, 2008–2018

Characteristic	No. (%)					
	2008	**2010**	**2012**	**2014**	**2016**	**2018**
Total WIC-PC records	1,015,556 (100)	1,012,960 (100)	980,523 (100)	898,341 (100)	800,603 (100)	674,521 (100)
Records excluded from analysis*	299,884 (29.5)	281,404 (27.8)	155,227 (15.8)	120,797 (13.4)	83,502 (10.4)	65,424 (9.7)
Duplicates within same year[†]	1,102 (0.4)	5 (0.002)	7 (0.005)	174 (0.1)	0 (—)	33 (0.05)
Missing Hb measure	183,960 (61.3)	151,773 (53.9)	142,526 (91.8)	107,106 (88.7)	75,984 (91.0)	55,698 (85.1)
Missing Hb test date	25,711 (8.6)	14,977 (5.3)	4,187 (2.7)	2,306 (1.9)	1,772 (2.1)	0 (—)
Hb test not completed during pregnancy[§]	88,806 (29.6)	114,343 (40.6)	8,134 (5.2)	5,038 (4.2)	5,062 (6.1)	8,870 (13.6)
Hb outlier (<5 or >17 g/dL)[¶]	305 (0.1)	306 (0.1)	373 (0.2)	6,173 (5.1)**	684 (0.8)	823 (1.3)
Records included in analysis	715,672 (70.5)	731,556 (72.2)	825,296 (84.2)	777,544 (86.6)	717,101 (89.6)	609,097 (90.3)
Participant characteristics among records included						
Age, yrs, median (range)	24 (10–51)	24 (10–51)	24 (10–51)	25 (10–51)	26 (11–50)	26 (10–51)
Race and ethnicity						
White, non-Hispanic	292,521 (40.8)	302,569 (41.4)	318,707 (38.6)	288,753 (37.1)	252,746 (35.3)	210,318 (34.5)
Black, non-Hispanic	147,361 (20.6)	151,990 (20.8)	166,257 (20.1)	158,883 (20.4)	149,422 (20.8)	133,174 (21.8)
Hispanic or Latino	236,295 (33.0)	231,362 (31.6)	288,503 (35.0)	284,524 (36.6)	270,798 (37.8)	229,030 (37.6)
American Indian or Alaska Native	13,055 (1.8)	12,585 (1.9)	14,726 (1.8)	13,370 (1.7)	12,379 (1.7)	10,749 (1.8)
Asian or Pacific Islander	23,156 (3.2)	26,334 (3.6)	31,579 (3.8)	31,477 (4.1)	31,278 (4.4)	26,127 (4.3)
Missing	4,386 (0.6)	5,721 (0.8)	5,531 (0.7)	711 (0.1)	478 (0.1)	377 (0.1)
Medicaid participation	423,915 (59.1)	461,213 (63.1)	505,116 (61.2)	470,949 (60.6)	477,533 (66.6)	435,695 (71.5)
% of federal poverty level						
0–100	432,370 (60.3)	453,644 (62.0)	539,622 (65.4)	514,295 (66.1)	458,517 (63.9)	386,573 (63.4)
>100–185	204,370 (28.5)	195,870 (26.8)	209,103 (25.3)	193,580 (24.9)	187,547 (26.2)	168,120 (27.6)
≥185	13,122 (1.8)	25,180 (3.4)	13,882 (1.7)	14,927 (1.9)	18,755 (2.6)	19,810 (3.3)
Missing	66,912 (9.3)	56,867 (7.8)	62,696 (7.6)	54,916 (7.1)	52,282 (7.3)	35,272 (5.8)
Trimester at Hb test[§]						
First	386,708 (54.0)	414,299 (56.6)	485,264 (58.8)	427,487 (55.0)	392,265 (54.7)	321,829 (52.8)
Second	26,2313 (36.6)	253,341 (34.6)	279,567 (33.9)	277,827 (35.7)	260,231 (36.3)	224,555 (36.8)
Third	67,753 (9.5)	63,921 (8.7)	60,472 (7.3)	72,404 (9.3)	64,605 (9.0)	63,391 (10.4)

Abbreviations: Hb = hemoglobin; WIC-PC = Special Supplemental Nutrition Program for Women, Infants, and Children Participant and Program Characteristics.
* Exclusions were mutually exclusive and excluded in order shown. Together, California and Texas accounted for the largest proportion of excluded records. Across survey cycles (years), exclusions for California and Texas combined were 57.0%, 62.3%, 59.0%, 52.4%, 55.0%, and 42.3%, respectively.
[†] Records with matching state, local agency, identification number, certification date, and maternal birth date.
[§] Week of Hb test during pregnancy = (Hb test date – [expected delivery date – 280 days] / 7 days). Week of Hb test was categorized as before pregnancy for those ≤0 days, first trimester 1–13 completed weeks (0–90 days), second trimester 14–27 completed weeks (91–188 days), third trimester 28–42 completed weeks (189–293 days), and postpartum ≥43 weeks (≥294 days). If expected delivery date was missing, trimester at Hb test was unknown.
[¶] Defined as values below the 0.01 and above the 99.9 percentiles for each data year.
** In 2014, 5,440 (89%) of records with biologically implausible values were from Kentucky and 99.2% (5,396 of 5,440) of those Hb measures were <1, suggesting a data entry or abstraction error.

FIGURE. Trends in anemia* prevalence among pregnant women enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children, by year (A) and trimester[†] and year of hemoglobin test (B), and by race and ethnicity[§] — United States,[¶] 2008–2018
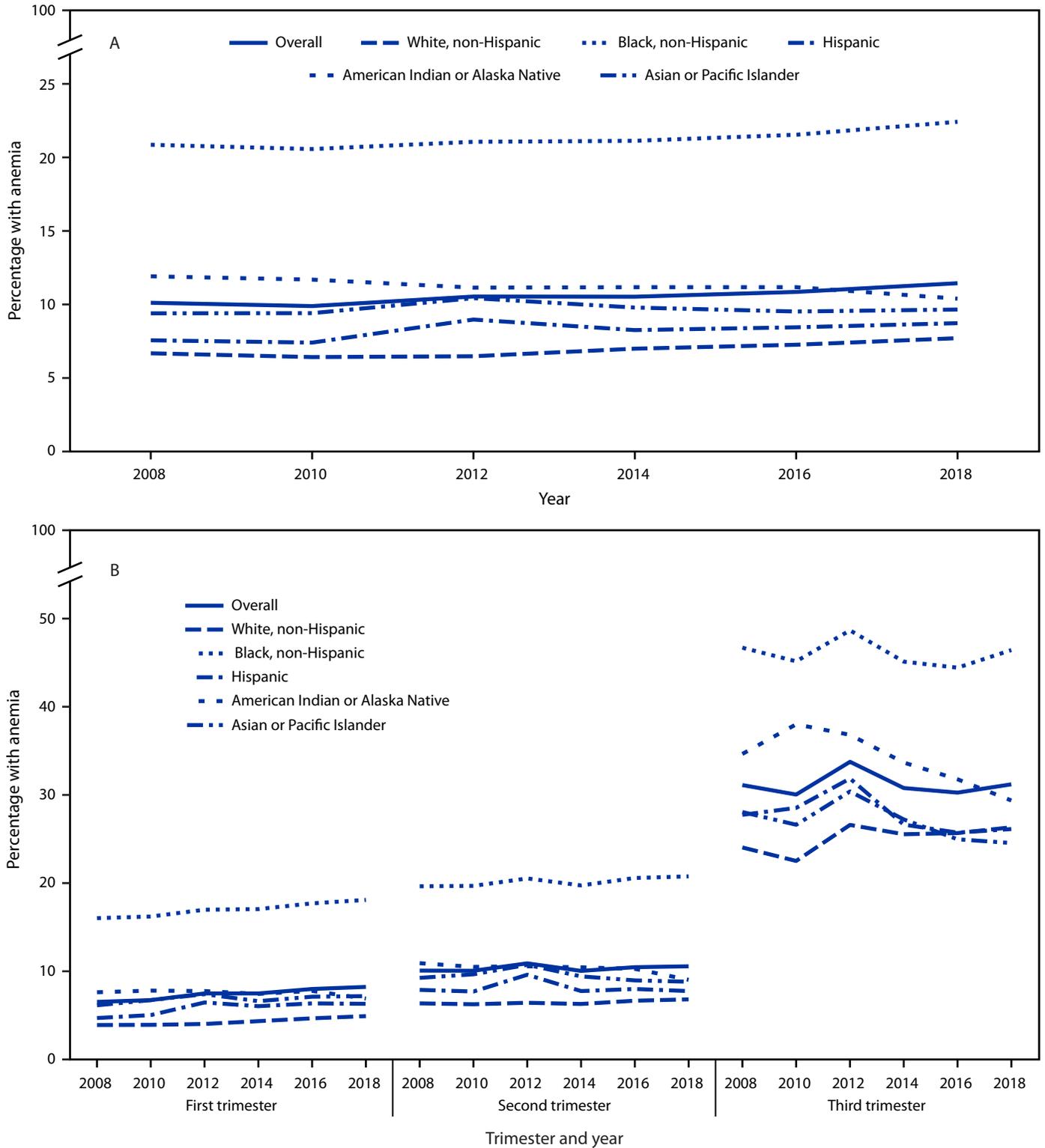
Abbreviation: WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
* Anemia is defined as an elevation-corrected hemoglobin of <11.0 g/dL (first or third trimester) or <10.5 g/dL (second trimester).
[†] Trimester at hemoglobin test is determined by calculating the gestational week of hemoglobin test (hemoglobin test date – [expected delivery date – 280 days] / 7 days). Hemoglobin test is categorized as first trimester if completed weeks = 1–13 (1–90 days), second trimester if completed weeks = 14–27 (91–188 days), and third trimester if completed weeks = 28–42 (189–293 days).
[§] Women whose race or ethnicity were unknown are not presented.
[¶] Includes data from all WIC state agencies in 50 states, the District of Columbia, five U.S. territories, and 34 Indian Tribal Organizations.

TABLE 2. Prevalence of anemia among pregnant women at time of enrollment in the Special Supplemental Nutrition Program for Women, Infants, and Children, by agency and year — United States and five U.S. territories, 2008–2018

WIC state agency*,†	No. of pregnant WIC participants						Crude anemia prevalence (%)						% Adjusted prevalence difference, 2008 versus 2018§ (95% CI)
	2008	2010	2012	2014	2016	2018	2008	2010	2012	2014	2016	2018	
Overall†,¶	716,774	731,561	825,303	777,718	717,101	609,775	10.1	9.8	10.5	10.5	10.8	11.4	1.0 (0.9 to 1.2)
Alabama†	15,209	16,524	15,713	15,880	15,841	14,196	16.5	13.0	13.6	14.9	16.8	18.8	3.9 (3.0 to 4.9)
Alaska	2,800	2,809	2,608	1,687	1,640	1,229	14.5	13.0	13.9	15.8	18.4	11.5	−3.4 (−5.2 to −1.2)
Arizona*	19,038	18,726	18,056	17,000	13,003	12,195	9.6	9.0	8.7	5.3	3.5	4.1	−5.6 (−5.9 to −5.2)
Arkansas†	12,435	11,974	11,736	10,394	9,117	8,213	9.7	7.8	8.7	10.2	12.1	14.4	3.5 (2.6 to 4.5)
California*	98,084	95,419	85,516	99,108	92,252	83,622	4.6	5.2	5.5	4.7	4.3	3.7	−1.3 (−1.5 to −1.2)
Colorado†	NA	NA	10,250	8,994	8,574	7,912	NA	NA	9.4	11.2	11.5	11.4	NA
Connecticut†	5,724	5,456	6,124	5,286	4,565	3,981	7.9	8.9	9.6	10.1	11.7	27.7**	18.6 (16.0 to 21.3)
Delaware†	1,750	2,233	2,073	1,864	1,814	1,577	15.0	12.7	13.6	16.2	19.1	17.1	1.2 (−1.0 to 3.9)
DC†	1,721	1,418	1,701	1,462	1,519	1,126	23.9	24.3	21.0	22.0	24.8	25.0	2.8 (−0.5 to 6.4)
Florida†	52,116	58,728	57,820	52,206	51,867	45,610	13.2	12.4	13.0	14.3	15.7	17.4	3.5 (3.0 to 4.0)
Georgia	37,012	35,514	37,567	33,312	28,507	24,273	12.1	12.7	13.4	12.4	13.2	13.8	0.6 (0.1 to 1.1)
Hawaii†	3,283	3,508	2,719	2,943	2,753	1,820	7.1	6.5	8.2	5.4	7.5	8.8	1.8 (0.3 to 3.7)
Idaho	4,783	5,026	4,500	4,198	3,685	3,010	6.9	5.9	4.6	4.4	7.4	5.3	−1.6 (−2.5 to −0.6)
Illinois*	15,386	28,342	26,440	25,319	20,591	17,373	15.2	9.0	9.4	9.4	10.5	10.0	−3.3 (−4.0 to −2.6)
Indiana*	17,426	18,311	17,964	15,913	13,465	12,352	11.4	10.9	10.5	12.4	6.6	4.9	−6.8 (−7.2 to −6.3)
Iowa*	7,454	7,197	7,086	6,394	5,514	4,919	8.1	7.0	8.1	5.6	6.0	5.7	−3.4 (−4.0 to −2.7)
Kansas	7,714	8,341	8,208	7,069	5,943	5,170	6.9	7.4	6.3	8.2	7.3	7.7	0.6 (−0.3 to 1.6)
Kentucky*	16,526	15,417	13,424	12,683	12,512	10,944	8.3	8.5	6.7	2.6	3.5	3.6	−5.1 (−5.4 to −4.7)
Louisiana†	16,275	16,543	13,143	14,157	13,902	11,897	16.3	13.0	13.1	15.3	16.1	17.9	1.0 (0.1 to 1.9)
Maine*	1,950	1,980	1,945	1,996	1,879	1,634	7.3	6.1	7.1	2.6	1.8	1.8	−5.7 (−6.2 to −5.0)
Maryland†	13,672	14,591	14,199	13,246	12,767	11,384	18.0	15.6	16.1	16.1	18.0	18.7	1.3 (0.3 to 2.3)
Massachusetts†	8,090	8,085	7,242	6,522	6,126	4,901	8.1	7.6	8.3	11.3	13.9	12.0	2.2 (1.2 to 3.4)
Michigan†	24,717	26,002	25,623	23,584	20,294	17,003	10.9	11.1	11.2	12.7	14.7	17.6	5.3 (4.6 to 6.1)
Minnesota†	15,317	14,504	12,908	12,098	11,057	9,168	7.6	7.3	7.2	8.6	9.2	11.4	2.2 (1.5 to 3.0)
Mississippi†	12,729	10,881	10,798	8,861	8,967	8,329	13.0	13.7	13.2	16.7	17.5	22.9**	10.1 (8.8 to 11.5)
Missouri†	17,397	16,274	16,360	14,815	14,381	11,426	10.4	10.0	9.7	10.7	11.8	12.2	1.5 (0.7 to 2.2)
Montana	2,494	2,170	2,035	1,902	1,719	1,480	11.5	9.2	8.6	9.1	8.7	8.9	−1.3 (−3.2 to 0.9)
Nebraska†	4,278	2,799	3,795	2,648	3,349	2,999	10.0	9.2	8.0	9.4	11.7	12.2	1.8 (0.4 to 3.5)
Nevada†	5,360	6,657	5,590	5,513	5,890	4,697	10.8	10.8	10.5	10.0	14.2	10.9	0.2 (−1.0 to 1.5)
New Hampshire	2,070	1,996	1,843	1,563	1,325	1,079	7.6	7.4	8.4	7.7	12.4	9.5	0.5 (−1.2 to 2.7)
New Jersey†	13,041	13,867	14,818	13,819	13,387	11,532	13.8	14.3	15.4	16.1	17.1	18.5	5.4 (4.3 to 6.5)
New Mexico†	7,308	6,994	7,682	7,042	5,767	4,431	8.8**	8.1**	17.2	19.4	22.3	24.1**	15.9 (13.8 to 18.3)
New York†	48,303	50,110	49,928	44,169	39,995	33,323	9.2	10.0	9.8	12.5	11.4	10.7	1.9 (1.5 to 2.4)
North Carolina†	22,525	22,794	23,590	22,936	24,154	21,445	10.7	11.0	11.2	11.7	14.9	15.4	4.7 (4.0 to 5.4)
North Dakota†	1,537	1,476	1,296	1,166	1,080	974	6.1	6.8	7.5	12.4	12.7	10.6	1.9 (0.0 to 4.3)
Ohio*	27,772	27,218	27,708	24,419	22,121	18,985	10.3	8.9	9.6	9.5	4.3	4.2	−6.4 (−6.7 to −6.1)
Oklahoma†	11,789	12,799	12,628	10,326	11,241	8,996	7.9	14.1	5.9	7.4	7.5	8.0	0.7 (−0.1 to 1.5)
Oregon†	11,358	11,441	9,439	10,448	8,677	6,815	8.2	6.6	6.6	8.4	8.4	10.4	2.6 (1.7 to 3.7)
Pennsylvania†	22,283	22,958	22,843	21,011	19,703	17,175	13.2	13.4	13.2	14.8	15.5	18.1	4.1 (3.4 to 4.9)
Rhode Island	2,171	2,463	1,860	1,605	1,191	1,048	11.1	11.2	9.5	11.6	9.3	14.7	2.8 (0.4 to 5.6)
South Carolina†	14,862	15,434	15,106	13,378	11,512	9,454	13.7	12.7	12.4	15.2	17.6	19.5	5.3 (4.2 to 6.3)
South Dakota†	2,119	2,061	2,138	1,740	1,590	984	4.3	5.6	6.1	7.8	9.1	18.8**	10.4 (7.2 to 14.4)
Tennessee†	18,988	15,550	20,694	18,600	17,502	15,800	7.3	8.1	7.7	7.1	8.0	8.7	1.8 (1.1 to 2.4)
Texas†	NA	NA	84,075	78,291	72,157	57,316	NA	NA	14.8	11.6	10.6	11.9	NA
Utah†	5,401	3,527	7,174	6,276	5,430	4,227	7.8	6.9	7.2	7.6	8.8	10.3	2.7 (1.5 to 4.1)
Vermont*	1,322	1,399	1,212	1,134	864	884	3.9	5.6	6.0	4.4	1.6	1.6	−2.4 (−3.1 to −1.2)
Virginia†	14,814	17,315	19,180	18,413	14,224	11,817	11.3	12.0	11.5	13.3	15.2	13.3	1.7 (0.9 to 2.5)
Washington*	533	NA	13,752	15,327	17,683	14,369	26.5**	NA	9.1	7.8	7.5	5.2	−19.9 (−20.9 to −18.8)
West Virginia†	6,735	6,628	5,628	4,886	4,417	3,677	6.1	5.5	4.7	7.5	9.3	10.8	4.6 (3.3 to 6.1)
Wisconsin†	12,984	12,851	12,002	10,680	9,200	7,719	10.2	9.2	8.7	9.1	11.2	11.4	0.5 (−0.3 to 1.4)
Wyoming†	1,024	1,436	1,184	1,065	988	749	13.4	7.8	8.3	13.1	16.1	13.0	0.4 (−2.6 to 4.2)

See table footnotes on the next page.

TABLE 2. (*Continued*) Prevalence of anemia among pregnant women at time of enrollment in the Special Supplemental Nutrition Program for Women, Infants, and Children, by agency and year — United States and five U.S. territories, 2008–2018

WIC state agency*,†	No. of pregnant WIC participants						Crude anemia prevalence (%)						% Adjusted prevalence difference, 2008 versus 2018§ (95% CI)
	2008	2010	2012	2014	2016	2018	2008	2010	2012	2014	2016	2018	
Territory													
American Samoa*	431	506	467	426	441	390	10.9	10.1	6.4	6.8	10.2	4.6	−6.1 (−8.1 to −2.7)
Guam†	NA	201	598	616	459	527	NA	12.9**	13.4**	3.6	2.6	1.3	NA
Northern Mariana Islands††	NA	493	421	333	281	278	NA	14.0	12.6	16.2	12.5	10.1**	NA
Puerto Rico†	20,752	18,587	18,669	15,210	12,812	6,592	6.4	5.9	8.7	7.3	7.3	9.6	3.6 (2.7 to 4.5)
U.S. Virgin Islands†	326	327	336	265	263	210	11.0**	16.5	19.9	17.4	19.4	17.6	9.2 (2.2 to 19.8)

Abbreviations: DC = District of Columbia; Hb = hemoglobin; NA = not available; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
* Statistically significant decrease across all available reporting years based on linear contrast test (p<0.05) using log binomial regression model adjusted for age, race and ethnicity, and trimester at Hb test.
† Statistically significant increase across all available reporting years based on linear contrast test (p<0.05) using log binomial regression model adjusted for age, race and ethnicity, and trimester at Hb test.
§ Calculated as (prevalence at beginning of period) x (adjusted prevalence ratio) – (prevalence at beginning of period). The adjusted prevalence ratios that represent relative changes in anemia prevalence during 2008–2018 were calculated from log binomial regression models adjusted for age, race and ethnicity, and trimester at Hb test.
¶ Overall includes data from all 90 WIC state agencies in 50 states, DC, five U.S. territories, and 34 Indian Tribal Organizations. Prevalence among individual Indian Tribal Organizations were not shown because most reported <100 records.
** Estimates should be interpreted with caution because the estimate was determined to be an outlier based on data cleaning protocols. Estimates were retained in analyses because no indicators of suspected data quality concerns were observed.
†† Sample size in Northern Mariana Islands was <50 in 2008.

Discussion

During 2008–2018, approximately one in 10 pregnant WIC participants had anemia at WIC enrollment, with considerable variation by state and race and ethnicity. The national prevalence of anemia estimated by 2007–2018 National Health and Nutrition Examination Surveys (NHANES) data among pregnant women receiving WIC benefits was higher (18.6% [95% CI = 11.0–28.6]) (A Sharma, CDC, unpublished data, 2021).¶ This difference might result from the timing of anemia assessment because approximately one half of WIC participants were assessed during their first trimester, whereas the distribution of NHANES testing was usually equal across trimesters.*** The upward trends in anemia prevalence in the U.S. population and the disparity by race and ethnicity have been reported using 2003–2012 NHANES data (*6*). Because of limited sample size (approximately 30 pregnant WIC participants per year), NHANES has limited ability to monitor trends among pregnant women over time or prevalence by characteristics, including race and ethnicity, trimester, and poverty level. In contrast, WIC-PC allows for both national- and state-level monitoring of women living at low-income levels where prevalences of insufficient iron

consumption and iron deficiency might be higher (*7,8*). The ability to stratify prevalence estimates by the characteristics of pregnant women can guide policy and program decisions to better target interventions.

Factors associated with WIC enrollment might influence temporal trends. For example, WIC participation among pregnant women declined 34% from 1,017,967 in 2008 to 675,227 in 2018††† (*3*). Annually, agencies set their WIC eligibility criteria, which is based on income thresholds that fall at or below 185% of the federal poverty guidelines or participation in other income-dependent assistance programs, such as Medicaid. Improving economic conditions after the economic recession in 2008 (*9*) might have resulted in a decrease in the number of women whose income was below the cutoff to be eligible to enroll in WIC. On the basis of the World Health Organization criteria for defining anemia,§§§ anemia among all pregnant WIC participants throughout the study period was classified as a mild public health problem (prevalences ranging from 5.0% to 19.9%); anemia among Black pregnant women overall and women whose hemoglobin was assessed during the third trimester was classified as a moderate public health problem (20.0%–39.9%). Given the health risks associated with anemia for both women and children, there is a need for enhanced evidence-based public health interventions to

¶ NHANES questionnaires, data sets, and related documentation are available at https://wwwn.cdc.gov/nchs/nhanes/default.aspx. Prevalence estimate calculated from combined 2007–2018 NHANES surveys for pregnant women aged 15–49 years who responded "yes" to currently receiving benefits from the WIC program.
*** The trimester variable was included in NHANES during 2007–2012 only.

††† https://www.fns.usda.gov/wic/participant-and-program-characteristics-2018-charts#1
§§§ https://apps.who.int/iris/bitstream/handle/10665/85839/WHO_NMH_NHD_MNM_11.1_eng.pdf

Summary

What is already known about this topic?

Anemia during pregnancy increases risk for maternal and infant morbidity and mortality.

What is added by this report?

Anemia prevalence among pregnant women enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) increased 13% from 2008 (10.1%) to 2018 (11.4%); prevalence increased significantly in approximately one half of WIC agencies. In 2018, anemia was a moderate public health problem among non-Hispanic Black or African American pregnant women overall and those assessed during the third pregnancy trimester.

What are the implications for public health practice?

Findings support efforts to ensure low-income women have access to healthier, iron-rich foods before and during pregnancy and improve WIC enrollment early during pregnancy for eligible women.

address anemia and associated health inequities among pregnant women with low income.

The findings in this report are subject to at least four limitations. First, findings might not be generalizable to all low-income pregnant women.¶¶¶ Second, hemoglobin was not adjusted for cigarette smoking, which varies during pregnancy by state and demographic characteristics (*10*); this limitation might result in an underestimate of anemia prevalence among agencies with higher percentages of persons who smoke (*5*). Third, nearly one third of records from 2008 and 2010 were excluded from the analysis; however, the race and ethnicity distribution of excluded records was consistently approximately 50% Hispanic, 25% White, and 15% Black across all reporting years. Reasons for missing hemoglobin data and implications of missing data on prevalence estimates are unknown; however, the percentage of missing data was <15% during each of the last four WIC-PC survey cycles. Finally, prevalence estimates were identified as "interpret with caution" based on data quality concerns but might be the result of factors associated with eligibility or enrollment.

WIC-PC allows for routine anemia surveillance to identify groups of women at higher risk for iron deficiency and provides evidence that anemia among pregnant women with low income is an ongoing public health problem. WIC provides nutritious foods, including those that are iron-rich, to supplement the dietary needs of pregnant women, as well as nutrition

---

¶¶¶ https://www.fns.usda.gov/wic-2017-eligibility-and-coverage-rates

education and referrals to health care and social services. Anemia assessment at WIC certification is an efficient means to identify women with this nutritional risk who might need more support.

Corresponding author: Florence A. Kanu, fkanu@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, CDC; [3]Special Nutrition Research and Analysis Division, Food and Nutrition Service, U.S. Department of Agriculture, Alexandria, Virginia.

References

1. Young MF, Oaks BM, Tandon S, Martorell R, Dewey KG, Wendt AS. Maternal hemoglobin concentrations across pregnancy and maternal and child health: a systematic review and meta-analysis. Ann N Y Acad Sci 2019;1450:47–68. PMID:30994929 https://doi.org/10.1111/nyas.14093
2. Breymann C. Iron deficiency anemia in pregnancy. Semin Hematol 2015;52:339–47. PMID:26404445 https://doi.org/10.1053/j.seminhematol.2015.07.003
3. Kline N, Thorn B, Bellows D, Wroblewska K, Wilcox-Cook E. WIC participant and program characteristics 2018. Alexandria, VA: US Department of Agriculture, Food and Nutrition Service; 2020.
4. Food and Nutrition Service, US Department of Agriculture. Special Supplemental Nutrition Program for Women, Infants, and Children (WIC): bloodwork requirements. Final rule. Fed Regist 1999;64:70173–8. PMID:11010684
5. CDC. Recommendations to prevent and control iron deficiency in the United States. MMWR Recomm Rep 1998;47(No. RR-3):1–29. PMID:9563847
6. Le CH. The prevalence of anemia and moderate-severe anemia in the US population (NHANES 2003–2012). PLoS One 2016;11:e0166635. PMID:27846276 https://doi.org/10.1371/journal.pone.0166635
7. Rojhani A, Ouyang P, Gullon-Rivera A, Dale TM. Dietary quality of pregnant women participating in the Special Supplemental Nutrition Program for Women, Infants, and Children. Int J Environ Res Public Health 2021;18:8370. PMID:34444120 https://doi.org/10.3390/ijerph18168370
8. Swensen AR, Harnack LJ, Ross JA. Nutritional assessment of pregnant women enrolled in the Special Supplemental Program for Women, Infants, and Children (WIC). J Am Diet Assoc 2001;101:903–8. PMID:11501864 https://doi.org/10.1016/S0002-8223(01)00221-8
9. National Academies of Sciences, Engineering, and Medicine. The WIC program: changes since the last review and continuing challenges [Chapter 2]. In: review of WIC food packages: improving balance and choice: final report. Washington, DC: National Academies Press; 2017.
10. Drake P, Driscoll AK, Mathews TJ. Cigarette smoking during pregnancy: United States, 2016. NCHS Data Brief 2018;(305):1–8. PMID:29528282

HIV Testing Before and During the COVID-19 Pandemic — United States, 2019–2020

Elizabeth A. DiNenno, PhD[1]; Kevin P. Delaney, PhD[1]; Marc A. Pitasi, MPH[1]; Robin MacGowan, MPH[1]; Gillian Miles, MPH[1]; Andre Dailey, MSPH[1]; Cari Courtenay-Quirk, PhD[1]; Kathy Byrd, MD[1]; Dominique Thomas, MPA[1]; John T. Brooks, MD[1]; Demetre Daskalakis, MD[1]; Nicoline Collins, MPH[1]

HIV testing is a core strategy for the Ending the HIV Epidemic in the U.S. (EHE) initiative, which has the aim of reducing new HIV infections by at least 90% by 2030.* During 2016–2017, jurisdictions with the highest HIV diagnosis rates were those with higher prevalences of HIV testing; past-year HIV testing was higher among persons who reported recent HIV risk behaviors compared with those who did not report these risks (*1*). During 2020–2021, the COVID-19 pandemic disrupted health care delivery, including HIV testing in part because many persons avoided services to comply with COVID-19 risk mitigation efforts (*2*). In addition, public health departments redirected some sexual health services to COVID-19–related activities.† CDC analyzed data from four national data collection systems to assess the numbers of HIV tests performed and HIV infections diagnosed in the United States in the years before (2019) and during (2020) the COVID-19 pandemic. In 2020, HIV diagnoses reported to CDC decreased by 17% compared with those reported in 2019. This decrease was preceded by decreases in HIV testing during the same period, particularly among priority populations including Black or African American (Black) gay men, Hispanic or Latino (Hispanic) gay men, bisexual men, other men who have sex with men (MSM), and transgender persons in CDC-funded jurisdictions. To compensate for testing and diagnoses missed during the COVID-19 pandemic and to accelerate the EHE initiative, CDC encourages partnerships among federal organizations, state and local health departments, community-based organizations, and health care systems to increase access to HIV testing services, including strategies such as self-testing and routine opt-out screening in health care settings.

CDC recommends that all adolescents and adults aged 13–64 years be tested for HIV at least once, with annual rescreening of persons who report behaviors that increase the chances of acquiring or transmitting HIV§ (*3*). Testing is the gateway to preexposure prophylaxis (PrEP) among uninfected persons for whom prophylaxis is indicated and to rapid treatment of persons with HIV infection¶ (*4*). The EHE initiative's emphasis on the role of routine testing contributes to its goals of reducing HIV infections and decreasing HIV disparities among populations most affected by the disease. For example, to prevent new HIV infections, the EHE initiative provides additional resources to jurisdictions with populations most disproportionately affected by HIV, including Black and Hispanic MSM. These populations account for the majority of new HIV infections in the United States (*5*).

The COVID-19 pandemic began during 2020, when jurisdictions funded to conduct activities as part of the EHE effort in the United States were beginning to expand testing and other HIV prevention activities. Access to and use of sexually transmitted disease (STD) and HIV diagnostic and preventive services were interrupted as the COVID-19 pandemic changed health-seeking behaviors (*6*). In addition, public health departments redirected some sexual health services to COVID-19–related activities.

This analysis summarizes the reported number of HIV tests conducted and the number of those test results that were positive during 2019–2020. Data on HIV tests conducted were derived from three overlapping data sources: the Health Resources and Services Administration's Uniform Data System (HRSA UDS),** CDC's National HIV Prevention Program Monitoring and Evaluation system (CDC NHM&E),†† and the National Syndromic Surveillance Program's (NSSP) commercial laboratory data.§§ Data on the number of positive tests

---

* https://www.hiv.gov/federal-response/ending-the-hiv-epidemic/overview
† https://www.ncsddc.org/wp-content/uploads/2021/01/COVID19-State-of-STD-Field-Phase-III-Report-1.28.21-FINAL-1.pdf
§ https://www.cdc.gov/hiv/basics/hiv-testing/getting-tested.html
¶ https://www.cdc.gov/hiv/pdf/risk/prep/cdc-hiv-prep-guidelines-2021.pdf

** The number of HIV tests performed, and the number of new diagnoses were extracted from the HRSA UDS reporting tables. https://data.hrsa.gov/tools/data-reporting/program-data (Accessed March 15, 2022).
†† CDC analyzes and disseminates data on CDC-funded HIV tests received from the NHM&E data reporting system (EvaluationWeb), reported by 60 CDC-funded health departments and 100 CDC-funded community-based organizations. The number of HIV tests and new diagnoses reported during 2019–2020 from health care and non–health care settings were summarized from the 2019 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-HIV-testing-report-2019.pdf) and 2020 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-hiv-testing-report-2020.pdf) NHM&E Annual HIV Testing reports.
§§ NSSP is a collaboration among CDC; local and state health departments; and federal, academic, and private sector partners (https://www.cdc.gov/nssp/index.html). Data were extracted from two laboratory data sources for all test orders with either an order or result containing "56888-1" within the reported Logical Observation Identifiers Names and Codes, indicative of an HIV-1 or HIV-2 antigen or antibody test recommended for HIV screening; other tests ordered were not selected for this analysis. Tests with a reactive result for this screening test should be confirmed using FDA-approved supplemental tests. In this analysis all reactive results are reported regardless of the final HIV diagnostic algorithm interpretation. https://www.aphl.org/aboutAPHL/publications/Documents/ID-2019Jan-HIV-Lab-Test-Suggested-Reporting-Language.pdf

came from HIV diagnoses reported through the National HIV Surveillance System (NHSS).[¶¶] For each data source, differences between 2019 and 2020 were calculated for both the absolute number and corresponding percentages of HIV tests conducted. Differences in HIV testing by race and ethnicity and by population group were estimated from CDC NHM&E data,[***] the only source of HIV testing data for which these additional variables were available. In addition, the total number of HIV antigen or antibody screening tests were summarized by the surveillance week[†††] during which they were

[¶¶] https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html
[***] Restricted to non–health care settings because CDC NHM&E data on population groups are required for all CDC-funded tests performed in non–health care settings but are only required for HIV-positive test results in health care settings. Population groups (e.g., MSM, transgender persons, persons who inject drugs, and heterosexual persons) are hierarchically assigned based on self-reported behaviors and gender identification. In NHM&E data, an HIV test is defined as a sequence of ≥1 HIV test conducted to determine a person's HIV status. Total tests include only tests with negative or positive results (excluding tests with discordant or inconclusive results).
[†††] The surveillance week for which the NNDSS disease report is assigned by the reporting local or state health department for the purposes of *MMWR* disease incidence reporting and publishing.

performed to assess weekly changes in testing reported to NSSP from February 3, 2019 (2019, week 6) through December 26, 2020 (2020, week 52). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.[§§§]

During February 3–December 31, 2019, and February 1–December 31, 2020, CDC received reports of 17,007,063 total HIV screening tests from two commercial laboratories (Table). Analyses of commercial laboratory tests reported by surveillance week indicated that testing volumes remained stable throughout 2019, at approximately 200,000 tests per week (Figure 1). In early 2020, testing volumes exceeded 2019 levels; however, by week 12, testing volumes declined to <50% the levels observed during 2019 and remained low through the end of 2020, with 1,350,609 (14.7%) fewer tests reported in 2020 compared with 2019.

In 2019, HRSA UDS received reports of 2,713,628 Bureau of Primary Health Care (BPHC)-funded HIV tests, and CDC NHM&E received reports of 2,385,343 CDC-funded tests

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

TABLE. Comparison of HIV testing and diagnosis data from four data sources — United States, 2019 and 2020

| | Commercial laboratory testing, NSSP* | | HRSA UDS, BPHC–funded HIV tests,[†] health care settings | | CDC NHM&E–funded HIV tests[§] | | | | NHSS |
| | | | | | Health care settings | | Non–health care settings | | |
Characteristic	Total HIV-1/HIV-2 ag/ab tests	Reactive tests[¶]	Total HIV tests	New diagnoses	Total HIV tests	New diagnoses	Total HIV tests	New diagnoses	HIV diagnoses reported to CDC**
Observed, 2019[††]	9,178,836	66,026	2,713,628	7,164	1,752,586	5,374	632,757	3,556	36,940
Observed, 2020[††]	7,828,227	55,658	2,489,031	6,304	1,005,553	3,857	319,799	2,509	30,635
Total observed, 2019–2020	**17,007,063**	**121,684**	**5,202,659**	**13,468**	**2,758,139**	**9,231**	**952,556**	**6,065**	**67,575**
Absolute difference, 2019–2020	−1,350,609	−10,368	−224,597	−860	−747,033	−1,517	−312,958	−1,047	−6,305
% Change, 2019–2020	−14.7	−15.7	−8.3	−12.0	−42.6	−28.2	−49.5	−29.4	−17.0

Abbreviations: ab = antibody; ag = antigen; BPHC = Bureau of Primary Health Care; HRSA = Health Resources and Services Administration; NHM&E = National HIV Prevention Program Monitoring and Evaluation; NHSS = National HIV Surveillance System; NSSP = National Syndromic Surveillance Program ; STD = sexually transmitted disease; TB = tuberculosis.
* NSSP is a collaboration among CDC; local and state health departments; and federal, academic, and private sector partners (https://www.cdc.gov/nssp/index.html). Data were extracted from two laboratory data sources for all test orders with either an order or result containing "56888-1" within the reported Logical Observation Identifiers Names and Codes, indicative of an HIV-1 or HIV-2 antigen or antibody test recommended for HIV screening. The performance period during which CDC and the laboratories submitted HIV test data began on February 3, 2019.
[†] Number of HIV tests performed; the number of new diagnoses were extracted from the HRSA Health Center Program Uniform Data System reporting tables. https://data.hrsa.gov/tools/data-reporting/program-data
[§] CDC analyzes and disseminates data on CDC-funded HIV tests received from the NHM&E data reporting system (EvaluationWeb), reported by 60 CDC-funded health departments and 100 CDC-funded community-based organizations. The number of HIV tests and new diagnoses reported during 2019–2020 from health care and non–health care settings were summarized from the 2019 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-HIV-testing-report-2019.pdf) and 2020 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-hiv-testing-report-2020.pdf) NHM&E Annual HIV Testing reports. An HIV test was defined as a sequence of ≥1 HIV test conducted to determine a person's HIV status. Total HIV tests included only tests with negative or positive results; tests with discordant or inconclusive results were excluded. New diagnoses were defined as persons who received a positive test result from the current HIV test who had no indication of a previous positive test result. Health care settings included STD clinics, community health centers, emergency departments, correctional clinics, primary care clinics, substance abuse treatment facilities, pharmacies, dental clinics, TB clinics, and inpatient hospitals. Non–health care settings included HIV testing sites, community settings, non–health care correctional facilities, health department field visits, and syringe service programs.
[¶] NSSP reactive tests included all screening test results reported as "reactive," which was defined as preliminarily positive test results; additional testing was not required to confirm an HIV diagnosis.
** https://www.cdc.gov/hiv/library/reports/hiv-surveillance.html
[††] To make NSSP counts comparable, "Observed, 2019" refers to February 3–December 31, 2019, and "Observed 2020" includes February 1–December 31, 2020.

(including 1,752,586 [73%] from health care settings and 632,757 [27%] from non–health care settings) (Table). These sources reported substantial decreases in the number of tests and positive results in 2020 compared with 2019. HRSA UDS data indicated an 8.3% decrease in HIV screening tests. In 2020, the total number of HIV tests funded by CDC that were distributed in health care and non–health care settings decreased by nearly one half (42.6% and 49.5%, respectively) compared with 2019, and ranged from –44.1% to –59.1% for racial and ethnic groups and –47.3% to –57.4% for population groups (Figure 2) in non–health care settings during this period. Substantial absolute reductions in HIV tests reported in non–health care settings were among those prioritized in CDC's HIV testing efforts, including 74,947 fewer tests among MSM (a 49.2% reduction), 4,145 fewer tests among transgender persons (a 47.3% reduction), and 430,713 (44.1%) and 265,494 (46.3%) fewer tests among Black and Hispanic persons, respectively. In 2020, 30,635 diagnoses were reported to NHSS compared with 36,940 in 2019 (Table). Reductions in testing were mirrored by a 17.0% reduction in new diagnoses.

Discussion

In 2020, the number of HIV tests reported to CDC- and BPHC-funded settings and some commercial laboratories declined sharply compared with 2019. All racial and ethnic groups and population groups examined experienced substantial decreases in HIV testing, including populations with elevated potential for HIV acquisition, including Black and Hispanic persons, MSM, and transgender persons, all of whom experienced substantial decreases in the availability of CDC-funded HIV testing. Similar declines in clinical visits for HIV testing and other services during the COVID-19 pandemic (e.g., STD testing and PrEP) have been reported (7).

The COVID-19 pandemic adversely affected efforts to expand HIV testing, including expansions related to the EHE initiative. The substantial reduction in testing and new

FIGURE 1. Weekly HIV screening tests* reported by two commercial laboratories — National Syndromic Surveillance Program,† United States, February 3, 2019–December 26, 2020§
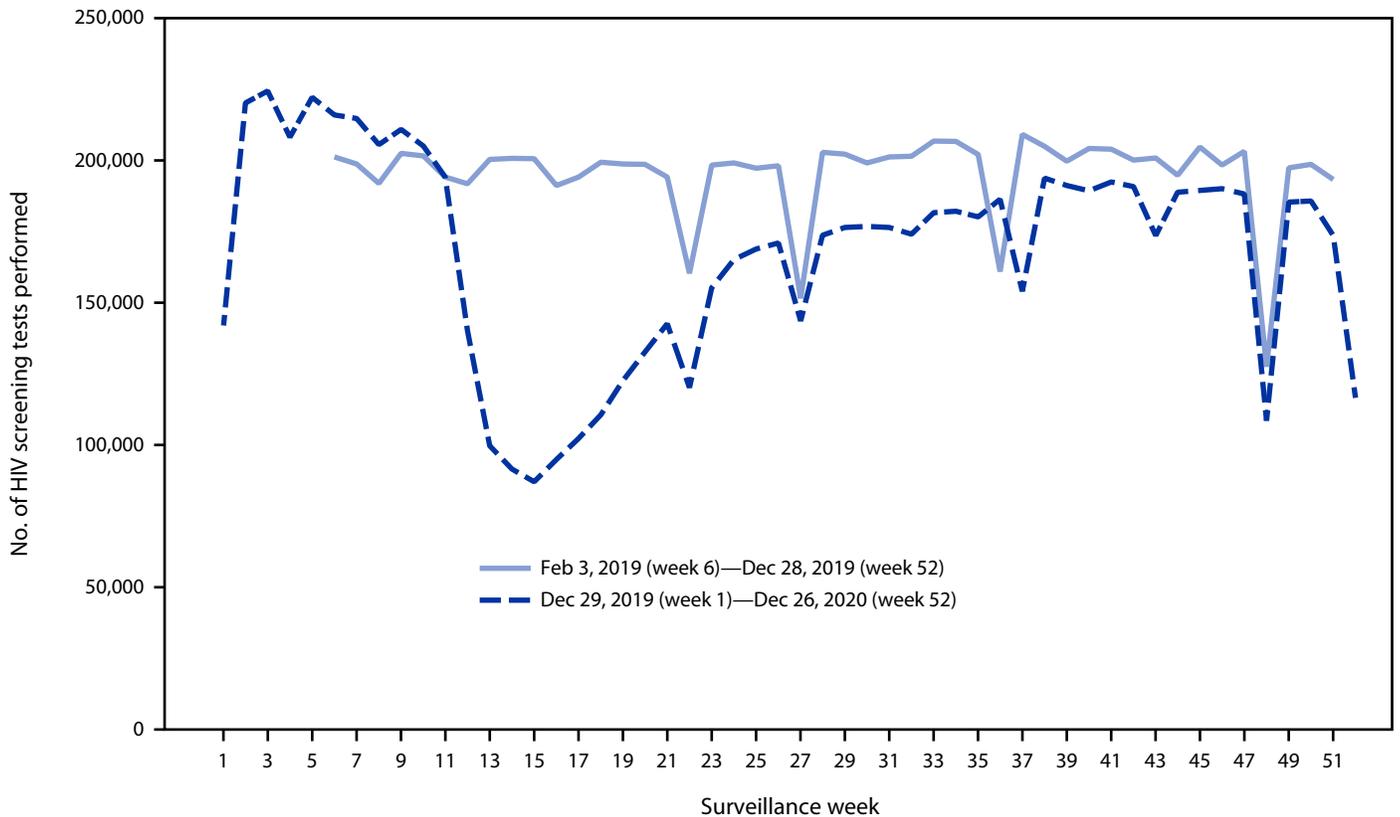
* Data were extracted from two laboratory data sources for all test orders with either an order or result containing "56888-1" within the reported Logical Observation Identifiers Names and Codes, indicating an HIV-1 or HIV-2 antigen or antibody test recommended for HIV screening and summed by surveillance week from February 3, 2019 (2019, week 6) through December 26, 2020 (2020, week 52). The performance period during which CDC and the laboratories submitted HIV test data began on February 3, 2019.
† National Syndromic Surveillance Program is a collaboration among CDC; local and state health departments; and federal, academic, and private sector partners. https://www.cdc.gov/nssp/index.html
§ Data collection began February 3, 2019.

diagnoses suggest that a concerted effort is needed at local, state, and national levels to increase testing rates among all persons, especially those populations most affected by HIV, in keeping with EHE goals. Self-testing for HIV is another testing option outside of health care settings, and it is an effective, convenient, and accurate way to diagnose HIV infection.¶¶¶ Distribution of HIV self-tests increases awareness of HIV infection among priority populations, including some MSM who do not report annual HIV testing using other modalities (8). Self-test distribution has expanded since 2020 and might have replaced some of the usual sources of testing in the United States during the pandemic (9).

¶¶¶ https://www.cdc.gov/hiv/policies/data/self-testing-issue-brief.html

The findings in this report are subject to at least three limitations. First, it cannot be determined whether decreases in the number of reported HIV tests and new HIV diagnoses resulted from decreased access to testing services and laboratory materials, reductions in sexual behaviors that would make testing unnecessary, reductions in overall HIV incidence, or a combination of these and other factors. Limited evidence obtained through a survey of MSM indicated that sexual activity declined early in the COVID-19 pandemic (10); similar data are not yet available for other populations or during later phases of the pandemic. Second, CDC NHM&E, HRSA UDS, and commercial laboratory data represent the number of tests performed and not the number of unique persons tested; clients tested multiple times might have been included in the analysis. Finally, the findings of this analysis are not a

FIGURE 2. Absolute numbers and percent change in total number of CDC-funded HIV tests,* by race and ethnicity,† and population group§ in non–health care settings¶ — United States, 2019 and 2020
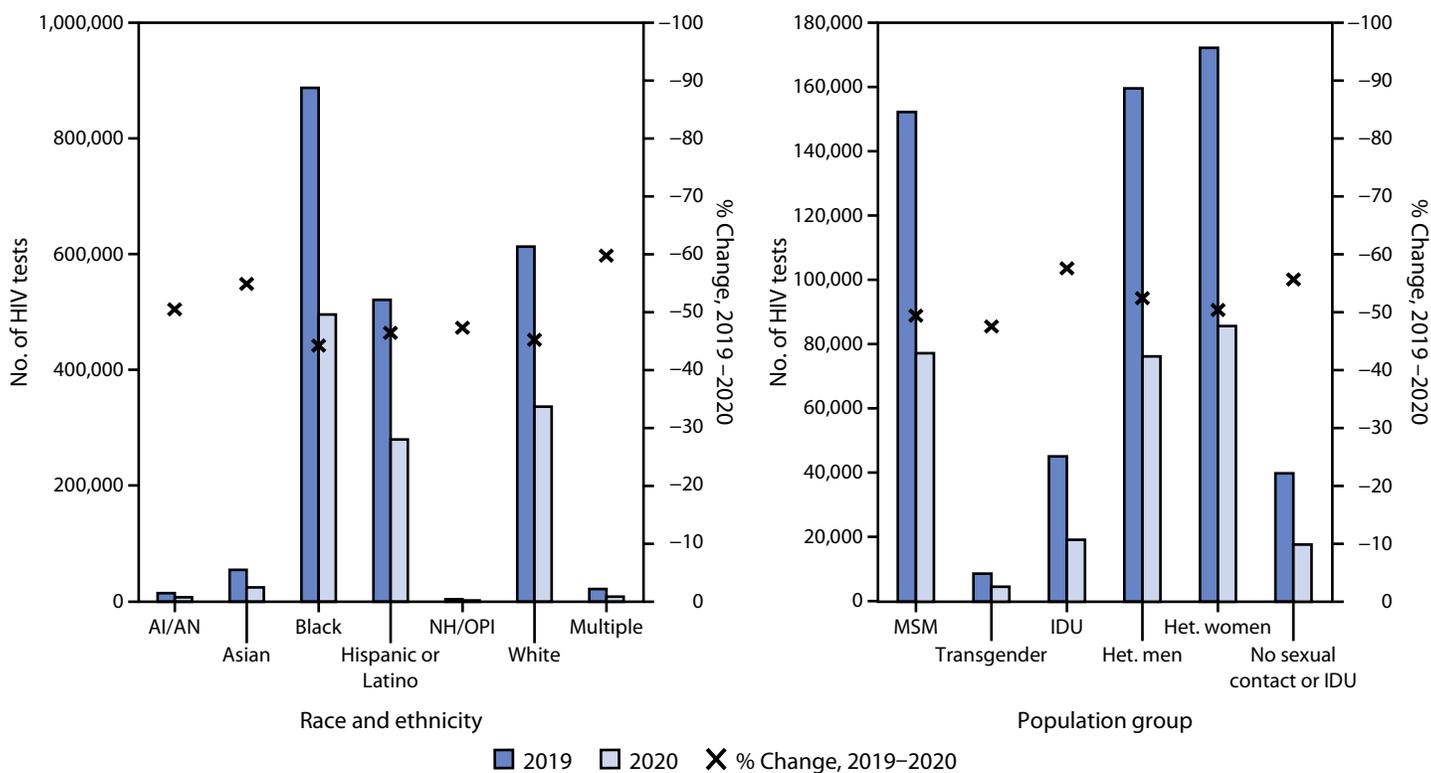
Abbreviations: AI/AN = American Indian or Alaska Native; Het. = heterosexual; IDU = injection drug use; MSM = men who have sex with men; NHM&E = National HIV Prevention Program Monitoring and Evaluation; NH/OPI = Native Hawaiian or other Pacific Islander.
* Summarized from the 2019 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-HIV-testing-report-2019.pdf) and 2020 (https://www.cdc.gov/hiv/pdf/library/reports/cdc-hiv-annual-hiv-testing-report-2020.pdf) NHM&E Annual HIV Testing reports. An HIV test is defined as a sequence of ≥1 HIV test conducted to determine a person's HIV status. Total tests include only tests with negative or positive results (excludes tests with discordant or inconclusive results).
† Race and ethnicity categories include Hispanic and Latino persons of any race; multiple races; and American Indian or Alaska Native, Asian, Black, Native Hawaiian or other Pacific Islander, and White races.
§ Population groups are hierarchically assigned based on self-reported behaviors and gender identification. In this figure, the MSM group includes MSM and MSM who inject drugs; the transgender group includes transgender persons and transgender persons who inject drugs.
¶ Restricted to non–health care settings because NHM&E data on population groups are required for all CDC-funded tests performed in non–health care settings but are only required for HIV-positive test results in health care settings. Non–health care settings include HIV testing sites, community settings, non–health care correctional facilities, health department field visits, and syringe service programs.

Summary

What is already known about this topic?

HIV testing is the first step in accessing HIV prevention and care services. The COVID-19 pandemic disrupted health care delivery and might have affected HIV testing, which is critical to ending the HIV epidemic in the United States.

What is added by this report?

From 2019 to 2020, new HIV diagnoses reported to CDC decreased by 17% accompanied by a substantial decline in HIV testing during the same period, including among priority populations in CDC-funded jurisdictions.

What are the implications for public health practice?

Partnering among federal organizations, state, and local health departments, community-based organizations, and health care systems to increase access to services, including HIV self-testing and routine opt-out screening in health care settings, can compensate for testing and diagnoses missed during the COVID-19 pandemic and accelerate the Ending the HIV Epidemic initiative.

comprehensive estimate of HIV testing; some testing providers, including some commercial laboratories, do not report to NSSP, and self-testing results are not included in this report.

To compensate for testing and diagnoses missed during the COVID-19 pandemic and accelerate the EHE initiative, partnerships among federal organizations, state and local health departments, community-based organizations, and health care systems could increase access to HIV testing services, including self-testing. In addition, expansion of routine screening in health care settings and locally tailored HIV testing efforts in non–health care settings is an important aspect of the EHE initiative and its goal of reducing disparities in HIV diagnoses.**** CDC supports the need for status-neutral approaches to health care and service delivery, which emphasizes ongoing engagement in HIV-related services irrespective of a person's HIV status (*4*).

**** https://www.cdc.gov/hiv/funding/announcements/ps20-2010/index.html

Corresponding author: Elizabeth A. DiNenno, edinenno@cdc.gov.

[1]Division of HIV Prevention, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, CDC.

References

1. Pitasi MA, Delaney KP, Brooks JT, DiNenno EA, Johnson SD, Prejean J. HIV testing in 50 local jurisdictions accounting for the majority of new HIV diagnoses and seven states with disproportionate occurrence of HIV in rural areas, 2016–2017. MMWR Morb Mortal Wkly Rep 2019;68:561–7. PMID:31246940 https://doi.org/10.15585/mmwr.mm6825a2
2. Czeisler MÉ, Marynak K, Clarke KEN, et al. Delay or avoidance of medical care because of COVID-19–related concerns—United States, June 2020. MMWR Morb Mortal Wkly Rep 2020;69:1250–7. PMID:32915166 https://doi.org/10.15585/mmwr.mm6936a4
3. Branson BM, Handsfield HH, Lampe MA, et al.; CDC. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. MMWR Recomm Rep 2006;55(No. RR-14):1–17. PMID:16988643
4. Myers JE, Braunstein SL, Xia Q, et al. Redefining prevention and care: a status-neutral approach to HIV. Open Forum Infect Dis 2018;5:ofy097. PMID:29977957 https://doi.org/10.1093/ofid/ofy097
5. Pitasi MA, Beer L, Cha S, et al. Vital signs: HIV infection, diagnosis, treatment, and prevention among gay, bisexual, and other men who have sex with men—United States, 2010–2019. MMWR Morb Mortal Wkly Rep 2021;70:1669–75. PMID:34855721 https://doi.org/10.15585/mmwr.mm7048e1
6. Pampati S, Emrick K, Siegler AJ, Jones J. Changes in sexual behavior, PrEP adherence, and access to sexual health services because of the COVID-19 pandemic among a cohort of PrEP-using MSM in the South. J Acquir Immune Defic Syndr 2021;87:639–43. PMID:33512848 https://doi.org/10.1097/QAI.0000000000002640
7. Huang YA, Zhu W, Wiener J, Kourtis AP, Hall HI, Hoover KW. Impact of COVID-19 on HIV preexposure prophylaxis prescriptions in the United States—a time series analysis. Clin Infect Dis 2022:ciac038. PMID:35040928 https://doi.org/10.1093/cid/ciac038
8. MacGowan RJ, Chavez PR, Borkowf CB, et al.; eSTAMP Study Group. Effect of internet-distributed HIV self-tests on HIV diagnosis and behavioral outcomes in men who have sex with men: a randomized clinical trial. JAMA Intern Med 2020;180:117–25. PMID:31738378 https://doi.org/10.1001/jamainternmed.2019.5222
9. Hecht J, Sanchez T, Sullivan PS, DiNenno EA, Cramer N, Delaney KP. Increasing access to HIV testing through direct-to-consumer HIV self-test distribution—United States, March 31, 2020–March 30, 2021. MMWR Morb Mortal Wkly Rep 2021;70:1322–5. PMID:34555001 https://doi.org/10.15585/mmwr.mm7038a2
10. Stephenson R, Sullivan SP, Pitter RA, Hunter AS, Chavanduka TMD. Are we still having sex? Results of round two of the Love and Sex in the Time of COVID survey with gay, bisexual and other men who have sex with men. AIDS Behav 2022;26:2338–48. PMID:35044555 https://doi.org/10.1007/s10461-022-03580-1

Dispensing of Oral Antiviral Drugs for Treatment of COVID-19 by Zip Code–Level Social Vulnerability — United States, December 23, 2021–May 21, 2022

Jeremy A.W. Gold, MD[1]; James Kelleher[2]; Jake Magid, MEng[2]; Brendan R. Jackson, MD[1]; Meghan E. Pennini, PhD[3]; Diana Kushner, MPH[3]; Emily J. Weston, MPH[1,3]; Bobby Rasulnia, PhD[1]; Sachiko Kuwabara, PhD[1,3]; Kelly Bennett, MPH[3]; Barbara E. Mahon, MD[1]; Anita Patel, PharmD[1]; John Auerbach, MBA[1]

On June 21, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

The COVID-19 pandemic has highlighted and exacerbated long-standing inequities in the social determinants of health (*1–3*). Ensuring equitable access to effective COVID-19 therapies is essential to reducing health disparities. Molnupiravir (Lagevrio) and nirmatrelvir/ritonavir (Paxlovid) are oral antiviral agents effective at preventing hospitalization and death in patients with mild to moderate COVID-19 who are at high risk* for progression to severe COVID-19 when initiated within 5 days of symptom onset. These medications received Emergency Use Authorization from the Food and Drug Administration (FDA) in December 2021[†] and were made available at no cost to recipients through the U.S. Department of Health and Human Services (HHS) on December 23, 2021. Beginning March 7, 2022, a series of strategies was implemented to expand COVID-19 oral antiviral access, including the launch of the Test to Treat initiative.[§] Data from December 23, 2021–May 21, 2022, were analyzed to describe oral antiviral prescription dispensing overall and by week, stratified by zip code social vulnerability. Zip codes represented areas classified as low, medium, or high

social vulnerability; approximately 20% of U.S. residents live in low-, 31% in medium-, and 49% in high-social vulnerability zip codes.[¶] During December 23, 2021–May 21, 2022, a total of 1,076,762 oral antiviral prescriptions were dispensed (Lagevrio = 248,838; Paxlovid = 827,924). Most (70.3%) oral antivirals were dispensed during March 7–May 21, 2022. During March 6, 2022–May 21, 2022, the number of oral antivirals dispensed per 100,000 population increased from 3.3 to 77.4 in low-, from 4.5 to 70.0 in medium-, and from 7.8 to 35.7 in high-vulnerability zip codes. The number of oral antivirals dispensed rose substantially during the overall study period, coincident with the onset of initiatives to increase access. However, by the end of the study period, dispensing rates in high-vulnerability zip codes were approximately one half the rates in medium- and low-vulnerability zip codes. Additional public health, regulatory, and policy efforts might help decrease barriers to oral antiviral access, particularly in communities with high social vulnerability.

Nationwide oral antiviral dispensing data are reported to HHS daily through the HHS Health Partner Ordering Portal (HPOP)**; 85%–95% of oral antiviral sites report dispensing

---

* Groups at high risk include persons aged ≥65 years and those with certain medical conditions. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

† Lagevrio and Paxlovid are oral antiviral therapies indicated for the treatment of patients with mild to moderate COVID-19 who have received positive results of direct SARS-CoV-2 viral testing and are at high risk for progression to severe COVID-19. Lagevrio is indicated for the treatment of adults aged ≥18 years for whom alternative COVID-19 treatment options approved or authorized by FDA are not accessible or clinically indicated. Paxlovid is indicated for persons aged ≥12 years who weigh at least 88 lbs (40 kg). https://www.fda.gov/media/155050/download; https://www.fda.gov/media/155054/download

§ Strategies implemented included the Test to Treat initiative, increased communication to providers and patients, and direct distribution to Federal Retail Pharmacy Therapeutic Partners, enabling expansion of the number of dispensing sites. A program of HHS, Test to Treat is a federal initiative designed to provide rapid access to lifesaving COVID-19 treatments at no cost to recipients. https://aspr.hhs.gov/TestToTreat/Pages/default.aspx The launch of this program garnered media attention and heightened the visibility of oral antivirals to health care providers and the public. At Test to Treat sites, patients can receive COVID-19 testing, obtain assessment by a qualified health care provider who can prescribe antivirals, and receive oral antiviral treatment. Providing these services at a single location ensures rapid and convenient access to treatment. Test to Treat program sites accounted for 6% of all oral antiviral dispensing sites and dispensed 17% of all prescriptions.

¶ Zip code–level social vulnerability was classified according to the equitable distribution index (EDI) score. EDI is used by the federal COVID-19 response because zip code–level data offer a more detailed characterization of population vulnerability than do county level–data, while providing sufficient geographic granularity to accomplish operational goals not achievable using U.S. Census Bureau tract–level data. Similar to the CDC SVI (https://www.atsdr.cdc.gov/placeandhealth/svi/index.html), which produces county-level and U.S. Census Bureau tract–level estimates of social vulnerability, EDI uses 15 indicators categorized into four themes: 1) socioeconomic status, 2) household composition and disability, 3) racial and ethnic minority status and language, and 4) housing type and transportation. EDI includes all 15 indicators as a composite measure, and a final score is ranked from lowest (0) to highest (1) vulnerability. A percent rank function is used, such that an equal number of geographic components are in each percentile of the index. To map U.S. Census Bureau tracts to zip codes, EDI uses a crosswalk file published by the U.S. Department of Housing and Urban Development. https://www.huduser.gov/portal/datasets/usps_crosswalk.html EDI is not generated for zip codes where any of the 15 components are suppressed within the American Community Survey (this represents <1% of all zip codes mapped to U.S. Census Bureau tract data).

** HPOP is used by oral antiviral partners to order oral antivirals cost-free to recipients and to report inventory and product use. HPOP oral antiviral partners include all U.S. states and other jurisdictions, Federal Retail Pharmacy Therapeutics Partners, and federal entities (e.g., Indian Health Service, Bureau of Prisons, and U.S. Department of State). https://aspr.hhs.gov/COVID-19/Therapeutics/Distribution/Pages/process-for-ordering.aspx

data to HHS. Information regarding the location of oral antiviral prescription dispensing and the number of active sites dispensing oral antivirals is geocoded to the zip code level. An active site dispensing oral antivirals was defined as any provider that had ordered oral antiviral courses during the previous 60 days or that reported inventory during the previous 14 days. For this analysis, zip codes were ranked according to the Equitable Distribution Index scale, a proxy for social vulnerability. Based on Equitable Distribution Index score, zip codes were classified as having low (0–0.33), medium (>0.33–0.66), or high (>0.66–1.00) social vulnerability.

Total numbers of Lagevrio and Paxlovid prescriptions dispensed and the number of dispensing sites during December 23, 2021–May 21, 2022, were tabulated and examined by week and zip code–level social vulnerability. Social vulnerability–stratified rates of oral antiviral prescription dispensing (prescriptions dispensed per 100,000 population) were calculated; the population denominators used for rate calculations were obtained from 2018 CDC and Agency for Toxic Substances and Disease Registry social vulnerability index (SVI) data (4). This activity was reviewed by HHS and CDC and was conducted consistent with applicable federal law and CDC policy.[††]

During December 23, 2021–May 21, 2022, a total of 1,076,762 oral antiviral prescriptions (248,838 Lagevrio; 827,924 Paxlovid) were dispensed (Figure 1); overall, 70.3% (756,858) were dispensed during March 7–May 21, 2022. The weekly number of oral antiviral prescriptions dispensed initially peaked at 56,073 (30,636 Lagevrio; 25,437 Paxlovid) during the week ending February 12, 2022; declined to 14,925 (3,821 Lagevrio; 11,104 Paxlovid) during the week ending March 26, 2022; and increased to 179,728 (19,162 Lagevrio; 160,566 Paxlovid) during the week ending May 21, 2022. The number of dispensing sites increased from 49 during the week ending December 25, 2021, to 39,687 during the week ending May 21, 2022 (Figure 2).

As of May 21, 2022, the largest number of dispensing sites was located in high-vulnerability zip codes (18,844; 47.5%), approximately one third (13,072; 32.9%) were in medium-vulnerability zip codes, and approximately one fifth (7,771; 19.6%) were in low-vulnerability zip codes. Overall, during December 23, 2021–May 21, 2022, the highest rates of oral antiviral prescriptions dispensed were in low-vulnerability zip codes (373.3 per 100,000), followed by medium- (359.5) and high- (287.4) vulnerability zip codes. During December 23, 2021–March 5, 2022, the rates of oral antiviral courses dispensed ranged from 0.2 to 27.0 per 100,000 in high-, 0.2 to 13.4 in medium-, and 0.1 to 8.6 in low-vulnerability zip codes

(Figure 3). During March 6, 2022–May 21, 2022, the rates of oral antivirals dispensed increased from 3.3 to 77.4 per 100,000 and from 4.5 to 70.0 in low- and medium-vulnerability zip codes, respectively; rates in high-vulnerability zip codes increased from 7.8 to 35.7, reaching approximately one half the rate in low- and medium-vulnerability zip codes. At the end of the study period, (May 21, 2022), COVID-19 continued to cause an average of 291 deaths and 3,833 new hospitalizations per day.[§§]

Discussion

This analysis of national oral antiviral dispensing data during December 23, 2021–May 21, 2022, highlights a substantial increase in the number of dispensing sites located throughout the country to 39,687 sites (87% of which were pharmacies) as of May 21, 2022, and in the number of oral antivirals dispensed (1,076,762 total, including 70.3% during March 7–May 21, 2022). These increases were possible because of coordinated efforts among federal, state, local, and pharmacy partners to expand access to COVID-19 therapies, coincident with an increased supply and a rise in the number COVID-19 cases nationwide. Efforts to expand oral antiviral access included the launch of the Test to Treat program, an expansion of the distribution network through federal pharmacy partners, increased access to testing,[¶¶] and ongoing implementation of community and clinician outreach efforts.[***]

Despite the increase in the number of oral antivirals dispensed during the study period, population-adjusted dispensing rates in high-vulnerability zip codes were substantially lower than those in medium- and low-vulnerability zip codes, even though high-vulnerability zip codes had the most dispensing sites. Oral antivirals, particularly Paxlovid, provide an essential tool that can prevent hospitalization and death from COVID-19 (5). The findings in this report highlight an ongoing need to identify and eliminate barriers to oral antiviral access, particularly within socially and economically disadvantaged communities.


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

[§§] The number of COVID-19 deaths and new COVID-19 hospitalizations presented are the 7-day moving averages on May 21, 2022. https://covid.cdc.gov/covid-data-tracker/#datatracker-home (Accessed June 2, 2022).

[¶¶] Access to testing for SARS-CoV-2 has been expanded through the postal distribution of home antigen COVID-19 testing kits and through the Increasing Community Access to Testing (ICATT) for COVID-19 program. ICATT has increased the number of pharmacies offering testing in high social vulnerability areas (https://www.cdc.gov/icatt/index.html), augmented testing capacity at Health Resources and Services Administration health clinics, and increased home testing through the launch of Medicare coverage for over-the-counter home tests.

[***] Community outreach efforts have included state, local, and jurisdictional public health department efforts to augment direct messaging to communities and partnerships with community-based organizations. Clinician outreach efforts have included collaborations with professional medical associations, dissemination of Health Alert Network communications, and the provision of updated clinical guidance by the National Institutes of Health.

FIGURE 1. Weekly number of courses of oral COVID-19 antiviral therapy (Lagevrio* and Paxlovid†) dispensed — United States, December 23, 2021–May 21, 2022
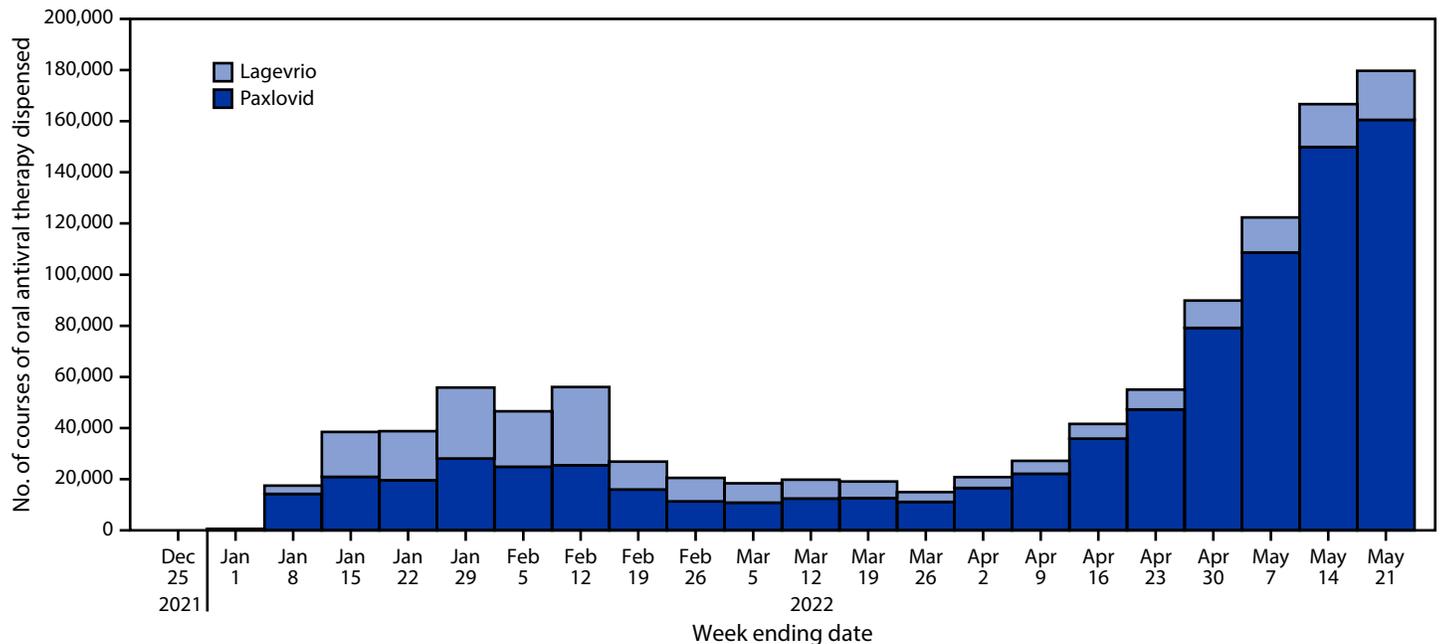
* Molnupiravir.
† Nirmatrelvir/ritonavir.

Timely administration of oral antivirals depends on multiple factors, including adequate drug supply and distribution; acceptance of the therapy by health care providers and the public; and patient access to testing, prescriptions, and drug dispensing sites (6). To access oral antiviral therapy, a patient must first receive a positive test result for SARS-CoV-2 (the virus that causes COVID-19), followed by a clinical assessment by a health care provider authorized to prescribe the drug (i.e., physicians, advanced practice registered nurses, and physician assistants). Although 47.5% of dispensing sites are located in high-vulnerability zip codes as of May 21, 2022, and approximately 88% of the U.S. population live within 5 miles of a site,††† most pharmacies serving as dispensing sites do not have authorized prescribers available on-site or via telemedicine.§§§ Persons living in high-vulnerability zip codes might face challenges accessing health care providers who are authorized to prescribe oral antivirals (1). In addition, the end of reimbursement for testing, health care provider assessment, and oral antiviral dispensing through the Health Resources and Services Administration Uninsured Program on March 22, 2022, might have contributed to lower oral

antiviral dispensing rates for certain populations living within high-vulnerability zip codes.¶¶¶

Several strategies could improve access to oral antivirals in high-vulnerability zip codes. Additional innovative approaches could be considered that facilitate patient access to testing, clinical assessments, and oral antivirals in a single visit (6). As access to prescriptions increases, provider reimbursements for clinical assessment services should be considered, including additional costs that might inadvertently create additional barriers to care.**** Additional needed efforts, with an emphasis on reaching high-vulnerability areas, include increasing access to authorized prescribers; continuing education and outreach for patients, reinforcing the importance of seeking medication early after the onset of COVID-19 symptoms; and continued expansion of oral antiviral dispensing sites nationwide. Health

††† This estimate was generated through a geospatial analysis that included zip code–level population density data and therapeutic site locations.
§§§ https://www.scrapehero.com/retail-health-clinic-locations-in-us-location-analysis/

¶¶¶ The Health Resources and Services Administration COVID-19 Uninsured Program was a program through which HHS provided claims reimbursement to health care providers generally at Medicare rates for testing uninsured persons for COVID-19, treating uninsured persons with a COVID-19 diagnosis, and administering COVID-19 vaccines to uninsured persons. The Uninsured Program stopped accepting claims for testing and therapeutic dispensing on March 22, 2022 because of lack of funding. https://www.hrsa.gov/CovidUninsuredClaim
**** Currently, most payors cover the cost of the clinical assessment required to prescribe oral antivirals. However, patients might be required to pay deductibles or copays associated with the service. Financial barriers associated with SARS-CoV-2 testing have been reduced by free at-home test distribution and ongoing access to free testing through the ICATT program. Oral antivirals are provided free of charge to recipients, with no associated dispensing fee to the patient.

FIGURE 2. Number of active provider sites for oral antiviral therapy against COVID-19, by week and zip code social vulnerability score* — United States, December 23, 2021–May 21, 2022
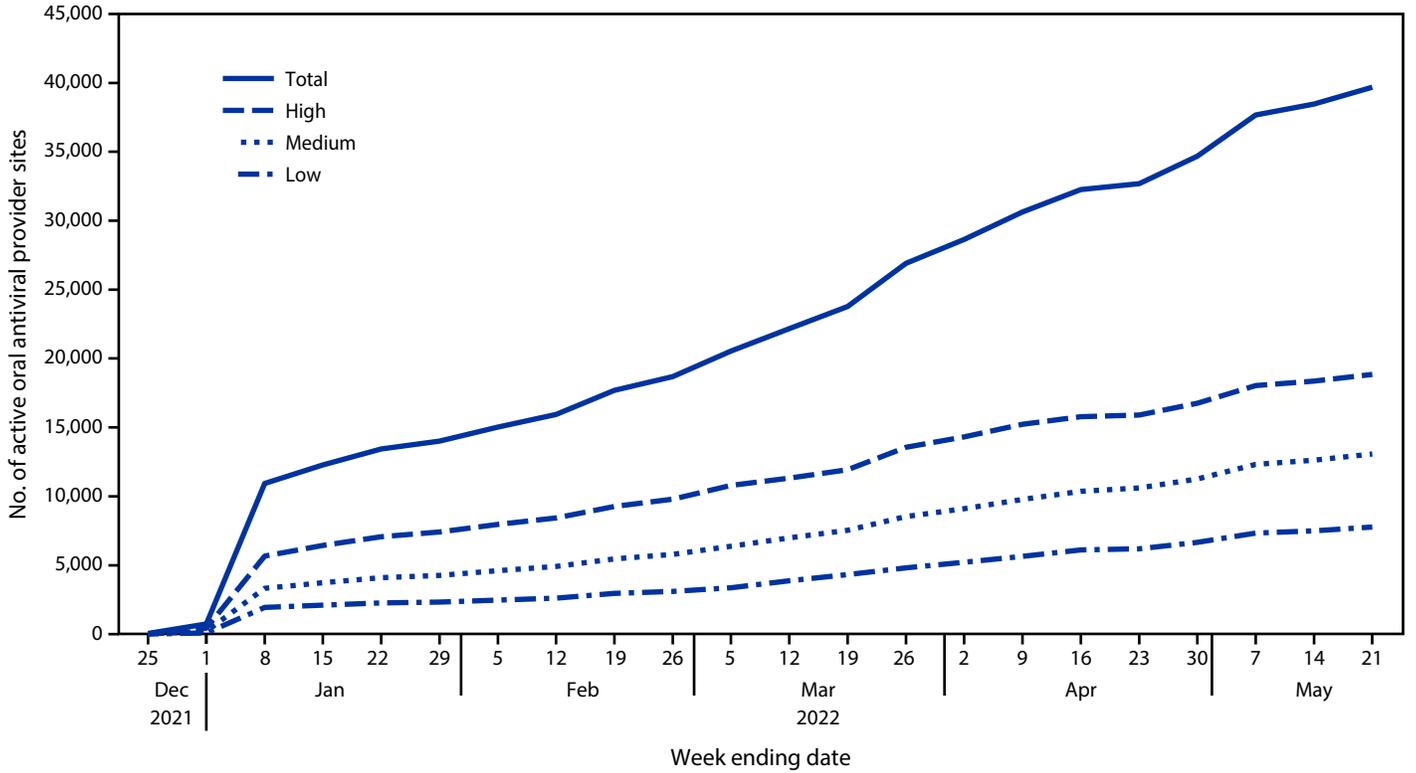
* Zip codes were classified as having low, medium, or high social vulnerability based on ranking within the lower, middle, and upper tertiles of the Equitable Distribution Index score.

FIGURE 3. Courses of oral COVID-19 antiviral therapy dispensed per 100,000 persons, by week and zip code social vulnerability level — United States, December 26, 2021–May 21, 2022*
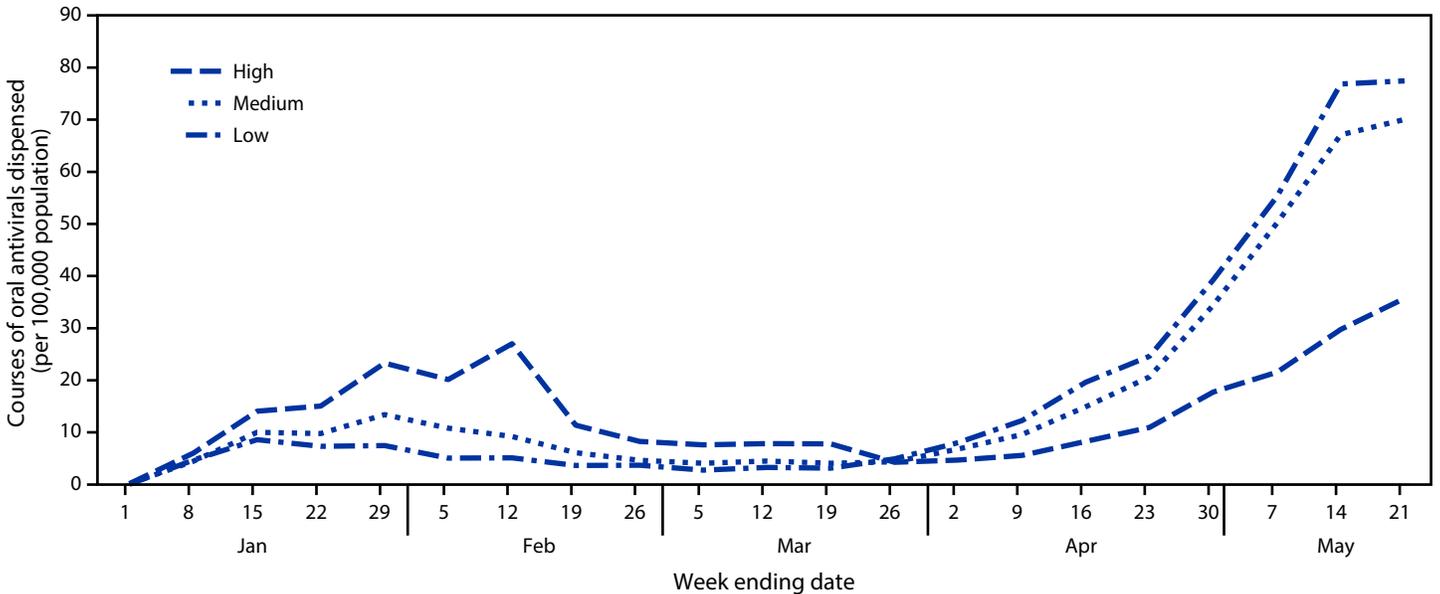
* The week ending December 25, 2021, is not shown because no oral antiviral dispensing was reported during that week. Zip codes were classified as having low, medium, or high social vulnerability based on ranking within the lower, middle, and upper tertiles of the Equitable Distribution Index score.

Summary

What is already known about this topic?

Lagevrio and Paxlovid are oral antiviral drugs effective at preventing hospitalization and death in patients with mild to moderate COVID-19 who are at risk for progression to severe disease.

What is added by this report?

During December 23, 2021–May 21, 2022, 1,076,762 oral antiviral prescriptions were dispensed in the United States. The overall number of antivirals dispensed increased; however, by the end of the study period, dispensing rates were lowest in high vulnerability zip codes, despite these zip codes having the largest number of dispensing sites.

What are the implications for public health practice?

Additional public health, regulatory, and policy efforts might help decrease barriers to oral antiviral access, particularly in communities with high social vulnerability.

care providers should be aware that Paxlovid is generally well-tolerated, is highly effective at preventing severe disease and hospitalization, and should be prescribed to treat mild to moderate illness in persons who are at high risk for progression to severe COVID-19, including persons aged ≥65 years.[††††]

The findings in this report are subject to at least four limitations. First, because oral antiviral dispensing data are based on self-reporting by dispensing sites, and 85%–95% of sites reported dispensing data to HHS, the number of prescriptions dispensed is likely underestimated. Second, the calculation of Equitable Distribution Index scores involves the aggregation of U.S. Census Bureau tracts into zip codes, a process that might compound the sampling error already inherent in calculating proxy scores for social vulnerability using U.S. Census Bureau data. Further, individual zip codes might still encompass communities with varying degrees of social vulnerability, and Equitable Distribution Index scores cannot be calculated in areas where U.S. Census Bureau population data are not publicly available. Third, this analysis did not assess correlations between rates of oral antiviral dispensing and measures of COVID-19 prevalence (e.g., percentage of test results that were positive) or associated outcomes (e.g., rates of hospitalization or death); although differences in these factors among zip codes might partially explain disparities in dispensing rates, such differences are unlikely to fully account for the twofold higher rates observed by the end of the study period in low- and medium-vulnerability zip codes compared with those in high-vulnerability zip codes, especially because areas with high social vulnerability have generally had greater COVID-19 disease burden during the

pandemic (1,3). Finally, the analysis did not examine person-level data such as age, gender, race and ethnicity, zip code of residence, underlying medical conditions, and indications for oral antiviral medications.

Despite the introduction of highly effective vaccines and medications to treat COVID-19, by the end of the study period, COVID-19 continued to cause substantial morbidity and mortality. Oral antivirals can provide a critical intervention that can mitigate COVID-19–associated morbidity and mortality. Although the overall number of antivirals dispensed has increased, in this analysis, dispensing rates were lowest in high-vulnerability zip codes. Additional public health, regulatory, and policy efforts might help to decrease barriers to oral antiviral access, particularly in communities with high social vulnerability.

Corresponding author: Jeremy A.W. Gold, jgold@cdc.gov.

[1]CDC COVID-19 Emergency Response Team; [2]Palantir Technologies, Palo Alto, California; [3]Office of the Assistant Secretary for Preparedness and Response, U.S. Department of Health and Human Services, Washington, DC.

References

1. CDC. Health equity considerations and racial and ethnic minority groups. Atlanta, GA: US Department of Health and Human Services, CDC; 2021. Accessed May 28, 2022. https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html
2. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. JAMA 2020;323:2466–7. PMID:32391864 https://doi.org/10.1001/jama.2020.8598
3. Bilal U, Jemmott JB, Schnake-Mahl A, Murphy K, Momplaisir F. Racial/ethnic and neighbourhood social vulnerability disparities in COVID-19 testing positivity, hospitalization, and in-hospital mortality in a large hospital system in Pennsylvania: a prospective study of electronic health records. Lancet Reg Health Am 2022;10:100220. PMID:35262038 https://doi.org/10.1016/j.lana.2022.100220
4. Agency for Toxic Substances and Disease Registry. CDC/ATSDR social vulnerability index 2018 database: United States. Atlanta, GA: US Department of Health and Human Services, Agency for Toxic Substances and Disease Registry; 2018. Accessed June 6, 2022. https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html
5. Bhimraj A, Morgan RL, Hirsch Shumaker A, et al. Infectious Diseases Society of America guidelines on the treatment and management of patients with coronavirus disease (COVID-19). Arlington, VA: Infectious Diseases Society of America; 2019 Accessed May 30, 2022. https://www.idsociety.org/practice-guideline/covid-19-guideline-treatment-and-management
6. Koonin LM, Patel A. Timely antiviral administration during an influenza pandemic: key components. Am J Public Health 2018;108:S215–20. PMID:30192657 https://doi.org/10.2105/AJPH.2018.304609

[††††] https://emergency.cdc.gov/han/2022/han00467.asp

Hospitalization and Emergency Department Encounters for COVID-19 After Paxlovid Treatment — California, December 2021–May 2022

Deborah E. Malden, DPhil[1,2]; Vennis Hong, MS[2]; Bruno J. Lewin, MD[2,3]; Bradley K. Ackerson, MD[2]; Marc Lipsitch, DPhil[4,5]; Joseph A. Lewnard, PhD[6]; Sara Y. Tartof, PhD[2,3]

On June 21, 2022, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Nirmatrelvir/ritonavir (Paxlovid) is a combination protease inhibitor that blocks replication of SARS-CoV-2 (the virus that causes COVID-19) and has been shown to reduce the risk for hospitalization and death among patients with mild to moderate COVID-19 who are at risk for progression to severe disease* (*1*). In December 2021, the Food and Drug Administration (FDA) issued an Emergency Use Authorization (EUA) for early treatment with Paxlovid among persons with mild to moderate cases of COVID-19 who are at high risk for progression to severe disease (*2*). FDA and a small number of published case reports have documented recurrence of COVID-19 symptoms or a positive viral test result (COVID-19 rebound) 2–8 days after recovery or a negative SARS-CoV-2 test result among patients treated with Paxlovid (*3–7*); however, large-scale studies investigating severe illness after Paxlovid treatment are limited. This study used electronic health record (EHR) data from a large integrated health care system in California (Kaiser Permanente Southern California [KPSC]) to describe hospital admissions and emergency department (ED) encounters related to SARS-CoV-2 infections during the 5–15 days after pharmacy dispensation of a 5-day treatment course of Paxlovid. Among 5,287 persons aged ≥12 years who received Paxlovid during December 31, 2021–May 26, 2022, 73% had received ≥3 doses of COVID-19 vaccine†, and 8% were unvaccinated. During the 5–15 days after Paxlovid treatment was dispensed, six hospitalizations and 39 ED encounters considered to be related to SARS-CoV-2 infection were identified, representing <1% of all patients to whom Paxlovid treatment was dispensed during the study period. Among these 45 persons, 21 (47%) were aged ≥65 years, and 35 (78%) had at least one underlying medical condition§ (*8*). This study found that hospitalization or ED encounters for COVID-19 during the 5–15 days after Paxlovid treatment was dispensed for mild to moderate COVID-19 illness were rarely identified. When administered as an early-stage treatment, Paxlovid might prevent COVID-19–related hospitalization among persons with mild to moderate cases of COVID-19 who are at risk for progression to severe disease.

Clinical and demographic characteristics from EHRs were described among patients receiving Paxlovid during December 31, 2021–May 26, 2022, within KPSC, a large integrated health care system in California. KPSC facilities include 15 large medical centers that provide care to approximately 4.6 million members across southern California. All hospital admissions and ED encounters during the 5–15 days after Paxlovid treatment was dispensed¶ were flagged for medical chart review to confirm that the hospitalization or ED encounter was related to COVID-19.** Patients identified with two Paxlovid prescriptions ≥14 days apart were followed for 5–15 days after each prescription date. For patients with both a documented hospital admission and an ED encounter during the 5–15 days after the date that Paxlovid was dispensed, the hospital admission was included in the analysis. Data analyses were performed using SAS software (version 9.4; SAS Institute). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.†† This activity was also reviewed and approved by KPSC Institutional Review Board.

---

* Persons eligible for treatment with Paxlovid include those aged ≥12 years, weighing ≥88 lbs (40 kg), with a positive SARS-CoV-2 test result, mild or moderate symptoms, not requiring hospitalization because of severe or critical COVID-19 illness at the time of treatment initiation, and the presence of at least one risk factor that can predispose them to severe disease (https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html), without evidence of severe renal or hepatic impairment. https://www.covid19treatmentguidelines.nih.gov/therapies/antiviral-therapy/ritonavir-boosted-nirmatrelvir--paxlovid-/

† COVID-19 vaccine doses were categorized ≥14 days before the Paxlovid dispense date as follows: 4 doses = receipt of a fourth COVID-19 vaccine dose; 3 doses = receipt of a third COVID-19 vaccine dose ≥28 days after the second dose (and no fourth dose received); 2 doses = receipt of a second COVID-19 vaccine dose (and no third dose received); 1 dose = receipt of a single COVID-19 vaccine dose (and no second dose received); 0 = unvaccinated.

§ Underlying medical conditions were defined according to the modified Charlson Comorbidity Index, which included 17 conditions of interest available in EHRs during the 12 months preceding the date of treatment. Conditions included immunosuppressive disorders, acute myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid disease, peptic ulcer disease, mild and moderate liver disease, severe liver disease, diabetes with severe complications, diabetes without severe complications, hemiplegia or paraplegia, renal disease, cancer, and HIV/AIDS.

¶ Patients were considered to have received treatment with Paxlovid if they had documentation of a pharmacy dispensation of Paxlovid in their EHRs.

** Patients were considered to have a confirmed COVID-19–related hospital admission or ED encounter if their EHRs indicated that COVID-19 was either the primary reason for the encounter or if there was documentation of symptoms consistent with COVID-19 according to the latest CDC definition. https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

†† 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.

Summary

What is already known about this topic?

Recurrence of COVID-19 symptoms and positive SARS-CoV-2 test results have been reported after completion of Paxlovid oral antiviral treatment for COVID-19, but real-world evidence of severe illness following Paxlovid is lacking.

What is added by this report?

COVID-19–related hospital admissions and emergency department (ED) encounters occurring 5–15 days after Paxlovid treatment were described using data from a large integrated health care system. Reports of such hospitalizations or ED encounters occurred infrequently, representing <1% of Paxlovid-treated patients over the study period.

What are the implications for public health practice?

When administered as an early-stage treatment, Paxlovid might prevent COVID-19–related hospitalization among persons with mild-to-moderate COVID-19 who are at risk for progression to severe disease.

During December 31, 2021–May 26, 2022, a total of 5,287 persons aged ≥12 years received a prescription for Paxlovid, including four (<0.1%) who received two Paxlovid prescriptions ≥14 days apart. Among these 5,287 persons, 3,025 (57.2%) were female, and the median age was 61 years (Table). The largest percentage of persons (2,245; 42.5%) identified as non-Hispanic White, and 30.3% (1,603) identified as Hispanic. A total of 2,999 (56.7%) Paxlovid recipients had at least one underlying medical condition. Overall, 4,875 (92.2%) persons had received at least 1 COVID-19 vaccine dose; most (3,836; 72.5%) received at least 3 doses, and 937 (17.7%) received 2 doses at least 14 days before the date of Paxlovid prescription; a total of 412 (7.8%) Paxlovid recipients were unvaccinated.

During the 5–15 days after treatment was dispensed, six (0.11%) hospitalizations and 39 (0.74%) ED encounters among persons with symptoms consistent with COVID-19 were identified, representing <1% of all patients who received Paxlovid during the study period; three hospitalizations and 10 ED encounters had a COVID-19 diagnosis code or positive SARS-CoV-2 test result documented in the associated EHR. Twenty-one (46.7%) of these 45 patients were aged ≥65 years and 35 (77.8%) had at least one documented underlying medical condition. A higher proportion of those identified with COVID-19–related hospitalizations or ED encounters were either unvaccinated or vaccinated with 1 dose of COVID-19 vaccine (eight of 45; 17.8%) compared with all treated patients (514 of 5,287; 9.7%). Among the six hospitalized patients, five had received 3 doses of COVID-19 vaccine and one had received a single vaccine dose. All hospitalized patients had comorbidities or were of advanced age (range = 61–104 years),

which put them at increased risk for severe COVID-19. Two hospitalized patients died; both were at high risk for severe illness because of multiple comorbidities and age, and their deaths were attributed to underlying disease. The remaining four hospitalized patients recovered, as did the 39 patients with COVID-19–related ED encounters during the 5–15 days after Paxlovid was dispensed.

Discussion

In this analysis of data from patients aged ≥12 years in a large integrated health care system who received Paxlovid treatment during December 2021–May 2022, hospitalizations or ED encounters for COVID-19–related illness during the 5–15 days after Paxlovid dispensation occurred among <1% of all patients. The rarity of these outcomes is consistent with evidence from recent case reports and large observational studies, which found that symptoms experienced by patients with COVID-19 rebound after treatment with Paxlovid are milder than those experienced during the primary infection (3–5) and are unlikely to lead to hospitalization (9,10).

The recurrence of symptoms might represent part of the natural history of SARS-CoV-2 infection in some persons, irrespective of treatment or vaccination status (6). Although little is known about the severity of COVID-19 rebound symptoms, it has been suggested that very early treatment with Paxlovid might transiently suppress viral replication before natural immunity is sufficient to complete viral clearance (3). This might allow for a short interval during which rebound-associated increases in SARS-CoV-2 viral load might be observed. However, the findings from the current study among approximately 5,000 eligible COVID-19 patients treated with Paxlovid suggest that responses (whether treatment-mediated, immune-mediated, or a combination of both) might be sufficient to prevent severe outcomes, including hospitalization, for most patients.

The recurrence of COVID-19 symptoms after Paxlovid treatment might also be related to other factors, including viral reinfection or the emergence of treatment-resistant mutations. In the current study, recovery from initial infection was not assessed and viral sequencing was not performed on specimens before and after treatment initiation; therefore, the distinction between progression of initial illness, COVID-19 rebound, or reinfection could not be made. However, in the limited studies that have obtained sequence data, similarity of viral strains between pre- and posttreatment specimens suggested that reinfection was unlikely, at least in the small number of patients studied (4). In addition, research conducted by FDA demonstrated that viral rebound in several subjects was not associated with known resistance mutations, although these analyses are ongoing (7).

TABLE. Characteristics of persons aged ≥12 years prescribed Paxlovid treatment, by COVID-19–related hospitalizations or emergency department encounters 5–15 days after treatment dispensation among members of a large integrated health care system — California, December 31, 2021–May 26, 2022

Characteristic	No. (column %)	
	All Paxlovid recipients	COVID-19–related* hospitalization/ED encounter 5–15 days after Paxlovid dispensed†
Total, row %	**5,287**	**45 (0.9)**
Age group, yrs§		
12–17	36 (0.7)	0 (—)
18–24	81 (1.5)	0 (—)
25–44	994 (18.8)	11 (24.4)
45–64	1,929 (36.5)	12 (26.7)
≥65	2,214 (41.9)	21 (46.7)
Unknown	33 (0.6)	1 (2.2)
Median (IQR)	61 (47.0–71.0)	63 (44.5–77.0)
Sex§		
Female	3,025 (57.2)	30 (66.7)
Male	2,228 (42.1)	14 (31.1)
Unknown	34 (0.6)	1 (2.2)
Race and ethnicity§		
White, non-Hispanic	2,245 (42.5)	16 (35.6)
Hispanic	1,603 (30.3)	14 (31.1)
Asian or Pacific Islander, non-Hispanic	823 (15.6)	8 (17.8)
Black, non-Hispanic	327 (6.2)	4 (8.9)
Multiple or other	119 (2.3)	1 (2.2)
Unknown	170 (3.2)	2 (4.4)
Charlson comorbidity index¶		
0	2,288 (43.3)	10 (22.2)
1	1,321 (25.0)	13 (28.9)
2	737 (13.9)	6 (13.3)
≥3	941 (17.8)	16 (35.6)
No. of COVID-19 vaccine doses received**		
0	412 (7.8)	5 (11.1)
1	102 (1.9)	3 (6.7)
2	937 (17.7)	9 (20.0)
3	3,279 (62.0)	27 (60.0)
4	557 (10.5)	1 (2.2)

Abbreviations: ED = emergency department; EHR = electronic health record.

* Patients were considered to have a confirmed COVID-19–related hospitalization or ED encounter if their EHRs indicated documentation of known symptoms consistent with COVID-19 illness.

† Patients were considered to have received treatment with Paxlovid if their EHR contained documentation of a pharmacy dispensation of Paxlovid.

§ At the date of treatment dispensation.

¶ The weighted Charlson Comorbidity Index included 17 conditions of interest available in EHRs from the 12 months preceding the date of treatment. Conditions included immunosuppressive disorders, acute myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid disease, peptic ulcer disease, mild and moderate liver disease, severe liver disease, diabetes with severe complications, diabetes without severe complications, hemiplegia or paraplegia, renal disease, cancer, and HIV/AIDs.

** COVID-19 vaccine doses were categorized ≥14 days before the Paxlovid dispense date as follows: 4 doses = receipt of a fourth COVID-19 vaccine dose; 3 doses = receipt of a third COVID-19 vaccine dose ≥28 days after the second dose (and no fourth dose received); 2 doses = receipt of a second COVID-19 vaccine dose (and no third dose received); 1 dose = receipt of a single COVID-19 vaccine dose (and no second dose received); 0 = unvaccinated.

The findings in this report are subject to at least five limitations. First, COVID-19–related hospital admissions and ED encounters among patients with symptoms consistent with COVID-19 illness were used as proxy indicators of COVID-19 disease severity; these instances might include admissions and encounters for persons seeking care for unrelated conditions. Although medical chart reviews were conducted to verify that COVID-19–related illness or symptoms were potentially a primary reason for these health care encounters, misclassification might have occurred because of the nonspecific nature of COVID-19–related symptoms. Second, there was no control population of persons who did not receive treatment with Paxlovid for mild to moderate COVID-19, and therefore the relative benefit of treatment with Paxlovid could not be determined, nor could it be distinguished from the overall benefit of receiving COVID-19 vaccination. However, data from randomized controlled trials and from large-scale observational studies have demonstrated a protective effect of Paxlovid on COVID-19–associated hospitalization and death (1,9,10), albeit sometimes with notably different study populations that differed by age or vaccination status. Third, data on treatment initiation and adherence were not systematically collected; therefore, persons with

incomplete treatment might have been misclassified as having completed a full course of Paxlovid. Fourth, patients might have sought care within ED settings because of convenience rather than acuity of illness. However, these last two limitations would have led to an overestimation of acute COVID-19 illness after Paxlovid dispensation, which strengthens the conclusion that such events are rare. Finally, although members typically seek care at KPSC, and KPSC receives a regular data feed from the California Immunization Registry on outside vaccinations, data on Paxlovid prescriptions dispensed or vaccinations administered by non-KPSC providers might be incomplete.

This study found that <1% of patients treated with Paxlovid were identified with COVID-19–related hospitalization or ED encounters 5-15 days after treatment was dispensed. When administered as an early-stage treatment, Paxlovid might prevent COVID-19–related hospitalization among persons with mild to moderate COVID-19 cases who are at risk for progression to severe disease. Additional research is warranted to provide further understanding of the apparent association between Paxlovid and reduced risk for severe COVID-19 illness, including studies with control groups and more precise indicators of COVID-19 illness severity.

Corresponding author: Debbie E. Malden, debbie.e.malden@kp.org.

[1]Epidemic Intelligence Service, CDC; [2]Kaiser Permanente Department of Research & Evaluation Southern California, Pasadena, California; [3]Kaiser Permanente Bernard J. Tyson School of Medicine, Pasadena, California; [4]CDC COVID-19 Emergency Response Team; [5]Center for Communicable Disease Dynamics, Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; [6]School of Public Health, University of California, Berkeley, California.

References

1. Hammond J, Leister-Tebbe H, Gardner A, et al.; EPIC-HR Investigators. Oral nirmatrelvir for high-risk, nonhospitalized adults with COVID-19. N Engl J Med 2022;386:1397–408. PMID:35172054 https://doi.org/10.1056/NEJMoa2118542
2. Food and Drug Administration. FDA updates on Paxlovid for health care providers. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2022. Accessed May 27, 2022. https://www.fda.gov/drugs/news-events-human-drugs/fda-updates-paxlovid-health-care-providers
3. Gupta K, Strymish J, Stack G, Charness M. Rapid relapse of symptomatic omicron SARS CoV-2 infection following early suppression with nirmatrelvir/ritonavir. Research Square [Preprint posted online April 6, 2022]. https://www.researchsquare.com/article/rs-1588371/v1
4. Charness M, Gupta K, Stack G, et al. Rapid relapse of symptomatic omicron SARS-CoV-2 infection following early suppression with nirmatrelvir/ritonavir. Research Square [Preprint posted May 12, 2022]. https://www.researchsquare.com/article/rs-1588371/v2
5. Carlin AF, Clark AE, Chaillon A, et al. Virologic and immunologic characterization of COVID-19 recrudescence after nirmatrelvir/ritonavir treatment. Research Square [Preprint posted May 18, 2022]. https://www.researchsquare.com/article/rs-1662783/v1
6. CDC. CDC Health Advisory: COVID-19 rebound after Paxlovid treatment. Atlanta, GA: US Department of Health and Human Services, CDC; 2022. https://emergency.cdc.gov/han/2022/pdf/CDC_HAN_467.pdf
7. Food and Drug Administration. Emergency Use Authorization (EUA) for Paxlovid (nirmatrelvir tablets co-packaged with ritonavir tablets) Center for Drug Evaluation and Research (CDER) review. Silver Spring, MD: US Department of Health and Human Services, Food and Drug Administration; 2021. https://www.fda.gov/media/155194/download
8. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. J Clin Epidemiol 1992;45:613–9. PMID:1607900 https://doi.org/10.1016/0895-4356(92)90133-8
9. Arbel R, Sagy YW, Hoshen M, et al. Oral nirmatrelvir and severe Covid-19 outcomes during the Omicron surge. Research Square [Preprint posted June 1, 2022]. https://www.researchsquare.com/article/rs-1705061/v1
10. Najjar-Debbiny R, Gronich N, Weber G, et al. Effectiveness of Paxlovid in reducing severe COVID-19 and mortality in high risk patients. Clin Infect Dis 2022;ciac443. PMID:35653428 https://doi.org/10.1093/cid/ciac443

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Uninsured Adults Aged 18–64 Years,† by Race and Selected Hispanic§ Origin Subgroup — National Health Interview Survey, United States, 2019–2020

Uninsured adults aged 18–64 years
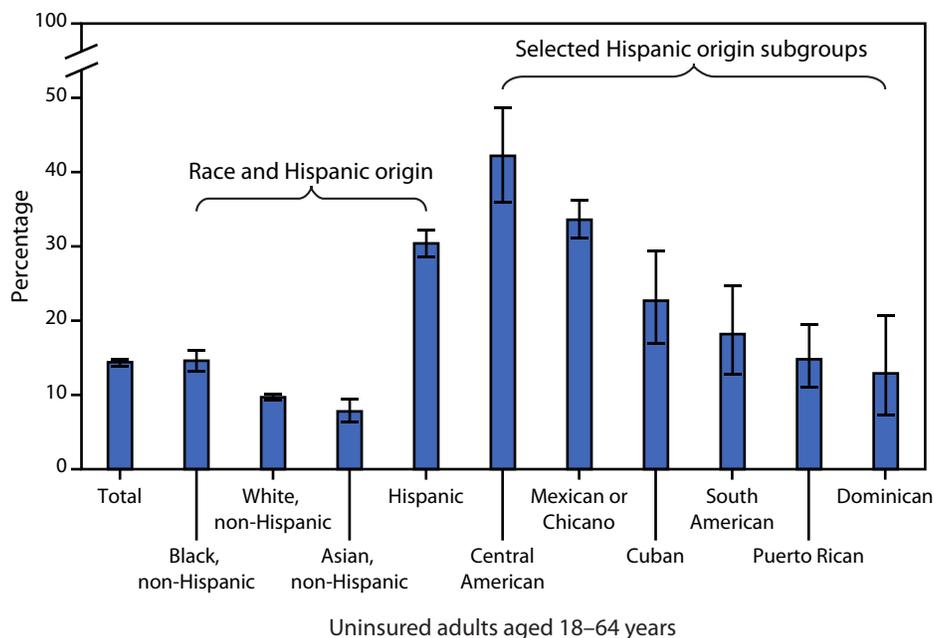
* With 95% CIs indicated by error bars.
† Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population and are derived from the 2019 and 2020 National Health Interview Survey.
§ Hispanic includes other Hispanic origin subgroups, which are not included.

During 2019–2020, the percentage of U.S. adults aged 18–64 years who were uninsured was 14.4%. Among all race and Hispanic origin subgroups, those most likely to be uninsured were Hispanic adults (30.4%) followed by non-Hispanic Black (14.6%), non-Hispanic White (9.7%), and non-Hispanic Asian (7.8%) adults. Among the Hispanic origin subgroups included, those most likely to be uninsured were of Central American (42.2%) origin followed by Mexican or Chicano (33.6%) origin. Adults of Cuban (22.7%) origin were more likely to be uninsured than those of Puerto Rican (14.8%) and Dominican (12.9%) origin. Other observed differences were not statistically significant.

Source: National Center for Health Statistics, National Health Interview Survey, 2019 and 2020. https://www.cdc.gov/nchs/nhis.htm
Reported by: Michael E. Martinez, MPH, MHSA, memartinez@cdc.gov, 301-458-4758; Emily P. Terlizzi, MPH; Amy E. Cha PhD, MPH.