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

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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

* 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.

† 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.

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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.

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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

	No. (%)					
Characteristic	**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.

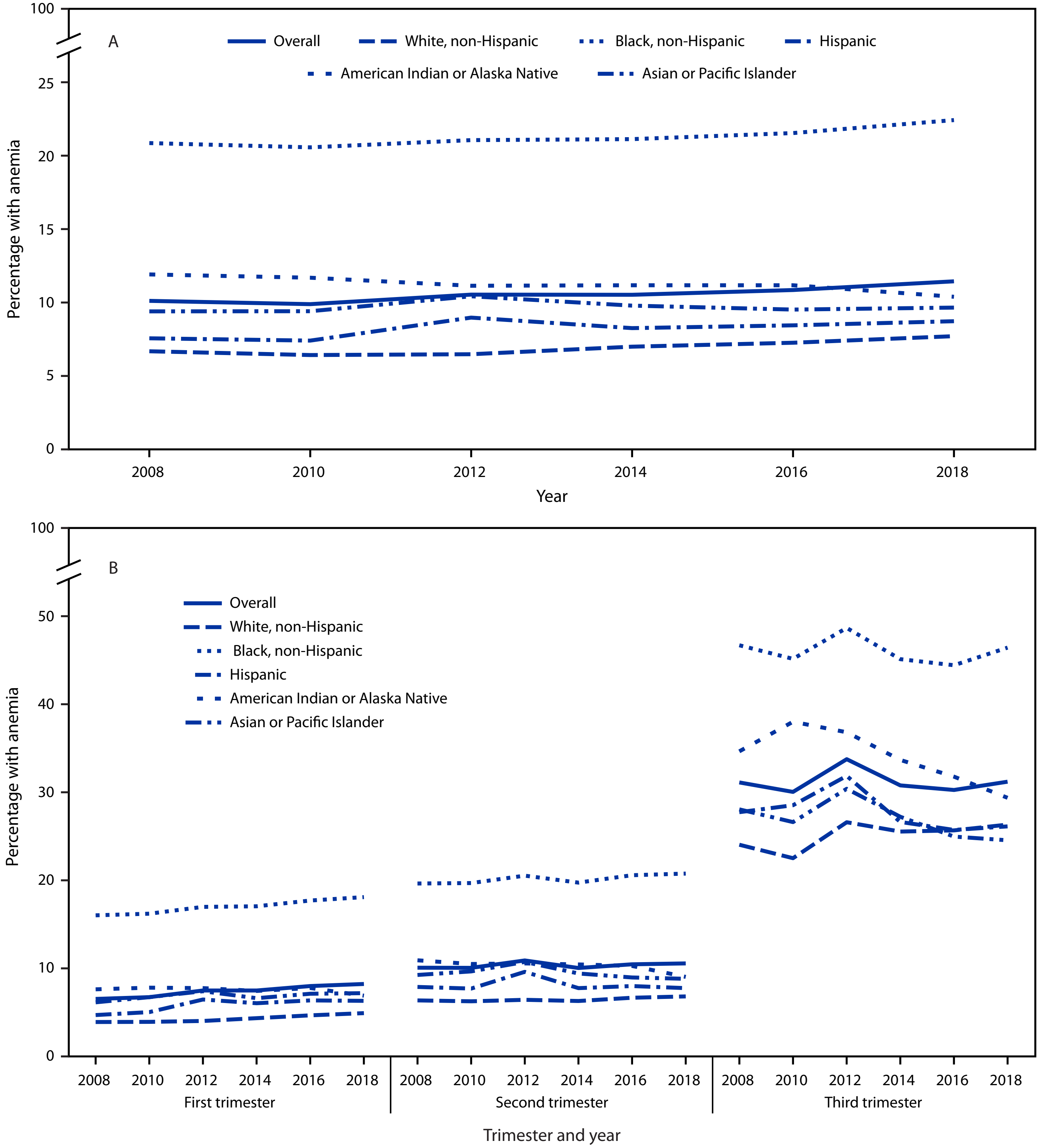
† Records with matching state, local agency, identification number, certification date, and maternal birth date.

§ 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 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.

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

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