

Prepregnancy Body Mass Index by Maternal Characteristics and State: Data From the Birth Certificate, 2014

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Abstract

Objectives—This report describes prepregnancy body mass index (BMI) among women giving birth in 2014 for the 47-state and District of Columbia reporting areas that implemented the 2003 U.S. Standard Certificate of Live Birth by January 1, 2014.

Methods—Data for 2014 are based on 100% of births to residents of the reporting areas that implemented the 2003 birth certificate revision by January 1, 2014 (96% of all births in 2014). Prepregnancy BMI was derived from the mother's reported height and prepregnancy weight. Results may not be generalizable to the entire United States, because the reporting areas do not represent a random sample of U.S. births. Approximately 4% of records from the revised reporting areas were missing data on maternal height or weight.

Results—Among women giving birth in 2014, 3.8% were underweight (BMI is less than 18.5), 45.9% were of normal weight (BMI is 18.5–24.9), 25.6% were overweight (BMI is 25.0–29.9), and 24.8% were obese (BMI is greater than 29.9) before becoming pregnant. The prevalence of overweight and obesity before pregnancy was lowest among women under age 20, non-Hispanic Asian women, women with at least a college degree, women giving birth for the first time, and women using self-payment for delivery. Women with obesity before pregnancy were more likely to be older (aged 40–54), non-Hispanic black or non-Hispanic American Indian and Alaska Native, at least partially college educated, to have had three previous births or more, or using Medicaid for payment of delivery. Prepregnancy obesity prevalence increased in 30 of the 37 reporting areas that adopted the 2003 certificate in 2011 and 2014.

Keywords: obesity • maternal • weight • pregnancy • maternal age

Introduction

Overweight and obesity prevalence increased among U.S. women over the period 1960–1962 to 2010–2011, from 19% to 163%, respectively. (1). Increased maternal weight before and during pregnancy has been associated with fertility problems, increased risk of cesarean delivery, increased macrosomia among infants, and other adverse pregnancy and infant outcomes (2–7). Body mass index (BMI) status prior to pregnancy also has an impact on the amount of weight gained during pregnancy. The Institute of Medicine recommends following weight gain guidelines during pregnancy based on a woman's prepregnancy BMI (8). However, there are currently no national data available to examine prepregnancy BMI. The 2003 birth certificate revision includes new items on prepregnancy weight and height. These variables allow for the calculation of prepregnancy BMI among women giving birth. Data on prepregnancy BMI are available for 47 states and the District of Columbia for women who gave birth in 2014. This report presents data on prepregnancy BMI according to selected maternal characteristics for states that implemented the 2003 U.S. Standard Certificate of Live Birth as of January 2014.

Methods

This analysis uses data from the 2014 birth certificate and is based on 100% of births registered in the 47 states and the District of Columbia (D.C.) that implemented the 2003 revision of the birth certificate by January 1, 2014 (9). Births in these reporting areas represent 96% of all births in 2014 but may not be generalizable to the entire United States in 2014. Births among jurisdictions implementing the 2003 birth certificate revision compared with births from all reporting areas were more likely to occur among non-Hispanic white (0.1%), American Indian and Alaska Native (AIAN) (6.0%), and Asian or Pacific Islander (6.0%) women and less likely among Hispanic (–0.4%) and non-Hispanic black (–1.0%) women compared with all U.S. births in 2014 (10). Most of these differences are slight but statistically significant.

Prior to the 2003 revision, information on maternal prepregnancy weight and height was not included on the national standard birth certificate. For the 2003 revision, it was recommended that prepregnancy weight (pounds) and height (feet and inches) be collected via self-report by the mother at the time of delivery and recorded as part of the maternal worksheet (10). Data are edited at the time of their submission to the National Center for Health Statistics (NCHS) according to the following criteria: maternal height outside of 1–8 feet and 1–11 inches and maternal weight outside of 50–400 pounds (11). There was variability among reporting areas in stating maternal weight and height in 2014. Out of the 3,837,663 births occurring in the 48 reporting areas, 150,976, or 4% of births, did not have prepregnancy BMI stated due mainly to missing data on maternal weight or height (11). Data not stated for either maternal weight or height ranged from less than 1% to 25% (one state) (median = 2%) among the 2014 reporting areas (11). More detailed information about these missing data is available in the “User Guide to the 2014 Natality Public Use File” (11).

Prepregnancy BMI is derived from prepregnancy weight and height according to the following formula:

$$\frac{\text{mother's prepregnancy weight (lb)}}{\text{mother's height (in)}^2} \times 703$$

In addition to providing data on the separate components of BMI, NCHS provides a calculated categorization of maternal prepregnancy BMI that aligns with those established by the National Heart, Lung, and Blood Institute (12) for all adults and are as follows:

Underweight = BMI less than 18.5

Normal weight = BMI of 18.5 to less than 25.0

Overweight = BMI of 25.0 to less than 30.0

Obese = BMI of 30.0 and over

Data in this report are presented for mothers who gave birth in 2014 regardless of plurality or gestational age, since the variable of interest is a characteristic of prepregnancy and not affected by pregnancy outcome. Patterns of prepregnancy BMI are explored by race and Hispanic origin, maternal age, maternal education, and number of previous live births. Race and Hispanic origin are reported separately on the birth certificate. For this report, categories of maternal race and Hispanic origin were created for non-Hispanic white, non-Hispanic black, non-Hispanic Asian, non-Hispanic AIAN, and Hispanic women. All race and Hispanic origin groups are based on single race reporting. Prepregnancy BMI is shown by state, and changes in obesity among the 36-state and D.C. reporting areas that recorded BMI in both 2011 and 2014 are also described. Differences in percentages of BMI among groups are tested for statistical significance (11). Differences referred to in text are statistically significant unless otherwise stated.

Results

- Overall, 3.8% of women who gave birth in 2014 were underweight and 45.9% were of normal BMI before becoming pregnant (Table 1).
- Approximately 50% of women who delivered a live-born infant in 2014 were either overweight (25.6%) or had obesity (24.8%) before becoming pregnant.

Age

- The percentage of women who were underweight before pregnancy decreased with age, from 7.7% among those under age 20 to 2.0% among those aged 40–54 (Figure 1, Table 1).
- The percentage of women with a normal prepregnancy BMI ranged from 53.1% (those under age 20) to 42.5% (those aged 40–54). There was no difference in normal BMI among women aged 20–24, 25–29, and 35–39.
- Generally, the percentage of women who were overweight before pregnancy increased with age, from 22.6% among those under age 20 to 28.5% among those aged 40–54, although there was no difference between those aged 25–29 and 30–34.
- The percentage of women with obesity before pregnancy ranged from 16.6% (those under age 20) to 27.0% (those aged 40–54). Obesity was lower among women under age 20 compared with women aged 20–24 and 35–39.

Race and Hispanic origin

- The percentage of women who were underweight before pregnancy was lowest among Hispanic (2.8%) and highest among non-Hispanic Asian (8.6%) women (Figure 2, Table 1).
- Non-Hispanic AIAN women (33.9%) had the lowest percentage of normal BMI, whereas non-Hispanic Asian women (64.0%) had the highest percentage.
- The percentage of women who were overweight before pregnancy was highest among Hispanic women (29.7%), lowest among non-Hispanic Asian women (19.9%), and essentially the same for non-Hispanic AIAN (27.2%) and non-Hispanic black (26.9%) women.
- Compared with the overweight category, the pattern was different among those with obesity before pregnancy. The percentage was highest among non-Hispanic AIAN women (36.4%), followed by non-Hispanic black women (34.7%). However, like the overweight category, the percentage of women with obesity before pregnancy was lowest among non-Hispanic Asian women (7.5%).

Education

- The percentage of women who were underweight before pregnancy generally decreased as education increased, ranging from 4.8% among women with less than a high school degree to 3.5% among those with some college education or a college degree.
- The percentage of women with a normal prepregnancy weight (53.5%) was highest among those with a college degree.
- The percentage of women who were overweight before pregnancy ranged from 24.5% among those with a college degree to 27.6% among those with less than a high school degree but was significantly higher among women with at least some college education (26.0%) compared with those with a high school degree (25.7%).
- Women with a college degree were less likely to have obesity (18.8%) compared with women with less than a college degree (26.2%–29.8%).

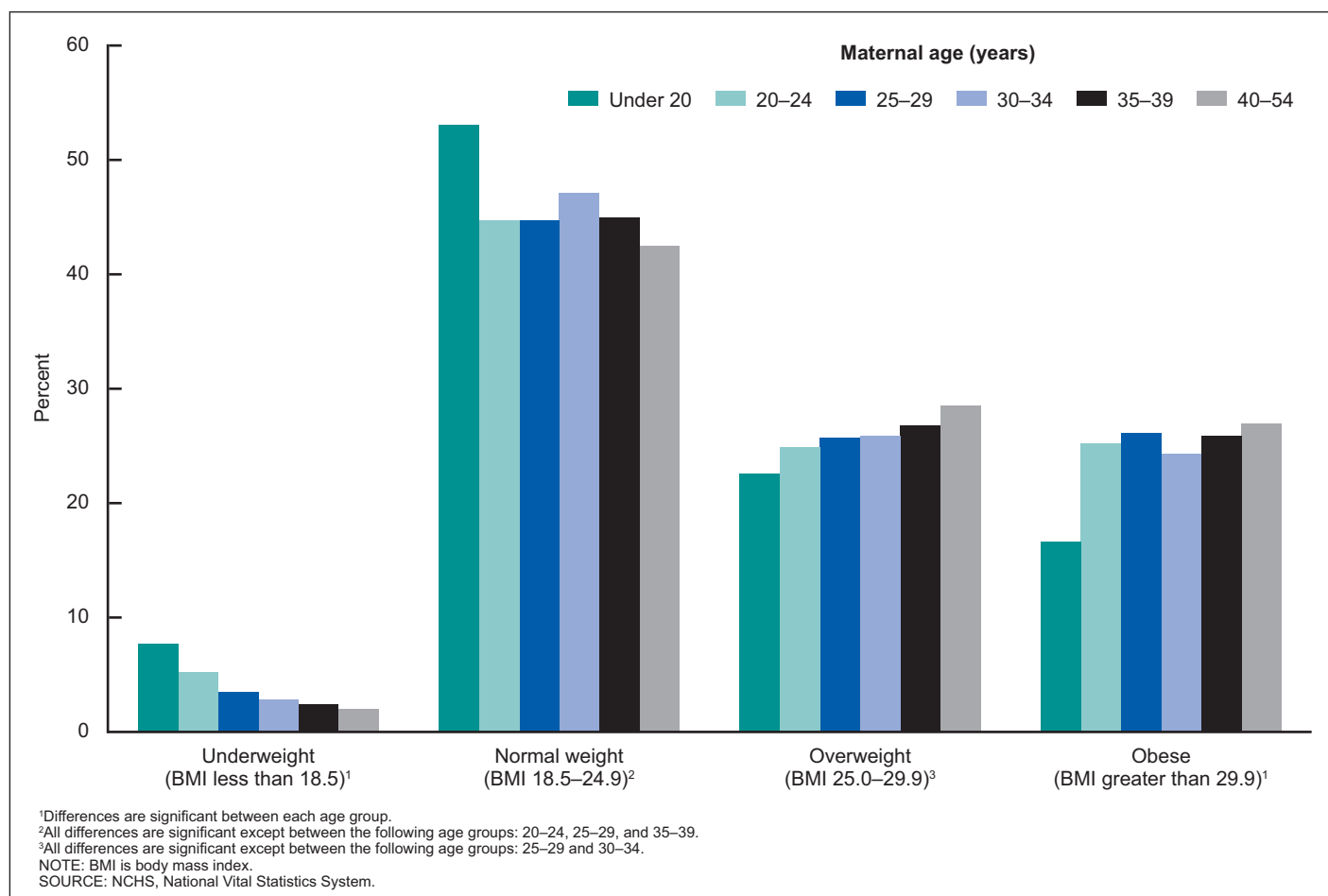


Figure 1. Prepregnancy body mass index, by mother's age: 47 states and the District of Columbia, 2014

Parity

- The percentage of women who were underweight before pregnancy was highest among women giving birth for the first time (4.7%). This percentage decreased as parity increased, thus women having their fourth birth or higher (2.5%) had the lowest percentage of those in the underweight category.
- The normal weight category followed the same pattern as the underweight category. Women having their first birth (50.8%) had the highest percentage and women having their fourth birth or more (36.1%) had the lowest percentage of those having a normal prepregnancy weight.
- Patterns of overweight and obesity were reversed compared with the underweight and normal weight categories. The percentage of women who were overweight before pregnancy increased with the number of previous births, ranging from 23.7% (first birth) to 28.6% (fourth birth or more).
- Similar to the overweight category, the percentage of women with obesity before pregnancy increased with birth order, from 20.7% among those having their first birth to 32.8% among those having their fourth birth or more.

Source of payment

- The percentage of women who were underweight ranged by source of payment, from 3.1% (privately insured) to 4.9% (self-payment).
- The percentage of women with a normal prepregnancy weight was lowest among those using Medicaid (40.3%) for delivery payment and highest among those using self-payment (52.5%).
- A slight variation was observed among those who were overweight before pregnancy by source of payment for delivery, ranging from 25.0% (self-payment) to 27.7% (other payment). The percentage did not differ between women using private insurance and those using self-payment at the time of delivery.
- For the obesity category, there was greater variation by source of payment for delivery. Women using self-payment (17.6%) had the lowest percentage, whereas women paying via Medicaid (29.2%) had the highest percentage.

State of residence

- Among the 48 reporting jurisdictions in 2014, the percentage of women in the prepregnancy underweight category ranged from a low of 2.2% (Minnesota) to a high of 4.8% (West Virginia) (Figure 3, Table 2).

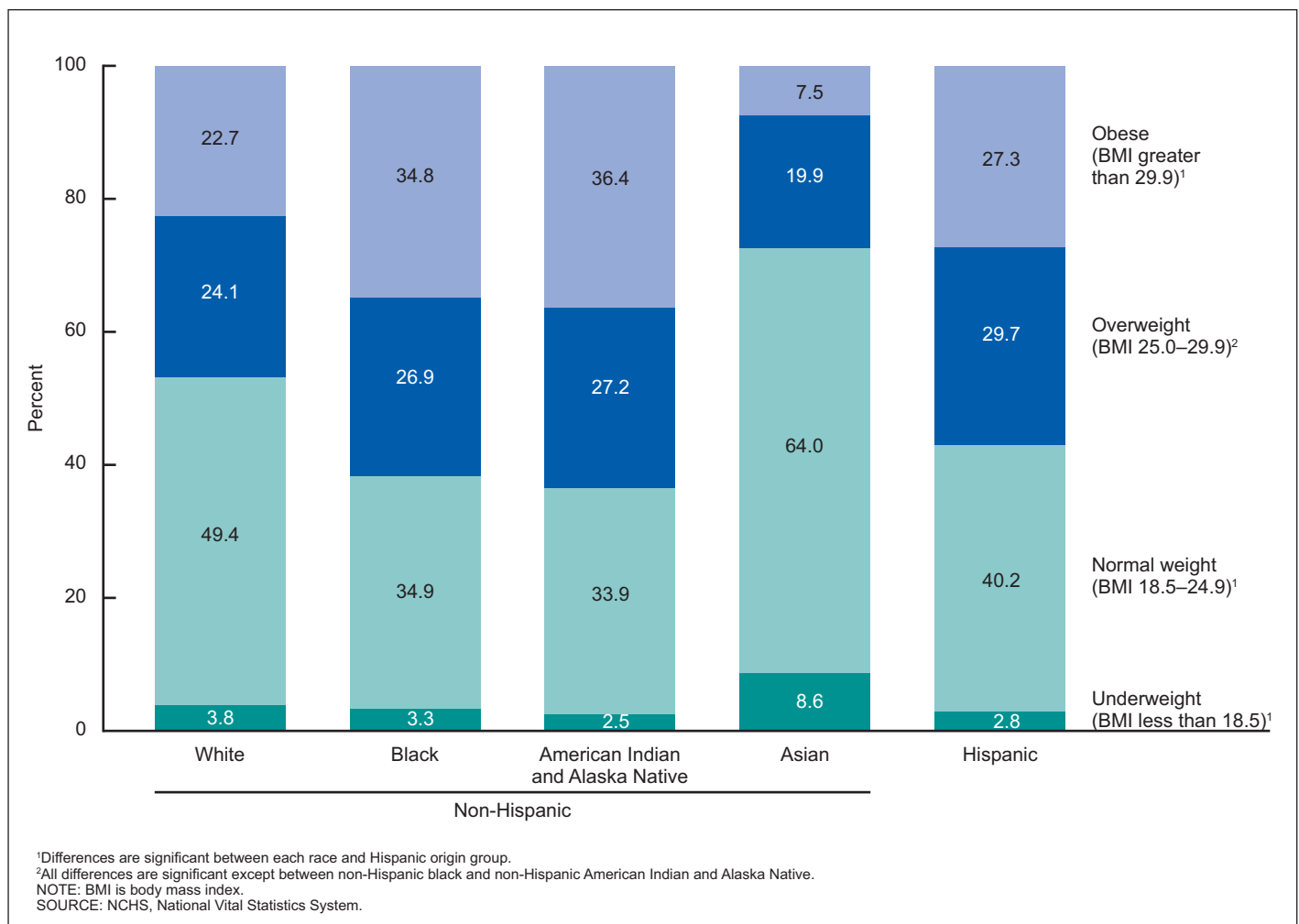


Figure 2. Percent distribution of prepregnancy body mass index, by race and Hispanic origin: 47 states and the District of Columbia, 2014

- Utah (53.1%) had the highest percentage of women in the prepregnancy normal weight category, whereas Mississippi (39.4%) had the lowest.
- The range for the prepregnancy overweight category was narrower among states compared with the underweight, normal weight, and obesity categories and was lowest in D.C. (22.5%) and highest in Minnesota (27.5%).
- Prepregnancy obesity ranged from 19.2% (Massachusetts) to 32.1% (Mississippi).
- Fifteen states (Alabama, Arkansas, Arizona, Georgia, Kentucky, Louisiana, Missouri, Mississippi, North Carolina, New Mexico, Ohio, Oklahoma, South Carolina, Tennessee, and West Virginia) had higher prepregnancy underweight and obesity percentages than the national rate.
- Between 2011 and 2014, 30 of 37 areas reporting prepregnancy BMI in both years had increases in prepregnancy obesity. There were no significant changes among 7 reporting areas (D.C., Montana, North Dakota, South Carolina, South Dakota, Washington, and Wyoming) (Figure 4, Table 3).
- Two states, Oklahoma (11%) and Vermont (12%), had increases in obesity over 10%.

Discussion

This report describes prepregnancy BMI status among U.S. women giving birth in 2014 from 47 states and D.C. that used the 2003 birth certificate revision by January 1, 2014. Among women giving birth in these reporting areas in 2014, more than 50% were overweight or had obesity, and 4% were underweight prior to becoming pregnant. Prepregnancy obesity was more likely to occur among non-Hispanic AIAN, non-Hispanic black, and Hispanic women as well as women using Medicaid as the source of payment for delivery. Of the education groups compared, obesity was lowest among women with a college degree. The prevalence of overweight or obesity before pregnancy increased as parity increased. Prepregnancy obesity increased in 30 of 36 states and D.C. between 2011 and 2014 among those using the 2003 birth certificate revision by January 1, 2011.

A previous *National Vital Statistics* report on new items from the 2003 birth certificate revision reported by 36 states and D.C. as of 2011 showed that 23% of women in this reporting area had obesity

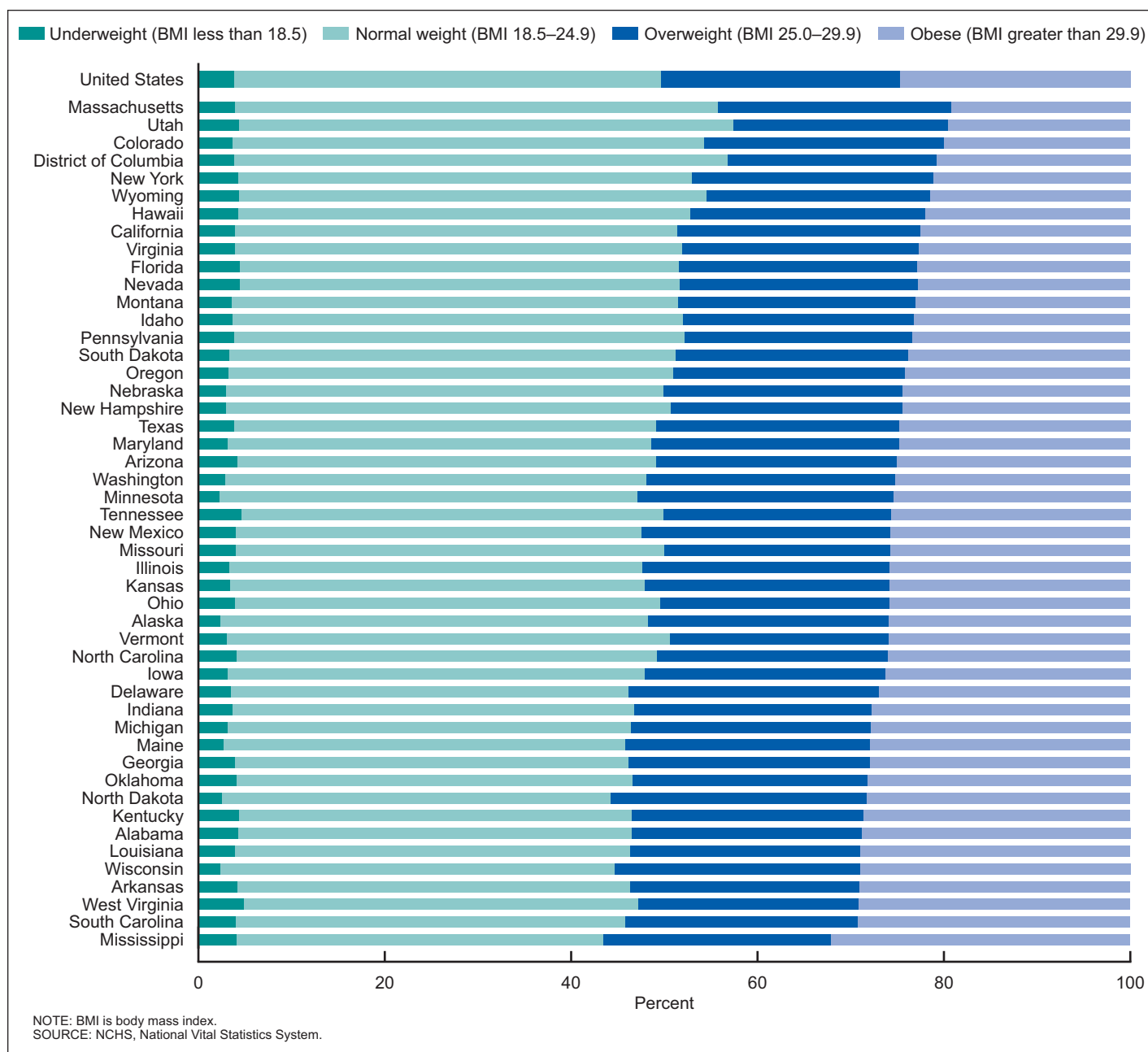


Figure 3. Prepregnancy body mass index distribution, by reporting area: 47 states and the District of Columbia, 2014

before pregnancy, ranging from 18% (Utah) to 29% (South Carolina) (13). The prevalence reported in the 2014 birth data is higher but could reflect differences in demographic characteristics by the additional reporting areas, although the state-specific trend analysis in this report demonstrated increases in prepregnancy obesity for the majority of comparable reporting areas between 2011 and 2014.

Findings from the birth certificate compared with other data sources

Few studies are available to compare results. Among them, the Pregnancy Risk Assessment Monitoring System (PRAMS) is a population-based survey conducted at the state level that has been

used to estimate prevalence and trends in prepregnancy obesity among a sample of women who have recently given birth. However, as of 2014, PRAMS is not conducted in every state and therefore cannot provide national estimates (14). In addition, maternal prepregnancy BMI in PRAMS is assessed 2 to 6 months after birth as part of the survey questionnaires. Using data from 26 PRAMS states and New York City, Chu et al. reported that 5% of women giving birth in 2004–2005 were underweight, 53% were of normal weight, 23% were overweight, and 19% had obesity (15). Higher percentages of prepregnancy obesity, lower percentages of underweight, and similar percentages of normal weight and overweight were reported in the 2014 natality data among the 48 jurisdictions reporting prepregnancy weight and height. Another analysis of PRAMS data

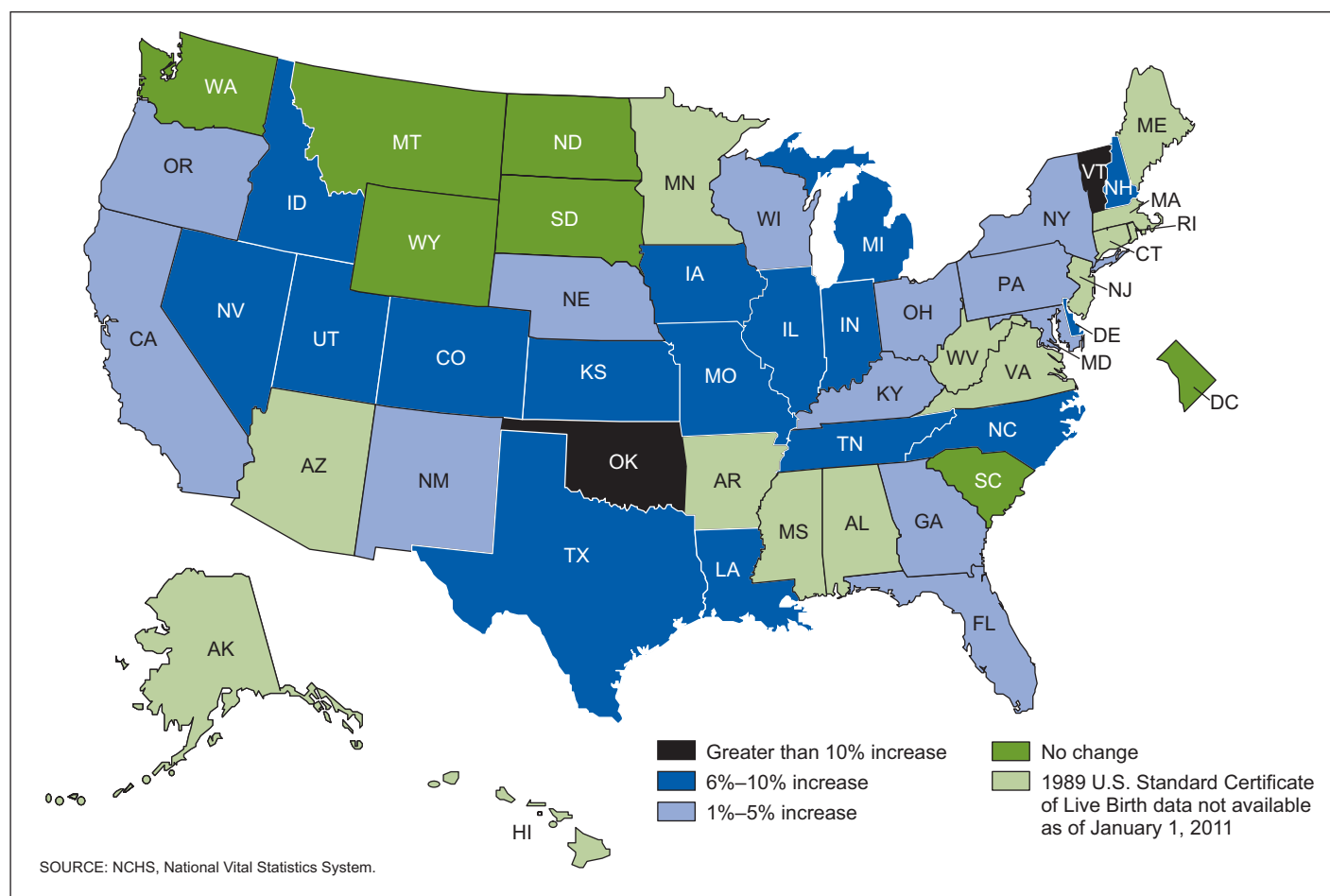


Figure 4. Percentage change in prepregnancy obesity between 2011 and 2014, by reporting area: 36 states and the District of Columbia

assessing trends in prepregnancy obesity among 20 states indicated an increase from 17.6% in 2003 to 20.5% in 2009 (16). The overall percentage of prepregnancy obesity from the 2011 PRAMS (20.7%), the most recent data currently available, was similar to data reported by Fisher et al. However, several PRAMS states reported percentages of prepregnancy obesity of 23% or more, which is closer to what was reported overall from the 2014 birth certificate (17). However, direct comparisons cannot be made due to differences in the time span and reporting areas.

Data on BMI status among all women is more readily available at the national level and there have been reports of BMI among women of reproductive age, usually defined as those aged 20–44. The National Health and Nutrition Examination Survey (NHANES), a complex probability-based survey that provides nationally representative estimates, reported that 34% of all women aged 20–39 had obesity in 2011–2014 according to measured height and weight (18). Patterns of obesity among non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and Hispanic women from NHANES were comparable to the results from the birth certificate data (18). In addition, patterns of prepregnancy obesity by state from the birth certificate generally correspond with those of all adult women using the Behavioral Risk Factor Surveillance System (19). However, women giving birth are a subset of women of childbearing age and differ from all women by various characteristics, particularly

age, which further prevents direct comparisons. Younger women are disproportionately represented among women giving birth compared with all women of reproductive age, with the majority of births occurring to women aged 20–34 (20,21). Birth rates are also highest among this age group (20).

Underreporting of BMI data and potential quality issues

It is recommended that maternal prepregnancy weight and height data are collected on the maternal worksheet at the time of delivery (11). It is well established that height is often overreported and weight underreported when self-report methods of anthropometric measurement are used, and this underreporting differs according to various characteristics, particularly weight status (22,23). This could result in misclassification bias in studies evaluating the effects of obesity or weight status on health outcomes. One recent study assessed the quality of self-reported prepregnancy weight data by evaluating birth certificate data and medical records. This study compared the medical records and birth certificate data of a large sample of women from Pennsylvania giving birth to singleton infants between 2003 and 2010 (24). It found that agreement of prepregnancy BMI on the birth certificate and medical record varied from 52% to 100% depending on the mother's BMI, race and ethnicity, and the

gestational age of the child at birth (24). Less agreement occurred for underweight women or those with obesity, among non-Hispanic black women compared with non-Hispanic white women, and among those giving birth preterm compared with those delivering at term. Birth certificate data quality studies conducted by NCHS did not include an assessment of the maternal worksheet and therefore did not evaluate the quality of reported height and weight (25). Studies of prepregnancy BMI using the birth certificate data should consider the possibility of misreported height and weight and misclassification and its effects on analysis.

This report provides descriptive information on prepregnancy BMI for births in 47 states and D.C. (96% of all births) occurring in 2014 and shows that approximately one-half of women were overweight or had obesity prior to becoming pregnant. Since prepregnancy BMI will be available from all reporting areas as of the 2016 data year, the birth certificate data can be used to fill a vital gap in describing and tracking BMI, specifically among childbearing women in the United States. This data will provide opportunities to further explore differences by race and ethnicity group as well as pregnancy and birth-related characteristics.

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Table 1. Prepregnancy body mass index, by selected maternal characteristics: 47 states and the District of Columbia, 2014

Maternal characteristics	Total number	BMI ¹				Not stated
		Underweight (BMI less than 18.5)	Normal weight (BMI 18.5–24.9)	Overweight (BMI 25.0–29.9)	Obese (BMI greater than 29.9)	
		Rate (percent)				
Total reporting area ²	3,837,663	3.78	45.86	25.58	24.78	150,976
Age group (years)						
Under 20	246,088	7.66	53.11	22.63	16.59	9,172
20–24	859,549	5.18	44.72	24.87	25.22	31,394
25–29	1,106,455	3.49	44.72	25.73	26.06	41,370
30–34	1,031,233	2.83	47.06	25.86	24.26	41,500
35–39	482,335	2.37	44.97	26.79	25.87	21,839
40–54	112,003	2.01	42.50	28.47	27.01	5,701
Race and Hispanic origin						
Non-Hispanic white	2,034,846	3.79	49.40	24.08	22.73	63,104
Non-Hispanic black	545,021	3.34	34.90	26.93	34.83	29,693
Non-Hispanic American Indian and Alaska Native	32,529	2.54	33.86	27.21	36.40	965
Non-Hispanic Asian	231,310	8.61	63.95	19.94	7.50	11,364
Hispanic	875,474	2.79	40.17	29.73	27.31	34,581
Educational attainment						
Less than high school	573,564	4.76	41.49	27.56	26.19	25,808
High school	953,831	4.32	41.11	25.72	28.84	39,752
Some college	812,796	3.49	40.67	26.04	29.81	24,767
College degree	1,447,635	3.18	53.54	24.45	18.83	47,546
Parity						
1st	1,489,089	4.74	50.84	23.73	20.69	54,805
2nd	1,216,483	3.55	45.87	25.76	24.82	45,433
3rd	644,154	2.91	41.38	27.31	28.39	24,772
4th or more	468,409	2.49	36.08	28.64	32.80	21,022
Source of payment						
Medicaid	1,662,904	4.38	40.28	26.11	29.22	62,072
Private insurance	1,812,581	3.14	50.38	24.96	21.52	62,893
Self-pay	155,331	4.93	52.50	25.01	17.56	10,364
Other	165,993	3.57	45.88	27.68	22.87	6,110

¹BMI is body mass index; see Methods for calculation.²Total reporting area represented 96% of all U.S. births in 2014 and excluded Connecticut, New Jersey, and Rhode Island.

Table 2. Prepregnancy body mass index, by state: 47 states and the District of Columbia, 2014

	BMI ¹					Not stated
	Total number	Underweight	Normal weight	Overweight	Obese	
		(BMI less than 18.5)	(BMI 18.5–24.9)	(BMI 25.0–29.9)	(BMI greater than 29.9)	
Rate (percent)						
Alabama	59,422	4.21	42.29	24.67	28.83	1,859
Alaska	11,392	2.30	45.94	25.82	25.94	291
Arizona	86,887	4.18	44.87	25.88	25.07	536
Arkansas	38,511	4.11	42.15	24.63	29.12	1,052
California	502,879	3.88	47.50	26.09	22.52	21,849
Colorado	65,830	3.65	50.56	25.74	20.05	1,921
Delaware	10,972	3.45	42.70	26.84	27.02	123
District of Columbia	9,509	3.77	52.98	22.47	20.78	487
Florida	219,991	4.43	47.08	25.65	22.83	13,120
Georgia	130,946	3.87	42.28	25.86	27.99	14,686
Hawaii	18,550	4.25	48.50	25.22	22.03	889
Idaho	22,876	3.58	48.42	24.71	23.29	57
Illinois	158,556	3.24	44.40	26.51	25.86	5,871
Indiana	84,080	3.66	43.09	25.45	27.80	344
Iowa	39,687	3.13	44.75	25.83	26.29	175
Kansas	39,223	3.37	44.54	26.20	25.89	547
Kentucky	56,170	4.36	42.12	24.83	28.70	517
Louisiana	64,497	3.85	42.47	24.66	29.02	2,069
Maine	12,698	2.62	43.14	26.33	27.91	113
Maryland	73,921	3.13	45.39	26.66	24.82	2,533
Massachusetts	71,908	3.84	51.89	25.07	19.20	4,096
Michigan	114,375	3.13	43.26	25.75	27.86	4,295
Minnesota	69,904	2.23	44.87	27.48	25.42	1,432
Mississippi	38,736	4.08	39.40	24.37	32.14	182
Missouri	75,360	3.93	45.99	24.29	25.79	1,008
Montana	12,432	3.51	47.96	25.43	23.09	191
Nebraska	26,794	2.96	46.90	25.73	24.41	263
Nevada	35,861	4.44	47.20	25.53	22.83	573
New Hampshire	12,302	2.95	47.67	24.88	24.50	653
New Mexico	26,052	3.95	43.58	26.70	25.76	1,386
New York	238,773	4.19	48.73	25.94	21.14	10,857
North Carolina	120,975	4.02	45.15	24.84	25.99	2,425
North Dakota	11,359	2.48	41.79	27.40	28.33	244
Ohio	139,467	3.89	45.68	24.54	25.90	4,253
Oklahoma	53,339	4.08	42.50	25.22	28.19	1,016
Oregon	45,556	3.22	47.67	24.88	24.23	881
Pennsylvania	142,268	3.80	48.39	24.38	23.43	9,160
South Carolina	57,627	3.98	41.79	25.01	29.22	708
South Dakota	12,283	3.30	47.84	24.98	23.87	147
Tennessee	81,602	4.61	45.23	24.48	25.68	2,490
Texas	399,766	3.78	45.34	26.08	24.80	2,809
Utah	51,154	4.32	53.12	23.02	19.53	681
Vermont	6,130	3.02	47.56	23.46	25.95	77
Virginia	103,300	3.84	48.06	25.40	22.70	25,421
Washington	88,585	2.82	45.26	26.65	25.28	4,764
West Virginia	20,301	4.84	42.39	23.58	29.19	592
Wisconsin	67,161	2.33	42.33	26.29	29.06	1,246
Wyoming	7,696	4.34	50.15	24.01	21.50	87

¹BMI is body mass index; see Methods for calculation.

Table 3. Prepregnancy obesity, by state: 36 states and the District of Columbia, 2011 and 2014 and percent change, 2011–2014

	Percent		Percent change
	2014	2011	2011–2014
California	22.5	21.6	4
Colorado	20.1	18.8	6
Delaware	27.0	24.7	10
District of Columbia	20.8	20.3	*
Florida	22.8	21.8	5
Georgia	28.0	27.3	3
Idaho	23.3	27.1	7
Illinois	25.9	24.1	7
Indiana	27.8	25.7	8
Iowa	26.3	24.8	6
Kansas	25.9	23.7	9
Kentucky	28.7	27.4	5
Louisiana	29.0	27.2	7
Maryland	24.8	23.7	5
Michigan	27.9	25.9	8
Missouri	25.8	24.4	6
Montana	23.1	22.9	*
Nebraska	24.4	23.5	4
Nevada	22.8	21.1	8
New Hampshire	24.5	22.6	9
New Mexico	25.8	24.8	4
New York	22.8	21.1	4
North Carolina	25.0	24.4	2
North Dakota	28.3	28.5	*
Ohio	25.9	24.8	4
Oklahoma	28.2	25.4	11
Oregon	24.2	23.4	4
Pennsylvania	23.4	22.9	3
South Carolina	29.2	28.6	*
South Dakota	23.9	23.2	*
Tennessee	25.7	24.3	6
Texas	24.8	23.3	6
Utah	19.5	18.0	8
Vermont	26.0	23.2	12
Washington	25.3	24.7	*
Wisconsin	29.1	27.8	5
Wyoming	21.5	22.1	*

*Percent change not significant at $p = 0.05$.

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