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Trends and Patterns in Menarche in the United States: 1995 through 2013–2017

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Abstract

Objective—This report presents national estimates of age at first menstrual period for women aged 15–44 in the United States in 2013–2017 based on data from the National Survey of Family Growth (NSFG). Estimates for 2013–2017 are compared with those from previous NSFG survey periods (1995, 2002, and 2006–2010).

Methods—Data for all survey periods analyzed are based on in-person interviews with nationally representative samples of women in the household population aged 15–44 in the United States. For the 2013–2017 survey period, interviews were conducted with 10,590 female respondents aged 15–44. In 2015–2017, the age range of the NSFG included women aged 15–49, but only those aged 15–44 were included in this analysis. The response rate for the 2013–2017 NSFG was 67.4% for women. Measures of menarche in this report include average age at first menstrual period, probability of first menstrual period at each age, and the relationship between age at menarche and age at first sexual intercourse.

Results—The median age at menarche decreased from 1995 (12.1) to 2013–2017 (11.9). The cumulative probability of menarche at young ages was higher in 2013–2017 compared with 1995. Differences in age at menarche exist by Hispanic origin and race, mother's education, and living arrangement at age 14. A decreasing linear trend in the probability of age at first sexual intercourse by age at menarche was seen.

Keywords: age at first menstrual period • first sexual intercourse • coitarche • National Survey of Family Growth

Introduction

This report focuses on age at first menstrual period, also known as age at menarche. It is useful to study demographic patterns in menarche because this biological milestone typically marks the start of the period

in which females can potentially get pregnant (1,2). Early menarche has been associated with earlier age at first sexual intercourse (3–7). One possible mechanism in which early menarche may result in earlier age at first sexual intercourse is that girls who experience menarche at younger ages may appear

older, have older friends, and be more likely to engage in negative behaviors such as missing school, smoking, and drinking (8–11). The younger the age at first menstrual period and first sexual intercourse, the longer the interval young women will potentially spend at risk of pregnancy. Differences in age at menarche across population subgroups may help explain differences in timing of first sexual intercourse and timing of first births. The relationship between age at menarche and the timing of first sexual intercourse in the United States has not been widely studied in the past few decades. Updated trend data help explain more recent patterns of age at menarche and timing of first sexual intercourse.

Studying demographic patterns and trends in menarche may also be informative because earlier age at menarche has been associated with greater risk of health problems including breast cancer, obesity, diabetes, and liver disease (12–14). In addition, early age at menarche is associated with early age at menopause (15). Reaching menarche earlier than peers has also been associated with higher risk of depression, eating disorders, and substance abuse during adolescence (8,15,16). Some explanations for early onset of menarche include genetics and body fat (via production of



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leptin), while others may be related to environmental factors that may impact reproductive hormones, such as growing up in a father-absent home, stepfather presence, and family conflict (8,12,16).

Since 1982, the National Survey of Family Growth (NSFG) has asked nationally representative samples of women aged 15–44 about their age at menarche. This report presents estimates on age at menarche using data from four of the more recent NSFG survey periods (1995, 2002, 2006–2010, and 2013–2017). This report provides national estimates on the trends in age at menarche in the United States and differentials in menarche timing by various characteristics including age, mother's education, and Hispanic origin and race. In addition, this report explores the relationship between age at menarche and timing of first sexual intercourse.

Methods

Data source

This report uses NSFG data from 1995, 2002, 2006–2010, and pooled NSFG data from 2013–2017 (2013–2015 and 2015–2017). The data were collected from women in face-to-face interviews—10,847 in 1995, 7,643 in 2002, 12,279 in 2006–2010, and 10,590 in 2013–2017—representative of the U.S. household population aged 15–44. The National Center for Health Statistics (NCHS) has been conducting NSFG since 1973 to collect data on fertility, proximate determinants of fertility, and reproductive health. NSFG is jointly planned and funded by NCHS and several other U.S. Department of Health and Human Services programs (see Acknowledgments). The response rate for women aged 15–44 in the NSFG was 78.5% in 1995, 80% in 2002, 78% in 2006–2010, and 67.4% in 2013–2017. More details on the sample design, fieldwork procedures, and variance estimation for the 2013–2017 NSFG were previously published (https://www.cdc.gov/nchs/nsfg/nsfg_2015_2017_puf.htm#design).

Measures of menarche and age at first sexual intercourse

This report measures age at menarche based on a question administered by interviewers to respondents asking, “How old were you when you had your *first* menstrual period?” (MENARCHE). For presentation purposes, the data on age at menarche are shown in five categories: age 10 or under, age 11, age 12, age 13, and age 14 or over. Age at first sexual intercourse is defined from a recode (VRY1STAG) based on a question asking respondents how old they were the first time they had sexual intercourse with a man.

Selected demographic variables

In this report, age at menarche is shown with respect to several key demographic characteristics including mother's education, living arrangement with parents at age 14, and Hispanic origin and race. Mother's education is included as a proxy for the respondent's socioeconomic status when she would have had her first menstrual period. Living arrangement with parents at age 14 is a measure of the family structure the respondent grew up in during her early teens and has been associated with timing of menarche. Hispanic origin and race are included in this report because previous studies have found an association between race and ethnicity and age at menarche (6,11). The definition of Hispanic origin and race used in this report considers the reporting of more than one race, in accordance with the 1997 guidelines from the Office of Management and Budget (18), and while not shown separately, data from respondents reporting more than one race are included in the total.

Statistical analysis

All estimates in this report are weighted to represent women aged 15–44 in the household population of the United States in 1995 (60.2 million), 2002 (61.6 million), and at the midpoint of 2006–2010 (61.7 million) and

2013–2017 (61.5 million). SAS software, Version 9.4 (<https://www.sas.com>), was used to produce statistics for this report. Probabilities in this report were calculated using the Kaplan-Meier procedure in the software program SUDAAN 11 (<https://www.rti.org/sudaan>). The Kaplan-Meier procedure fits the Kaplan-Meier model, or product-limit estimator, to estimate the survival function for a given population (18,19). This method takes censored data and the NSFG's complex survey design into account. The probability of menarche by age represents the expected proportion of women who have had a first period by a certain age. Probabilities were estimated based on retrospective reporting of the age at first menstrual period and first sexual intercourse. In this report, probabilities are described as percentages, such as the percentage of women who had their first period by age 12. Women whose period had not yet begun were set to missing in this analysis. Similar methodology was used to calculate the probability of first sexual intercourse, stratified by age at menarche. Significant differences between probabilities were tested using the PROC SURVIVAL procedure in SUDAAN. Each table in this report includes standard errors as a measure of the precision of each point estimate.

Results

Trends in mean age at menarche

Table 1 shows mean and median age at menarche among women aged 15–44 for four time periods from 1995 to 2013–2017. There was a decreasing linear trend in the median age at menarche in the United States from 1995 to 2013–2017. The median age at menarche decreased from 12.1 in 1995 to 11.9 in 2013–2017. In 2013–2017, one-half of women reached menarche by age 11 years and 10 months. There was no significant difference in mean age at menarche from 1995 through 2013–2017.

Cumulative probability of menarche by age

Table 2 shows the cumulative probability of menarche by age and selected characteristics. Among women aged 15–44 in the United States in 2013–2017, 10% reached menarche by age 10, 53% by age 12, and 90% by age 14. The cumulative probability of menarche at ages 8 through 12 years was higher in 2013–2017 compared with 1995 (Figure 1). In 2013–2017, 10% of women reached menarche by age 10 and 26% by age 11, compared with 7% and 21% of women in 1995, respectively.

Hispanic women had a higher probability of menarche at younger ages than non-Hispanic white women ($p = 0.02$). Among Hispanic women aged 15–44 in 2013–2017, 10% had reached menarche by age 10, 31% by age 11, and 56% by age 12. Among non-Hispanic white women, 9% had reached menarche by age 10, 23% by age 11, and 52% by age 12. The differences narrowed

in the older ages. Non-Hispanic black women were not significantly different than Hispanic or non-Hispanic white women in their probability of menarche at each age. The probability of reaching menarche by each age was generally higher for women whose mothers had a high school diploma or GED than those whose mothers had a bachelor’s degree ($p = 0.01$). Among women aged 15–44 in 2013–2017 whose mothers had a high school diploma or GED, 11% had reached menarche by age 10, 27% by age 11, and 55% by age 12. Among women whose mothers had a bachelor’s degree, 7% had reached menarche by age 10, 20% by age 11, and 49% by age 12.

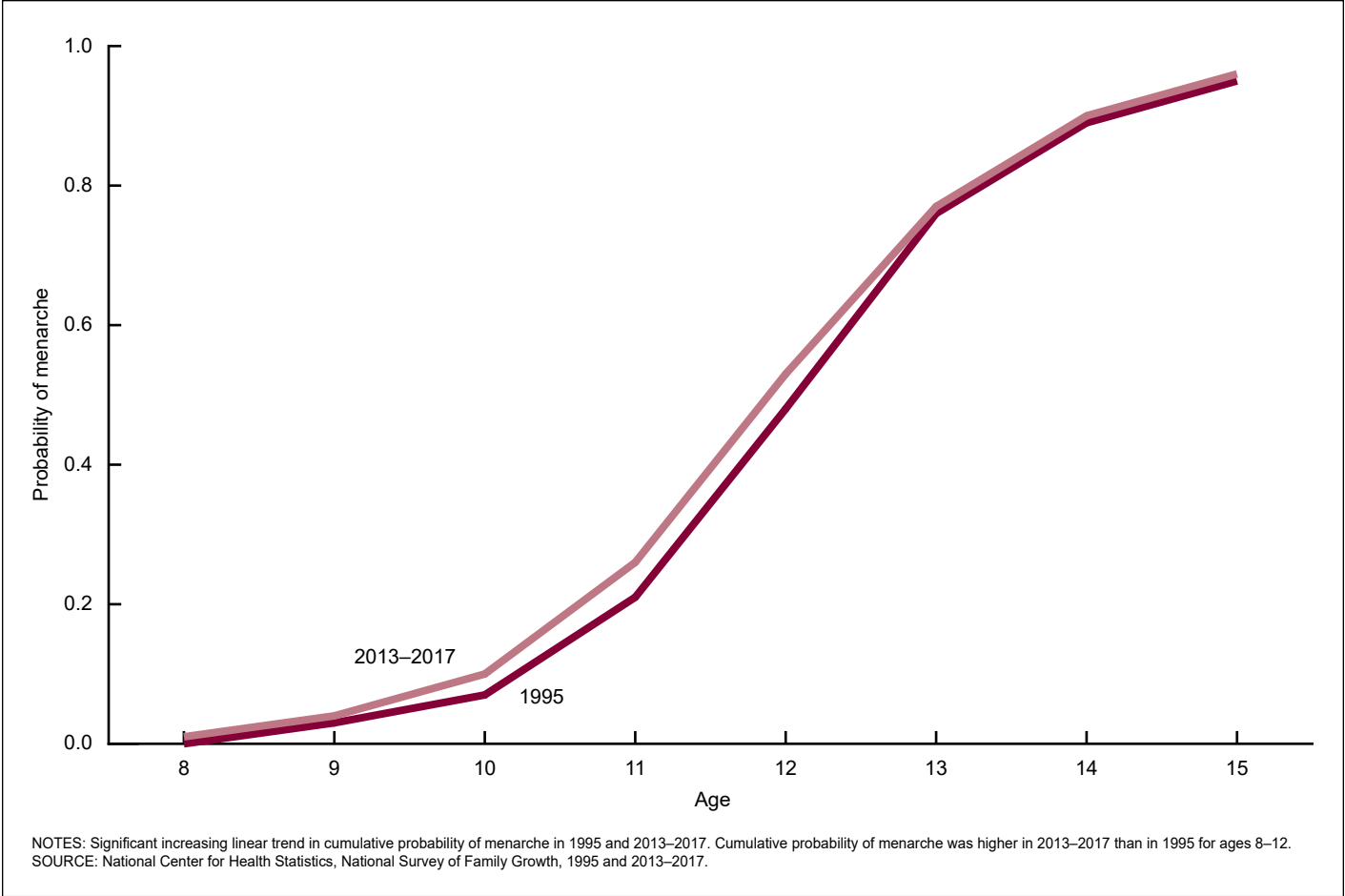
Women who lived with both parents at age 14 were more likely to have reached menarche at older ages than those who lived with a biological mother and a stepfather at age 14 ($p = 0.03$) and those who lived in some other type of family structure at age 14 ($p = 0.004$). Among women who lived with both

parents at age 14, 8% had reached menarche by age 10, 24% by age 11, and 52% by age 12. Among women who lived with their mother and stepfather at age 14, 15% had reached menarche by age 10, 32% by age 11, and 54% by age 12. Among women who lived in other types of living arrangements by age 14, 12% had reached menarche by age 10, 27% by age 11, and 56% by age 12.

Cumulative probability of first sexual intercourse by age

Table 3 looks at the probability of first sexual intercourse by selected ages, stratified by age at menarche. In 2013–2017, a significant decreasing linear trend in the probability of first sexual intercourse by age at menarche was seen. The older the age at menarche, the lower the probability of having had sexual intercourse by each age. For example, by age 14, 20% of women

Figure 1. Cumulative probability of menarche among women aged 15–44, by age: United States, 1995 and 2013–2017



whose age at menarche was 10 or under had experienced first sexual intercourse compared with 5% of those whose age at menarche was 14 or over. This pattern was seen for each of the teen years. By age 16, 53% of women whose age at menarche was 10 or under had experienced first sexual intercourse compared with 33% of those whose age at menarche was 14 or over. The probability of first sexual intercourse by each age, among women whose age at menarche was 10 or under, increased at each age from 1995 to 2013–2017, but was only significantly different by ages 16 through 18 (Figure 2). In 2013–2017, 53% of women who had reached menarche by age 10 or under had experienced first sexual intercourse by age 16, compared with 44% in 1995.

The relationship between age at menarche and the probability of first sexual intercourse also differed by Hispanic origin and race (Table 4). Earlier age at menarche was associated

with earlier age at first sexual intercourse for Hispanic and non-Hispanic white women at ages 15 and 16. But for non-Hispanic black women, age at menarche at 10 or under and at age 12 were similarly likely to have experienced first sexual intercourse at each age than those whose age at menarche was 14 or over (Figure 3). Nonetheless, among all three Hispanic origin and race groups, women who reached menarche at age 14 or over were less likely to have experienced sexual intercourse at each age compared with those who reached menarche at younger ages. Although the general pattern of decreasing likelihood of sexual intercourse with increasing age at menarche was consistent by Hispanic origin and race, not all results were statistically significant.

Table 5 shows the quartiles of age at first sexual intercourse by age at menarche for women in 1995 and 2013–2017. In both time periods, there was a linear trend in the median age

at first sexual intercourse by age at menarche. That is, the younger the age at menarche, the younger the median age at first sexual intercourse. For example, in 2013–2017 women who reached menarche by age 10 or under had an earlier median age at first sexual intercourse (age 15.4) compared with those whose age at menarche was 12 (age 16.0) and those whose age at menarche was 14 or over (age 16.6). The median age at first sexual intercourse by age at menarche was younger in 2013–2017 compared with 1995 (Figure 4).

Summary

This report looked at trends in age at menarche in the United States from 1995 to 2013–2017 and at the relationship between age at menarche and timing of first sexual intercourse. There was a decreasing trend in median age at menarche from age 12.1 in 1995 to

Figure 2. Cumulative probability of first sexual intercourse among women whose age at menarche was 10 or younger, by age: United States, 1995 and 2013–2017

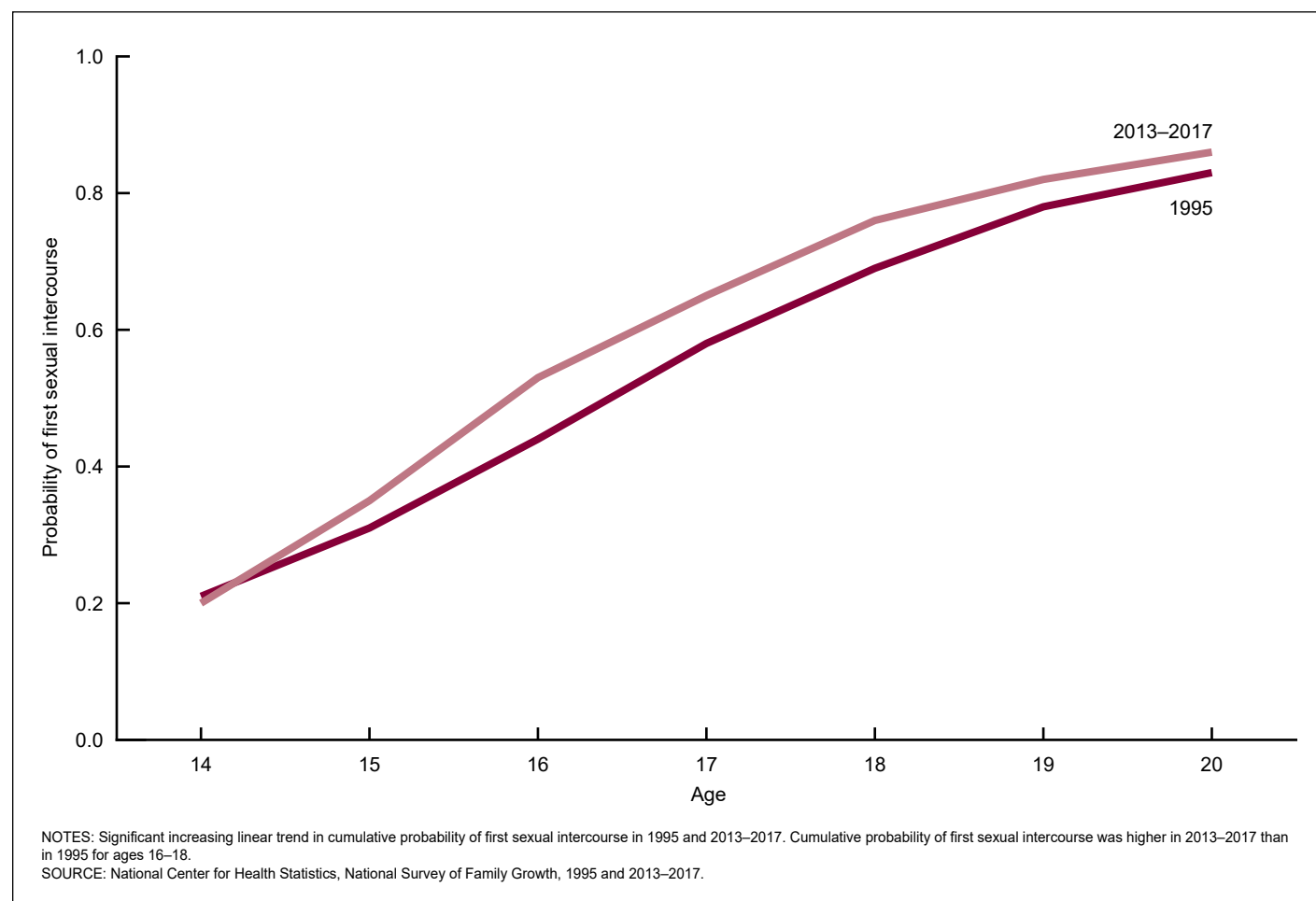


Figure 3. Cumulative probability of first sexual intercourse, by selected age at menarche and Hispanic origin and race: United States, 2013–2017

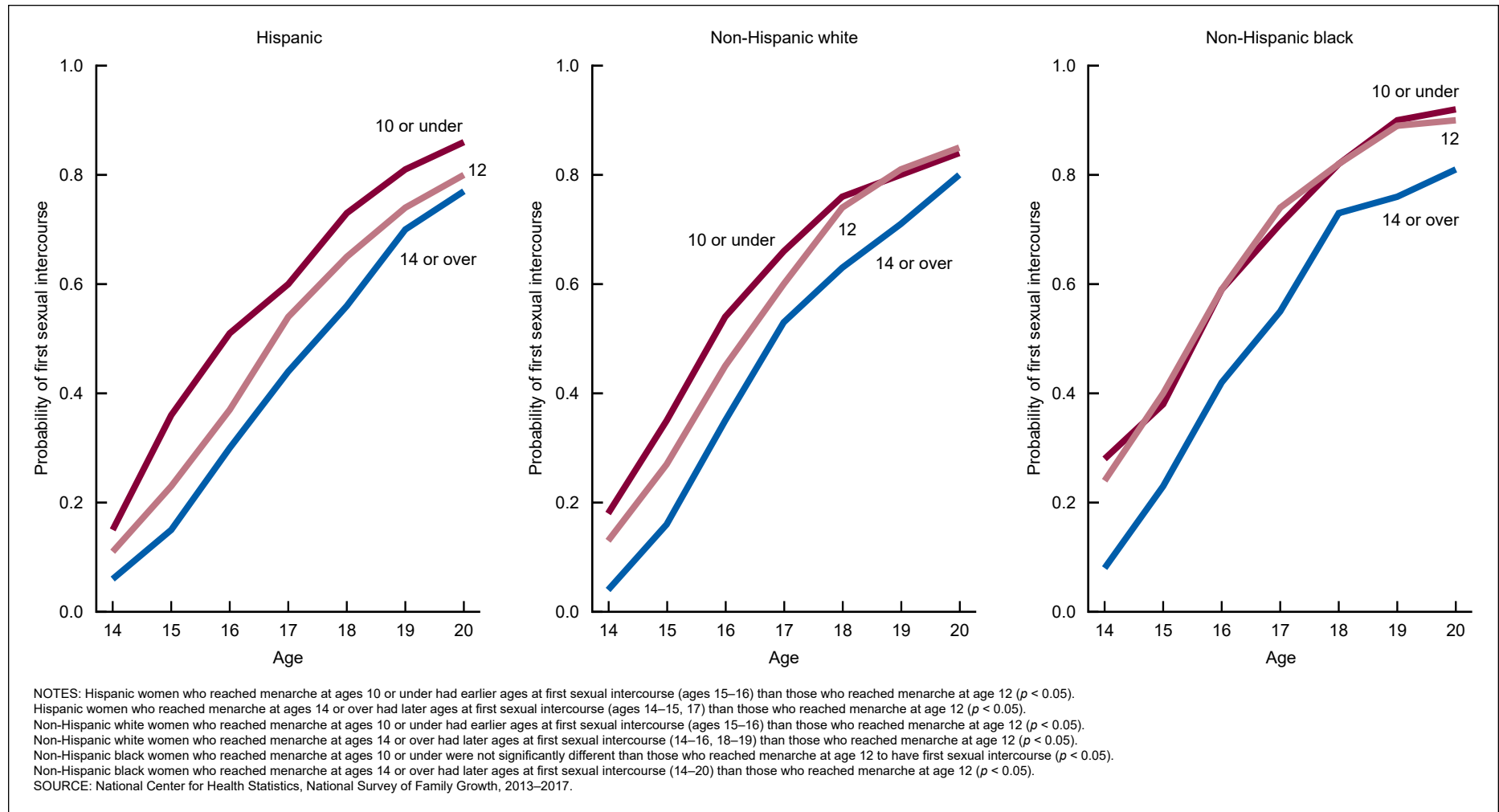
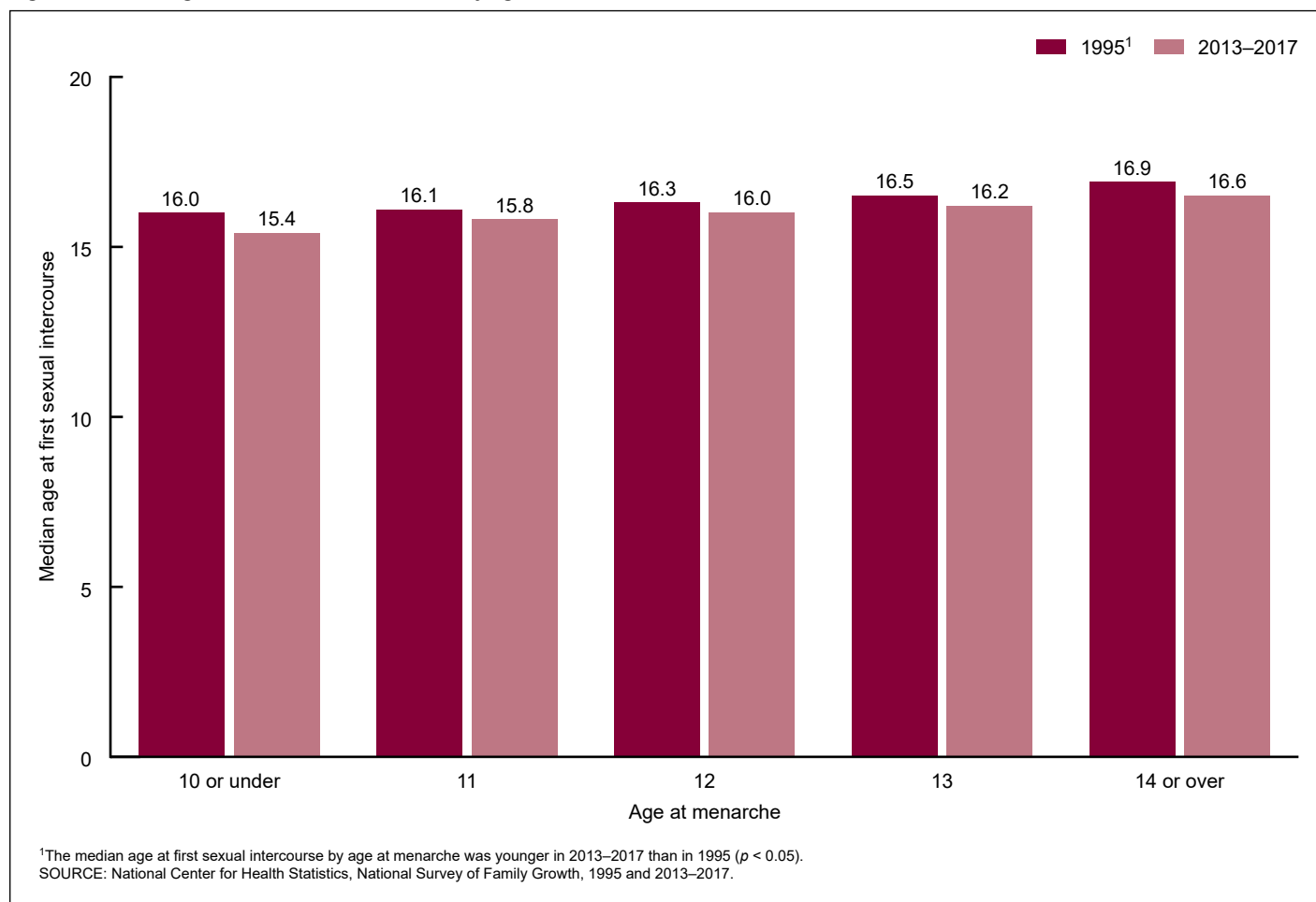


Figure 4. Median age at first sexual intercourse, by age at menarche: United States, 1995 and 2013–2017

age 11.9 in 2013–2017. The cumulative probability of reaching menarche by each age was higher in 2013–2017 compared with 1995. Among women aged 15–44 in 2013–2017, 10% had reached menarche by age 10 compared with 7% of women in 1995. A higher percentage of Hispanic women reached menarche by age 10 compared with non-Hispanic white women. Unlike prior research, non-Hispanic black women were not significantly different than Hispanic or non-Hispanic white women in their probability of menarche at each age.

Women from higher socioeconomic backgrounds, as measured by their mother's education, were less likely to reach menarche at an early age compared with those from lower socioeconomic backgrounds. Similarly, women who lived with both parents at age 14 were less likely to reach menarche at an early age compared with those who lived with their mother and a stepfather or those who lived in other types of family

structures at age 14. An increasing linear trend in the probability of age at first sexual intercourse by age at menarche was seen. That is, on average, the older a woman was when she reached menarche, the older her age at first sexual intercourse. This relationship also held true by Hispanic origin and race, although this pattern was not statistically significant for all ages.

Several limitations should be taken into consideration when interpreting these results. Data presented in this report are bivariate associations that may be explained by other factors not controlled for in the tables and figures. For example, race differences in timing of menarche may reflect differences by race in socioeconomic status, family structure, nutrition, and poverty level. In addition, for some women, living arrangements at age 14 may be different than living arrangements in earlier years. This report provides national estimates on the trends in age at menarche and the association

between timing of menarche and timing of first sexual intercourse.

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Table 1. Average age at menarche among women aged 15–44 in the United States: 1995 through 2013–2017

Survey year	Unweighted numbers	Number (in thousands)	Age at menarche	
			Mean (standard error) ¹	Median (standard error) ²
1995	10,847	60,201	12.6 (0.02)	12.1 (0.02)
2002	7,643	61,561	12.6 (0.03)	12.0 (0.03)
2006–2010	12,279	61,755	12.5 (0.03)	12.0 (0.03)
2013–2017	10,590	61,560	12.5 (0.03)	11.9 (0.04)

¹Mean age at menarche in 1995 was significantly different than 2006–2010 and 2013–2017. Mean age at menarche in 2002 was significantly different than in 2006–2010 and 2013–2017.

²Median age at menarche in 1995 was significantly different than 2002, 2006–2010, and 2013–2017. Median age at menarche in 2002 was significantly different than in 2013–2017. Median age at menarche in 2006–2010 was significantly different than in 2013–2017.

SOURCE: National Center for Health Statistics, National Survey of Family Growth, 1995, 2002, 2006–2010, and 2013–2017.

Table 2. Cumulative probability of menarche, by age and selected demographic characteristics: United States, 2013–2017

Characteristic	Age at menarche							
	8	9	10	11	12	13	14	15
	Percent (standard error)							
Total	0.01 (0.001)	0.04 (0.003)	0.10 (0.004)	0.26 (0.008)	0.53 (0.009)	0.77 (0.008)	0.90 (0.005)	0.96 (0.003)
Hispanic origin and race								
Hispanic or Latina ¹	0.01 (0.002)	0.04 (0.006)	0.10 (0.008)	0.31 (0.014)	0.56 (0.018)	0.79 (0.013)	0.91 (0.010)	0.96 (0.007)
Non-Hispanic white	0.00 (0.002)	0.04 (0.005)	0.09 (0.006)	0.23 (0.011)	0.52 (0.013)	0.76 (0.012)	0.90 (0.008)	0.95 (0.005)
Non-Hispanic black or African American	0.01 (0.003)	0.06 (0.008)	0.14 (0.011)	0.30 (0.017)	0.56 (0.017)	0.76 (0.016)	0.88 (0.011)	0.95 (0.007)
Mother's education ²								
No high school diploma or GED ³	0.01 (0.002)	0.04 (0.006)	0.11 (0.008)	0.28 (0.012)	0.54 (0.017)	0.76 (0.015)	0.89 (0.011)	0.96 (0.008)
High school diploma or GED	0.01 (0.001)	0.05 (0.005)	0.11 (0.006)	0.27 (0.009)	0.55 (0.011)	0.78 (0.010)	0.90 (0.006)	0.96 (0.004)
Bachelor's degree or higher	0.01 (0.003)	0.03 (0.005)	0.07 (0.007)	0.20 (0.013)	0.49 (0.016)	0.75 (0.016)	0.90 (0.011)	0.95 (0.008)
Living arrangement with parents at age 14								
Both biological or adoptive parents ⁴	0.00 (0.001)	0.03 (0.003)	0.08 (0.005)	0.24 (0.010)	0.52 (0.011)	0.76 (0.010)	0.89 (0.007)	0.95 (0.004)
Biological mother and stepfather	0.01 (0.002)	0.06 (0.012)	0.15 (0.016)	0.32 (0.023)	0.54 (0.022)	0.79 (0.021)	0.91 (0.013)	0.96 (0.008)
Other living arrangement	0.01 (0.003)	0.05 (0.006)	0.12 (0.009)	0.27 (0.012)	0.56 (0.014)	0.78 (0.012)	0.91 (0.008)	0.97 (0.005)

¹Cumulative probability of menarche at each age was significantly different for Hispanic women than for non-Hispanic white women ($p = 0.02$).

²Women who did not report a mother figure were set to missing on mother's level of education.

³Cumulative probability of menarche at each age was significantly different for women whose mother had a high school diploma or GED compared with those whose mothers had a bachelor's degree ($p = 0.03$).

⁴Cumulative probability of menarche at each age was significantly different for women who lived with both parents at age 14 compared with those who lived with their mother and a stepfather or in some other living arrangement ($p = 0.003$).

SOURCE: National Center for Health Statistics, National Survey of Family Growth, 2013–2017.

Table 3. Cumulative probability of first sexual intercourse among women aged 15–44, by age at menarche: United States, 2013–2017

Age at menarche ¹	Age at first sexual intercourse						
	14	15	16	17	18	19	20
	Percent (standard error)						
10 or under	0.20 (0.017)	0.35 (0.020)	0.53 (0.024)	0.65 (0.022)	0.76 (0.020)	0.82 (0.018)	0.86 (0.016)
11	0.16 (0.012)	0.30 (0.017)	0.45 (0.019)	0.59 (0.020)	0.70 (0.018)	0.78 (0.016)	0.83 (0.015)
12	0.14 (0.009)	0.27 (0.014)	0.44 (0.015)	0.59 (0.015)	0.71 (0.014)	0.78 (0.013)	0.83 (0.012)
13	0.11 (0.009)	0.23 (0.013)	0.37 (0.016)	0.52 (0.017)	0.65 (0.018)	0.72 (0.018)	0.78 (0.017)
14 or over	0.05 (0.006)	0.16 (0.012)	0.33 (0.017)	0.49 (0.020)	0.61 (0.020)	0.69 (0.019)	0.77 (0.018)

¹Significant linear trend in cumulative age at first sexual intercourse by age at menarche.

SOURCE: National Center for Health Statistics, National Survey of Family Growth, 2013–2017.

Table 4. Cumulative probability of first sexual intercourse among women aged 15–44, by age at menarche and race and Hispanic origin: United States, 2013–2017

Age at menarche and race and Hispanic origin	Age at first sexual intercourse						
	14	15	16	17	18	19	20
Hispanic ¹	Percent (standard error)						
10 or under	0.15 (0.036)	0.36 (0.047)	0.51 (0.047)	0.60 (0.045)	0.73 (0.035)	0.81 (0.032)	0.86 (0.028)
11	0.12 (0.021)	0.26 (0.034)	0.40 (0.040)	0.55 (0.034)	0.67 (0.031)	0.78 (0.029)	0.85 (0.032)
12	0.11 (0.014)	0.23 (0.027)	0.37 (0.026)	0.54 (0.026)	0.65 (0.027)	0.74 (0.027)	0.80 (0.027)
13	0.09 (0.017)	0.21 (0.032)	0.36 (0.039)	0.49 (0.041)	0.62 (0.036)	0.72 (0.037)	0.80 (0.043)
14 or over	0.06 (0.015)	0.15 (0.024)	0.30 (0.031)	0.44 (0.035)	0.56 (0.037)	0.70 (0.035)	0.77 (0.034)
Non-Hispanic white ²							
10 or under	0.18 (0.022)	0.35 (0.029)	0.54 (0.035)	0.66 (0.031)	0.76 (0.030)	0.80 (0.028)	0.84 (0.026)
11	0.16 (0.014)	0.31 (0.025)	0.46 (0.028)	0.60 (0.028)	0.72 (0.026)	0.80 (0.022)	0.84 (0.019)
12	0.13 (0.013)	0.27 (0.022)	0.45 (0.022)	0.60 (0.024)	0.74 (0.020)	0.81 (0.018)	0.85 (0.017)
13	0.11 (0.013)	0.22 (0.014)	0.37 (0.020)	0.52 (0.022)	0.65 (0.022)	0.72 (0.022)	0.79 (0.019)
14 or over	0.04 (0.007)	0.16 (0.017)	0.35 (0.025)	0.53 (0.028)	0.63 (0.026)	0.71 (0.029)	0.80 (0.027)
Non-Hispanic black ³							
10 or under	0.28 (0.029)	0.38 (0.035)	0.59 (0.039)	0.71 (0.039)	0.82 (0.036)	0.90 (0.027)	0.92 (0.028)
11	0.30 (0.039)	0.41 (0.043)	0.54 (0.041)	0.68 (0.038)	0.78 (0.032)	0.84 (0.030)	0.87 (0.028)
12	0.24 (0.025)	0.40 (0.031)	0.59 (0.031)	0.74 (0.024)	0.82 (0.023)	0.89 (0.018)	0.90 (0.017)
13	0.15 (0.022)	0.27 (0.030)	0.46 (0.035)	0.67 (0.036)	0.78 (0.035)	0.85 (0.030)	0.87 (0.030)
14 or over	0.08 (0.013)	0.23 (0.023)	0.42 (0.030)	0.55 (0.034)	0.73 (0.032)	0.76 (0.032)	0.81 (0.032)

¹Significant linear trend for Hispanic women in age at first sexual intercourse (ages 15–16,18) by age at menarche ($p < 0.05$).²Significant linear trend for non-Hispanic white women in age at first sexual intercourse (ages 14–19) by age at menarche ($p < 0.05$).³Significant linear trend for non-Hispanic black women in age at first sexual intercourse (ages 14–16) by age at menarche ($p < 0.05$).

SOURCE: National Center for Health Statistics, National Survey of Family Growth, 2013–2017.

Table 5. Quartiles of age at first sexual intercourse, by age at menarche: United States, 1995 and 2013–2017

Age at menarche	1995			2013–2017		
	First quartile	Second quartile ¹	Third quartile	First quartile	Second quartile ¹	Third quartile
10 or under	14.2	16.0	18.0	13.8	15.4	17.1
11	14.3	16.1	18.0	14.2	15.8	17.7
12	14.7	16.3	18.3	14.4	16.0	17.8
13	14.9	16.5	18.3	14.7	16.2	17.9
14 or over	15.5	16.9	18.8	15.2	16.6	18.5

¹Statistically significant linear trend in median age at first sexual intercourse by age at menarche ($p < 0.05$).

SOURCE: National Center for Health Statistics, National Survey of Family Growth, 1995 and 2013–2017.

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