Age at Menarche: 50-Year Socioeconomic Trends Among US-Born Black and White Women

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Objectives. We investigated 50-year US trends in age at menarche by socioeconomic position (SEP) and race/ethnicity because data are scant and contradictory.

Methods. We analyzed data by income and education for US-born non-Hispanic Black and White women aged 25 to 74 years in the National Health Examination Survey (NHES) I (1959–1962), National Health Examination and Nutrition Surveys (NHANES) I–III (1971–1994), and NHANES 1999–2008.

Results. In NHES I, average age at menarche among White women in the 20th (lowest) versus 80th (highest) income percentiles was 0.26 years higher (95% confidence interval [CI] = –0.09, 0.61), but by NHANES 2005–2008 it had reversed and was –0.33 years lower (95% CI = –0.54, –0.11); no socioeconomic gradients occurred among Black women. The proportion with onset at younger than 11 years increased only among women with low SEP, among Blacks and Whites (*P* for trend < .05), and high rates of change occurred solely among Black women (all SEP strata) and low-income White women who underwent menarche before 1960.

Conclusions. Trends in US age at menarche vary by SEP and race/ethnicity in ways that pose challenges to several leading clinical, public health, and social explanations for early age at menarche and that underscore why analyses must jointly include data on race/ethnicity and socioeconomic position. Future research is needed to explain these trends. (*Am J Public Health.* 2015;105:388–397. doi:10.2105/AJPH.2014.301936)

Age at menarche is of clinical, public health, and social importance,[1–4] but in the United States scant and contradictory data exist as to whether trends in the overall declining age at menarche[1,2] vary by race/ethnicity and socioeconomic position (SEP), singly and combined.[5–9] Highlighting the biological relevance of age at menarche, evidence indicates age at menarche is influenced by nutrition from gestation through childhood, which is germane to girls' risk of becoming pregnant and predictive of chronic disease, for example, early age associated with increased risk for breast cancer and cardiovascular disease.[1–3] Socially, age at menarche matters for both girls' sense of themselves and how they are treated by others, with early maturation increasing the likelihood of girls being precociously sexualized and sexually harassed.[3,4]

Factors hypothesized to affect age at menarche range from material (e.g., impact of economic deprivation on nutrition) to psychosocial (e.g., association between childhood sexual abuse and earlier age of onset).[1,2,5] Consistent with trends in improved nutrition, robust evidence indicates that age at menarche has overall declined since the early 20th century in North America and Europe.[1,2,5] European and Latin American studies likewise indicate that lower age at menarche, once more common among affluent girls, has become more common among more impoverished girls, with the decline in age fastest among impoverished girls.[1,10–13] In the United States, however, although some studies have reported that age at menarche and its decline are higher and faster among Black than among White girls (consistent with higher rates of poverty among the Black than among the White population), other studies have reported the reverse.[6–9] No US studies have analyzed US socioeconomic trends in age at menarche overall or by race/ethnicity.

To address gaps and inconsistencies in evidence, we have presented novel data on 50-year social patterns and trends in age at menarche among US-born non-Hispanic Black and White women, stratified by SEP. Additionally, we have employed a metric developed in evolutionary biology—the haldane[14–16]—which scales the pace of change in population traits (phenotypic or genotypic) to biological generation, rather than calendar year, and which, although rarely used in human health research, provides a benchmark for gauging the tempo of change within and across humans and other species.[14]

METHODS

Our study base comprised women aged 25 to 74 years included in the National Health Examination Survey (NHES) I (1959–1962)[17] and the National Health and Nutrition Examination Surveys (NHANES) I–III (1971–1994) through NHANES 1999–2008.[18] These surveys are nationally representative cross-sectional samples of the US noninstitutionalized civilian population and contain the only long-term US individual-level data on measured health characteristics and SEP; their survey design, data collected, and sampling weights are extensively documented online.[17,18]

We focused on women aged 25 to 74 years because by age 25 years most US adults have completed their educational attainment[19,20] and because 74 years was the oldest age group common to all surveys.[17,18] We restricted analyses to US-born non-Hispanic Black and White women (referred to as "Black" and "White," with these racial/ethnic categories conceptualized as social constructs that can affect health status and health care[21,22]) because they are the sole racial/ethnic groups identifiable across all surveys[14,17,18] and because restriction to US-born non-Hispanics avoids confounding by immigration status.[14,23] Table 1 provides the number of adult women from each survey included in the study database.

Study Variables

Women in each survey were asked their age in years when their periods, or menstrual cycles, started.[17,18] Answers were recorded as whole numbers. The only 2 consistently

TABLE 1—Population Variables of US-Born Non-Hispanic Black Women and White Women Aged 25–74 Years: NHES I, 1959–1962, through NHANES, 2005–2008

Variable	NHES I, 1959–1962	NHANES I, 1971–1975	NHANES II, 1976–1980	NHANES III, 1988–1994	NHANES, 1999–2004	NHANES, 2005–2008
No. of women in survey						
Black, by age, y						
Total (age 25-74)	381	1342	839	2041	1130	925
25–34	105	361	181	618	248	199
35–44	101	357	129	570	279	175
45–54	98	159	118	304	227	200
55–64	47	137	191	299	212	207
65–74	30	328	220	250	164	144
White, by age, y						
Total (age 25-74)	2552	5044	5373	2790	2751	1855
25–34	622	1413	1007	598	701	395
35–44	670	1121	746	587	547	387
45–54	601	761	697	479	538	378
55–64	392	603	1371	523	476	341
65–74	267	1146	1552	603	489	354
Estimated no. of corresponding women[a]						
Black	5 121 050	5 542 321	4 457 984	8 031 772	9 252 517	10 284 805
White	42 682 388	35 278 632	33 378 263	54 027 903	57 717 508	60 039 632
Income distribution, %[a]						
Black						
< 20th percentile	42.1	51.6	36.4	38.5	45.8	32.3
< 50th percentile	75.5	79.0	73.7	69.3	71.4	67.3
≥ 80th percentile	6.1	2.1	6.5	8.9	10.0	14.4
(Missing)	(9.7)	(4.0)	(5.8)	(10.0)	(9.3)	(6.0)
White						
< 20th percentile	11.6	23.0	15.2	16.6	22.1	17.4
< 50th percentile	39.3	49.4	51.4	48.5	50.8	49.2
≥ 80th percentile	31.1	9.8	16.4	26.7	26.3	27.6
(Missing)	(9.7)	(4.0)	(3.2)	(5.9)	(7.1)	(4.1)
Educational levels, %[a]						
Black						
< high school	91.3	61.2	51.7	30.0	31.0	24.2
≥ high school, < 4 y college	4.7	32.9	40.9	58.4	55.5	55.8
≥ 4 y college	4.0	5.9	7.4	11.6	13.6	20.0
(Missing)	(5.0)	(1.0)	(1.3)	(0.2)	(0.1)	(0.0)
White						
< high school	82.3	34.1	28.0	17.7	12.4	10.9
≥ high school, < 4 y college	7.4	54.4	59.1	60.6	59.4	57.3
≥ 4 y college	10.4	11.6	12.9	21.8	28.3	31.8
(Missing)	(3.5)	(0.2)	(0.5)	(0.5)	(0.0)	(0.0)

Continued

available SEP measures pertained to family income and education. We used both measures because their associations with diverse health outcomes may be independent and can vary over time,[19,24,25] both because of different causal pathways (e.g., income as linked to economic deprivation; education as linked to health illiteracy) and because of changing economic trends (e.g., between 1960 and 2008, employment and earnings for adults with less than a high school diploma sharply declined whereas the college wage premium increased considerably[20]).

TABLE 1—*Continued*

	Survey timeline					
Survey midpoint	1961	1972.5	1978	1991.5	2002	2007
Years between survey midpoints	(Ref)	11.5	17.0	30.5	41.0	46.0
Generations elapsed since NHES I	(Ref)	0.575	0.850	1.525	2.050	2.300
Decades spanned for recall of age at menarche	1900s–1940s	1910s–1950s	1920s–1960s	1930s–1970s	1940s–1980s	1950s–1990s

Note. NHANES = National Health and Nutrition Examination Survey; NHES = National Health Examination Survey. Percentage socioeconomic distribution is on the basis of observed data; percentage missing is on the basis of total population (observed + missing). Technical details on the categorization of the racial/ethnic and socioeconomic data and determination of survey midpoint, generation length, and decades spanned for recall of age at menarche are available as a supplement to the online version of this article at http://www.ajph.org.
[a]Weighted by survey demographic weights.

To demarcate family income quintiles, we used data from the Current Population Survey,[26] whose dollars we set to 2010 values adjusted to the US Census Bureau Average Consumer Price Index Series Using Current Methods (commonly referred to as CPI-UR-S). We then assigned each woman to the US yearly family income quintile (Q1: lowest; Q5: highest) that encompassed the midpoint of her precategorized family income brackets for the survey's midpoint year, as defined in the technical documentation[17,18] (Table 1). Following standard practice, we compared persons in the 20th (low) versus 80th (high) percentiles.[19,24] A key advantage of this approach, by contrast to the US poverty line—which was initially set in the mid-1960s in relation to food (but not housing) costs and thereafter adjusted only for changes in the consumer price index[19,27]—is that the 20 to 80 contrast is based solely on each year's income levels and can validly be compared over time and cross-nationally.[19,24]

Data Analysis

We used linear regression analysis to estimate the magnitude of social inequalities in age at menarche within each survey, with analyses employing relevant sample weights. We first imputed data, using the Amelia II program version 1.6.4 (Gary King, Cambridge, MA)[28] for income and education, for which the percentage missing across surveys ranged 3% to 10% and 0% to 5%, respectively (Tables 1 and 2). We then used SAS version 9.2 (SAS Institute, Cary, NC) PROC SURVEYREG to estimate regression coefficients that accounted for survey weights and design effects. To combine multiple imputation results (5 data sets), we used SAS PROC MIANALYZE. We then used Stata version 12.0 (StataCorp LP, College Station, TX) to conduct weighted meta-analyses using random effects[29] for socioeconomic inequalities within each racial/ethnic group, adjusted for age, and inequalities between Blacks and Whites, adjusted for age and additionally adjusted separately for income percentile and education.

The linear test for trend for proportion of age at menarche is 2 sided, as is the meta-analysis overall P value for heterogeneity[29] (with no assumption of a monotonic trend), and we considered the results statistically significant if $P<.05$, which we also did for the absolute difference parameter estimates whose 95% confidence intervals (CIs) excluded zero. Within each survey we also ascertained, by race/ethnicity and SEP, the percentage of women with early menarche (<11 years)[8,9] and tested for trends over time within each racial/ethnic SEP stratum.

For the haldane analyses, we followed standard practice for biological field studies[15,16,30,31] and set the earliest survey (NHES I; 1959–1962) as baseline and then computed the haldane. Mathematically, the haldane,[16] which measures "rates in phenotypic standard deviations per generation"[15(p453)] is expressed as follows:

$$(1)\quad h = \left((m_{t2} - m_{t1})/S_{pooled}\right)/g,$$

where

$$(2)\quad S_{pooled} = \sqrt{\left((n_2-1)s_2{}^2+(n_1-1)s_1{}^2\right)/(n_1+n_2-2)}$$

and h = haldane, g = number of generations, m_{t2} = mean value at time 2, m_{t1} = mean value at time 1, n_2 = size of the population at time 2, n_1 = size of the population at time 1, $s_2{}^2$ = variance at time 2, and $s_1{}^2$ = variance at time 1. As the formula indicates, for a given effect size (the numerator), the smaller the N of generations, the larger the haldane and hence the greater change per generation.

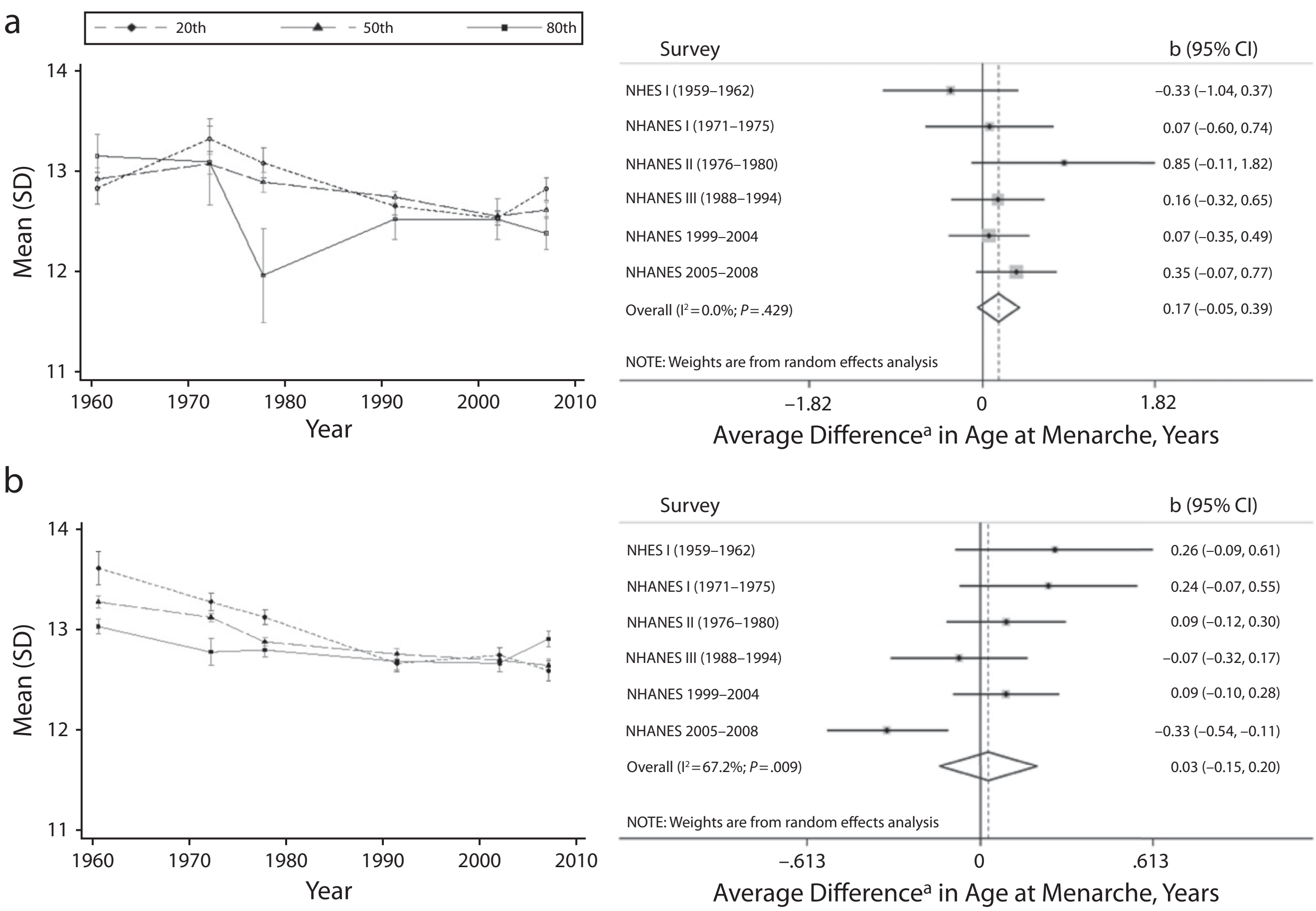
To compute the haldanes, we set generation length equal to 20 years on the basis of trends in the mean and median age at first birth in the United States and their variation by education level.[32,33] We then age-standardized the haldane by computing the age-standardized means and SDs across age strata, with weight defined by the year 2000 standard million.[34] The 46 years that elapsed between the midpoints of NHES I and NHANES 2005–2008 thus equaled 2.3 generations. Following established practice,[15,16,31] we denoted haldanes with an absolute value of 0.3 or greater as high and those with an absolute value of 0.2 to less than 0.3 as intermediate high.

RESULTS

Table 1 provides data on the number of Black and White women aged 25 to 74 years in each survey and their changing distributions of income and education. Across all surveys, Black women were from 1.8 times (lowest ratio) to 2.4 times (highest ratio) more likely than were White women to be in the lowest 20th income percentile, whereas White women were from 1.9 times (lowest ratio) to 5.1 times (highest ratio) more likely than were Black women to be in the 80th income percentile. Despite increasing gains in college education among both Black and White women, Black women since NHANES I were from 1.7 times (lowest ratio) to 2.5 times (highest ratio) more likely than were White women to not have completed high school, whereas White women were from 1.6 times (lowest ratio) to 2.1 times (highest ratio) more likely than were Black women to have a college degree. The span of decades in which menarche occurred ranged from the first half of the 20th century for women in NHES I to the second half of the 20th century for women in NHANES 2005–2008 (Table 1).

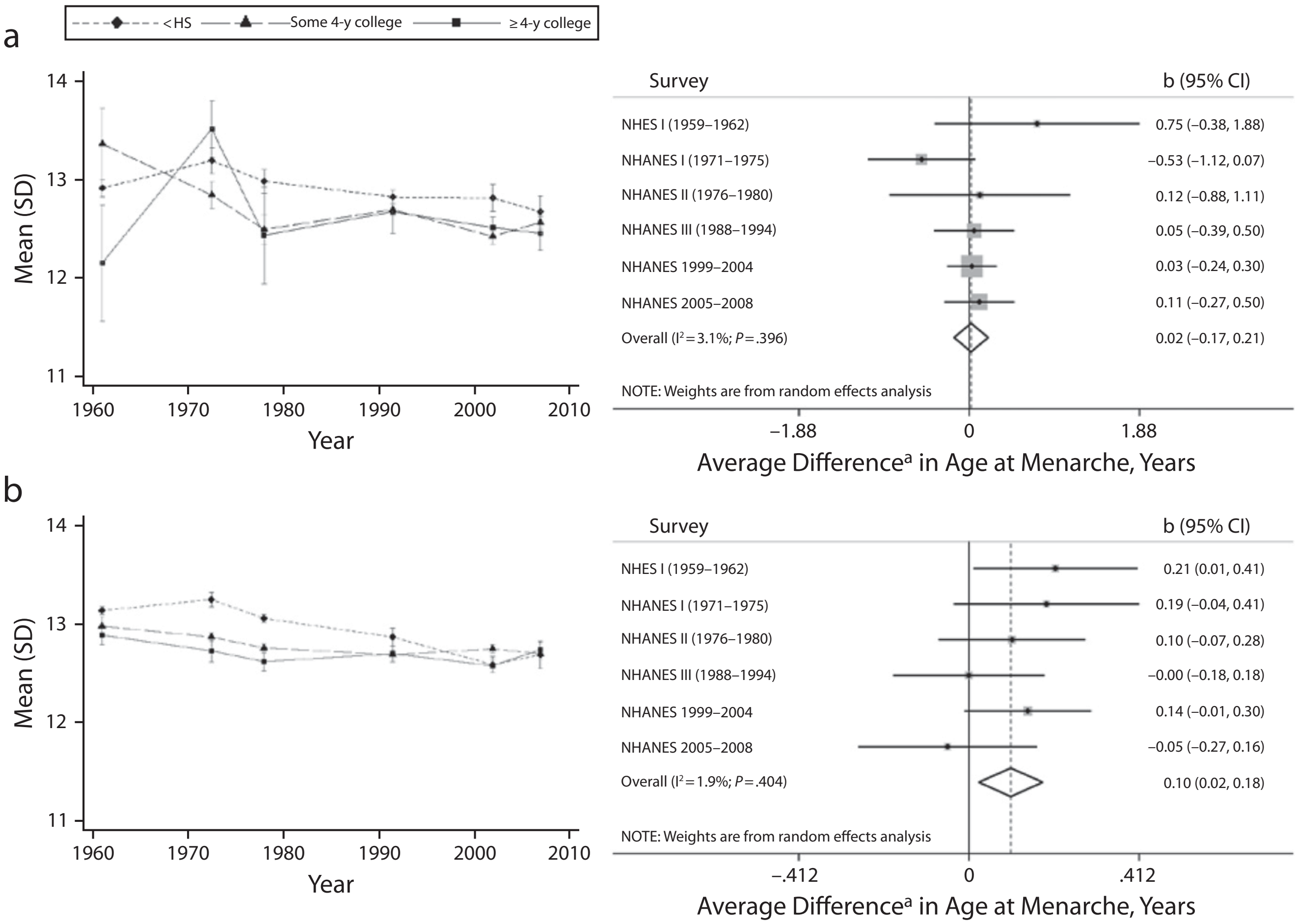
As shown in Figures 1 and 2 (point estimates data available as a supplement to the online version of this article at http://www.ajph.org.), across surveys the average age of menarche declined overall among both Black and White women, but patterns differed by socioeconomic strata and race/ethnicity. Related, for the proportion with menarche at younger than 11 years (Table 2), a significant linear trend for increase (more than double) occurred only among the women with lower, not higher, SEP. For example, among women with less than a high school education, the proportion with early menarche (< 11 years) increased, comparing NHES I to NHANES 2005–2008, from 4.0% to 11.8% among Black women (P = .003) and from 2.4% to 7.5% among White women (P = .013). For women with at least 4 years of college these proportions equaled 21.3% and 16.8%, respectively, among Black women (P = .757) and 3.3% and 5.4%, respectively, among White women (P = .224).

Among Black women, no significant socioeconomic gradient in age at menarche occurred in any survey, either for income percentile or education (Figures 1 and 2). By contrast, among White women, comparing NHES I to NHANES 2005–2008, the 20 to 80 income percentile gap reversed from 0.26 years (95% CI = –0.09, 0.61) to –0.33 (95% CI = –0.54, –0.11), and parameter estimates across surveys differed (overall P = .009). The corresponding changes for education (< 4 vs ≥ 4 years college) were from 0.21 years (95% CI = 0.01, 0.41) to –0.05 (95% CI = –0.27, 0.16), but parameter estimates did not differ across surveys (overall P = .404). The net effect was that age-adjusted differences between Blacks and



Note. CI = confidence interval.
[a]Difference compares 20th to 80th income percentile, adjusting for age.

FIGURE 1—Age at menarche as recalled by adult women aged 25–74 years by income percentile for (a) Black women and (b) White women: United States; National Health and Examination Survey (NHES) I, 1959–1962, through National Health and Nutrition Examination Survey



Note. CI = confidence interval; HS = high school.
[a]Difference compares persons with < 4 vs ≥ 4 years of college.

FIGURE 2—Age at menarche as recalled by adult women aged 25–74 years by education for (a) Black women and (b) White women: United States; National Health and Examination Survey (NHES) I, 1959–1962, through National Health and Nutrition Examination Survey (NHANES), 2005–2008.

Whites in age at menarche were null in each survey and overall (meta-analysis b = –0.04 [95% CI = –0.14, 0.05]), and these results were not altered by adjusting for either income percentile or education (meta-analysis b = –0.06 [95% CI = –0.16, 0.03] and –0.05 [95% CI = –0.15, 0.04], respectively; data available as a supplement to the online version of this article at http://www.ajph.org.).

Finally, as shown in Figures 3 and 4 (point estimates data available as a supplement to the online version of this article at http://www.ajph.org), among Black women, haldane values for age at menarche were both positive (indicating increasing age) and negative (indicating decreasing age), whereas among White women, all haldane values were less than zero. Additionally, absolute values for the haldane of 0.3 or greater occurred solely in NHANES I–III, and we observed them in virtually all socioeconomic strata among Black women, but among White women these occurred solely in the lowest income quintile. For NHANES 1999–2004 and 2005–2008, all haldane values were less than zero for both Black and White women in all SEP strata, and their absolute value typically ranged between 0.0 and < 0.2, that is, within the usual range of change observed in other species.[15,16,31]

DISCUSSION

Our novel analyses of 50 years of social trends in age at menarche among US-born non-Hispanic Black and White women demonstrate that although average age at menarche is declining in both groups, patterns vary by SEP and race/ethnicity. Among White women, comparing NHES I to NHANES 2005–2008, the socioeconomic gradient reversed, from an inverse (lower SEP, higher age) to positive (lower SEP, younger age) relationship. No socioeconomic gradient in age at menarche occurred among Black women in any survey or overall. Moreover, a significant linear trend ($P < .05$) for a more than double increase in the proportion of women with menarche at younger than 11 years occurred only among White and Black women with lower SEP. Lastly, high rates of change (absolute value of haldane ≥ 0.3) occurred solely among Black women

TABLE 2—Proportion With Early Age at Menarche (< 11 Years) Among US-Born Non-Hispanic Black Women and White Women Aged 25–74 Years: United States; NHES I, 1959–1962, through NHANES 2005–2008

Measure	NHES I (1959–1962),[a]	NHANES I (1971–1975),[a]	NHANES II (1976–1980),[a]	NHANES III (1988–1994),[a]	NHANES (1999–2004),[a]	NHANES (2005–2008),[a]	*P*[b]
			Black				
Income percentile							
Total[c]	4.64	5.55	8.02	8.94	13.42	12.23	.004
20th	5.15	3.67	5.15	9.72	15.03	8.04	.137
50th	4.09	5.22	5.98	9.12	13.59	12.73	.004
80th	0.00	4.29	13.87	9.29	12.93	11.38	.073
Education							
< high school	4.00	3.84	4.84	6.88	10.23	11.76	.003
≥ high school, < 4-y college	0.00	8.35	10.81	9.79	15.79	10.79	.07
≥ 4-y college	21.30	6.99	16.62	9.81	11.33	16.81	.757
			White				
Income percentile							
Total[c]	2.63	3.75	4.47	6.84	5.78	6.68	.012
20th	1.96	3.35	3.38	8.09	6.92	8.56	.01
50th	2.22	3.56	4.13	6.61	6.08	6.74	.006
80th	3.15	7.17	5.58	6.93	3.95	5.10	.929
Education							
< high school	2.40	3.44	3.73	7.38	8.89	7.51	.013
≥ high school, < 4 y college	3.00	3.74	4.30	7.37	4.50	7.27	.072
≥ 4 y college	3.29	4.75	6.91	5.05	7.10	5.36	.224

Note. NHANES = National Health and Nutrition Examination Survey; NHES = National Health Examination Survey.
[a]We weighted proportions for survey design.
[b]Test for linear trend across surveys.
[c]Regardless of socioeconomic position.

(all SEP strata) and low-income White women who underwent menarche before 1960.

Our study had several limitations and strengths. First, we relied on adult women's recalled age at menarche. Longitudinal studies conducted since the 1970s, however, indicate high correlations (~0.7–0.8) between women's recalled age at menarche as an adult and reported age when a girl, with upward of 75% to 90% of women accurate within 1 year and with no evidence of differential recall by sociodemographic group.[35–39] Second, we used cross-sectional data for 6 periods, limiting causal inference, even as the surveys were reasonably spaced during the 50-year study period, thereby permitting assessment of trends among women whose onset of menarche spanned the entire 20th century. Third, because of data limitations, we could analyze 50-year trends only among Black and White women; however, restriction of our analyses to US-born non-Hispanic women ensured that results were unconfounded by immigration.[14,23]

Contributing to study strengths were (1) our reliance on nationally representative data for the US civilian population collected using standardized protocols[17,18]; (2) our employment of both income and education data, with the contrasts for income percentiles directly comparable over time (and cross-nationally)[19,24]; and (3) our use of rigorous statistical methods, taking into account sample design and weighting,[17,18] and, via use of the haldane,[15,16] assessing the pace of change per biological generation.[14,40] Had we set generation equal to 25 as opposed to 20 years, the value of the haldanes would have increased by 1.25 times, while leaving unaltered the greater range in earlier surveys.

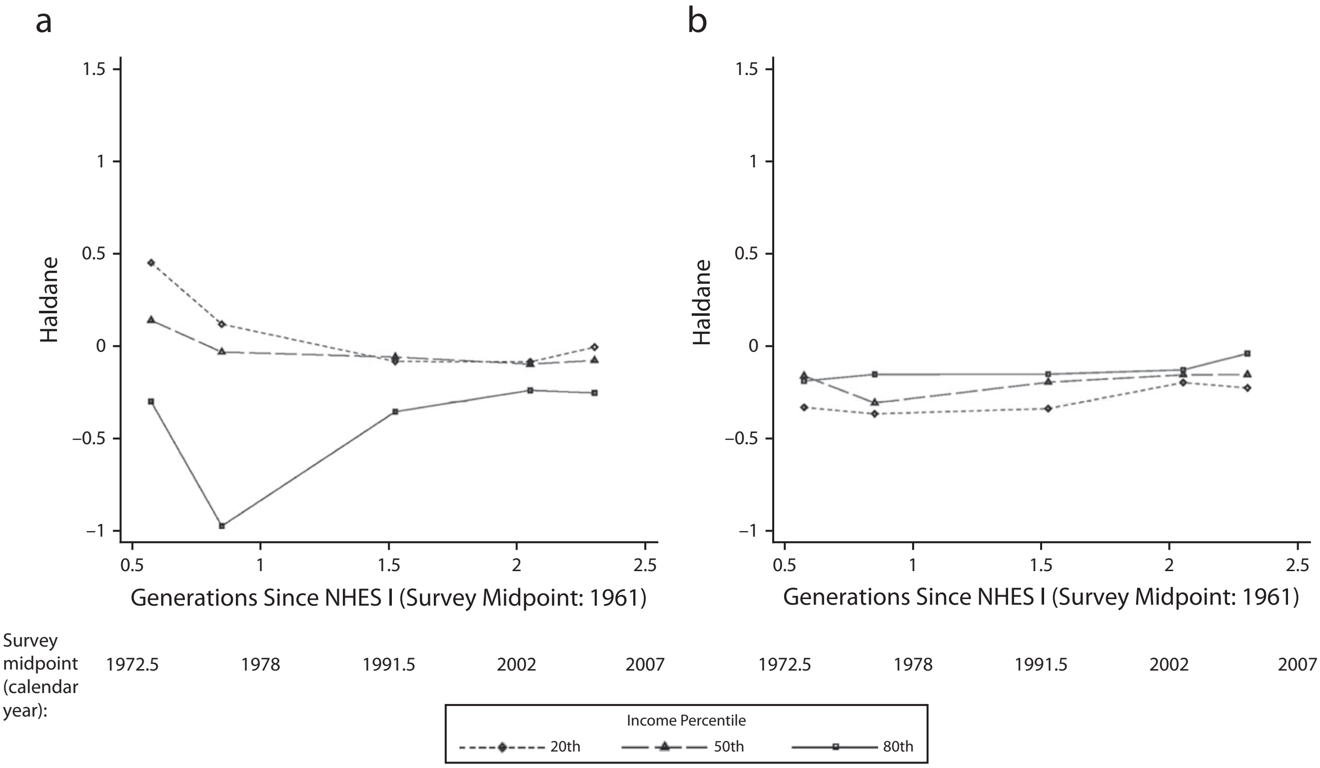
Assuming our findings are valid, the results raise important questions about whether major modifiable factors currently hypothesized to be determinants of age at menarche can adequately account for the observed social trends. Among these factors, the most plausible jointly involve childhood nutrition and economic deprivation, but inconsistencies are evident. Three lines of evidence are germane: (1) research indicating adiposity is inversely related to age at menarche[1–3,41]; (2) post-1970 rises in US childhood obesity among all socioeconomic strata and racial/ethnic groups, albeit with rates higher among lower versus higher income and Black versus White girls[42]; and (3) 20th-century trends in US childhood poverty, which declined from approximately 50% at birth among children born in the 1930s to approximately 20% among those born since the 1970s, with rates consistently higher among Black than among White children.[43]

Considered together, trends in childhood poverty and adiposity are consistent with the following:

- an overall declining age at menarche among both Black and White women (including increasing proportion with menarche before age 11 years, observed among women with low SEP, likely reflecting the association of adult education with childhood economic circumstances[19,24]) and their larger pre-NHANES III haldane values (because of improved nutrition linked to large pre-1970 declines in childhood poverty followed by increasing adiposity in all groups); and
- the reversing SEP gradient in age at menarche among White women (because of recently rising childhood obesity, especially in lower income girls);

but inconsistent with the following:

- the absence of an SEP gradient among the Black women;
- the greater variability in haldane values for income compared with education among the White women, because adult education is typically deemed a better indicator of



Note. We denoted haldanes with an absolute value of 0.3 or greater (shown by grey horizontal lines) as high and those with an absolute value of 0.2 to less than 0.3 as intermediate high.

FIGURE 3—Haldane versus generations elapsed for age at menarche (recalled) by income percentile for the US-born non-Hispanic (a) Black and (b) White populations: US National Health Examination Survey I, 1959–1962 (baseline), through US National Health and Nutrition Examination Survey, 2005–2008.

childhood economic conditions than is adult income[19,24]; and

- the larger changes in the first part of the 20th century.

Nor can these last 3 findings readily be reconciled with trends in exogenous exposures hypothesized to increase risk of early menarche, for example, xenoestrogens[1–3,44] or in utero exposure to cigarette smoke,[1–3,45] especially if these exposures are linked to economic adversity.

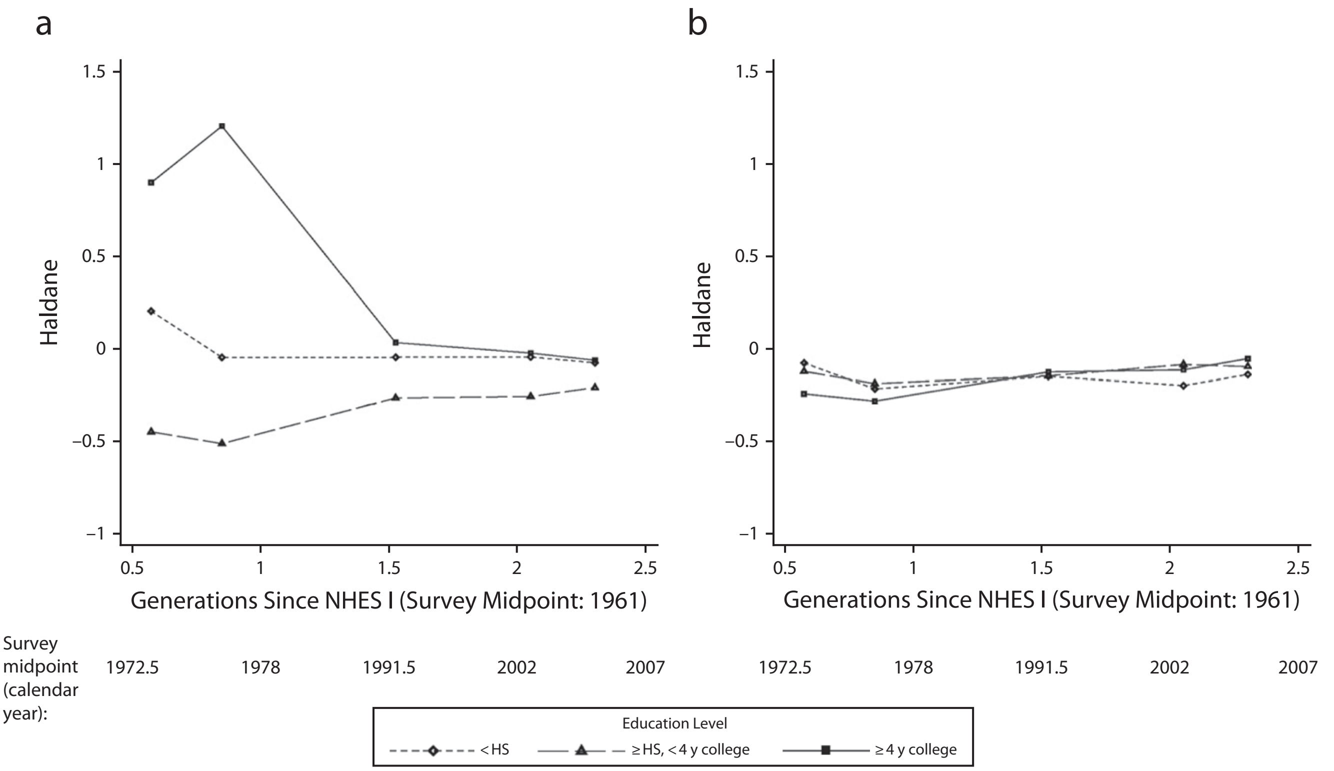
The observed social trends in age at menarche, moreover, are unlikely to be explained by leading hypothesized modifiable psychosocial factors for early age at menarche, that is, sexual or physical abuse or having an absent father (above and beyond economic hardship associated with lone parenthood).[1–3,46,47] Although no pre-1970 national population-based data exist on 20th-century trends in US childhood physical or sexual abuse, recent evidence suggests US rates are either stable or possibly declining, while potentially remaining higher among children in lower income families (if not an artifact of differential reporting bias, with abuse among more affluent children more hidden).[48,49]

Additionally, the marked rise in US children living with their mother but not father (either solo or, increasingly, in a complex household with other adults, e.g., grandparents, other kin, or mother's cohabiting partner) occurred primarily during the 1960s through 1980s, especially for girls in lower versus higher income families and for Black versus White girls, with this trend since stabilizing (except for a new rise in single parenthood among both White and Black women with a college education).[50,51] None of the trends in these psychosocial exposures are consistent with the following:

- the observed patterns of greater decline in age at menarche among women who commenced menarche in the earlier part of the 20th century,
- the null socioeconomic gradient among Black women and the reversal of the socioeconomic gradient among White women only, and
- the null difference between Blacks and Whites.

Changes in gene frequency are also unlikely to explain the observed patterns because of the small number of generations involved, even as genetic mutations (e.g., in MKRN3) may be linked to risk of central precocious puberty (before aged 8 years)[52]; changes in gene expression, affecting phenotypic expression of age at menarche, constitutes a more plausible explanation.

That our results include a mix of observed findings consistent and inconsistent with expected patterns suggests that more theorizing and research is required to understand both



Note. We denoted haldanes with an absolute value of 0.3 or greater (shown by grey horizontal lines) as high and those with an absolute value of 0.2 to less than 0.3 as intermediate high.

FIGURE 4—Haldane versus generations elapsed for age at menarche (recalled) by education for the US-born non-Hispanic (a) Black and (b) White populations: US National Health Examination Survey (NHES) I, 1959–1962 (baseline), through US National Health and Nutrition Examination Survey, 2005–2008.

societal determinants of age at menarche and the social patterning of rate of change in this outcome. For example, 5 hypotheses potentially worth testing regarding the unexpected finding of no socioeconomic gradient in age at menarche among the Black women, which could not be examined in the NHES and NHANES surveys because of data limitations, are the following:

1. Black women were more tightly clustered than were White women in the low end of each demarcated socioeconomic stratum, thereby reducing the variation needed to detect socioeconomic gradients.[19,24,25]
2. Educational attainment less adequately captures variation in childhood SEP among Black than among White women (e.g., in the United States, Black women with a college education are far less likely than are White women to have had parents with a college education).[19,24]
3. The impact of socioeconomic stratification on age at menarche among the Black population is modified by the severity of intra- and intergenerational exposure to racial discrimination, including the existence of legal (de jure) racial discrimination (Jim Crow) in 21 US states plus the District of Columbia, before the passage of the 1964 US Civil Rights Act, along with de facto racial discrimination in the remaining states.[53–55]
4. Selection bias arising from the study sample was restricted to the noninstitutionalized US civilian population,[55] which would have a greater effect on Black women than on White women because of higher contemporary rates of incarceration and military service among Black women; for example, in 2002, Black and White women constituted 40% and 42%, respectively, of women in US prisons[56] and 34% and 49%, respectively, of US enlisted women[57] at a time when Black and White persons constituted 13% and 69%, respectively, of the US civilian population aged 18 to 44 years,[57] and Black and White women constituted 14% and 79%, respectively, of US women residents aged 15 to 44 years.[58]
5. The sample size of Black women was relatively smaller than was that of White women, especially in NHES I, before the establishment of NHANES protocols to oversample among specified social groups, including Blacks,[17,18] thereby reducing statistical power to detect small effects.

Our findings on long-term social trends in age at menarche pose a challenge to several leading clinical, public health, and social explanations for early age at menarche. Reinforcing the population science insight that the causes of population differentials (over time or across populations) need not be the same as the causes of cases (variation within a given population at a given point in time),[21,59] our results also point to the limitations of US analyses that focus solely on racial/ethnic differences in age at menarche,[5–9] without regard to SEP. Lastly, if we are correct that earlier versus later 20th-century declines in age at menarche were not only relatively greater but also biologically larger than phenotypic changes in traits typically observed in other species, the medical and social impact of current changes may be smaller, not greater, than are those associated with the earlier declines. ■

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Contributors

N. Krieger conceptualized, designed, and oversaw all analyses and drafted the article. M. V. Kiang, A. Kosheleva, and P. D. Waterman conducted the analyses. J. T. Chen and J. Beckfield advised on design and analyses. All authors contributed to interpreting the results and preparing the article.

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Human Participant Protection

The Harvard School of Public Health Human Subjects Committee institutional review board exempted our study from approval because it was based solely on publicly available de-identified preexisting coded data (HSC Protocol #P16105-101). Written informed consent was obtained from all NHES and NHANES participants.

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