Disparities in Women's Health Across a Generation: A Mother–Daughter Comparison

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Abstract

Background: The U.S. Centers for Disease Control and Prevention has set national goals to eliminate health disparities by race, sex, and socioeconomic status. Progress in meeting these goals has been mixed. This paper provides a different view on the evolving health of U.S. women by examining a sample of daughters and their mothers.

Methods: The aim was to determine if the health risk profiles of daughters (born 1975–1992) were different from their mothers (born 1957–1964) measured when both were between the ages of 17 and 24 years. The U.S.-based National Longitudinal Survey of Youth 1979 and associated Children and Young Adult Surveys were used. The sample was 2411 non-Hispanic white and African American girls born to 1701 mothers. Outcomes were height, weight, body mass index (BMI), age of menarche, and self-reported health.

Results: In both races, daughters were taller but entered adulthood at greater risk for the development of chronic illness than their mothers. Racial differences were greater in the daughters' generation than in the mothers'. Whites in both generations experienced educational differences in health based upon the mother's educational level, with fewer years of maternal education associated with poorer health. African Americans of both generations experienced differences by maternal education in self-reported health. However, when African American daughters were compared with their mothers, daughters born to college educated women gained more weight and had higher BMI and earlier menarche than did daughters born to high school dropouts.

Conclusion: Health deterioration across generations in both races suggests that much work is needed to meet Healthy People 2020 goals of health equity.

Introduction

THE U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC) has set national goals to eliminate health disparities by race, sex, and socioeconomic status, as well to improve health for all in Healthy People 2020.¹ This paper provides evidence regarding progress toward the attainment of these goals for African American and white women by examining health risk measures—height, weight, body mass index (BMI), obesity, overweight, and self-reported health—in a sample of mothers and daughters. The existing literature, based on cross-sectional population surveys, has shown that progress toward meeting these goals has been mixed. The Healthy People 2010 Final Review noted improvements in life expectancy for all groups, with women gaining an additional year of life over the decade,² although recent work suggests that white women with the least education (less than a high school degree) are experiencing a decline in life expectancy.³ Race differences in life expectancy persist.³ Furthermore, African American wo-

men experience greater disease burden than their white counterparts,⁴ as do women with low educational attainment.

Increasing rates of obesity are thought to be a major contributor to these trends.^{5,6} Obesity rates have risen significantly over the last three decades in all women. While African American women weigh more than whites do on average, part of the BMI difference is explained by height differences. In studies using birth cohorts from the mid-1940s through 2002, African American females were found to grow faster throughout childhood and reach their adult height at a younger age, resulting in a shorter final height.⁷ Recent evidence also suggests that the stature of African-American females may be decreasing.⁸ An additional noteworthy trend, thought to be associated with rising obesity rates, is the declining age of menarche in all race/ethnic groups.^{9–11} However, the decline in age of menarche has been greater in African American girls than in whites.¹² Age of menarche is a critical piece of information about a woman's health: the lower the age, the higher risk of breast cancer, cardiovascular disease, and depression.^{13–16}

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These findings present a mixed picture with respect to trends in African American and white women's overall health. Although life expectancy has increased, except for the most disadvantaged white women, there is some evidence that chronic disease prevalence has increased, especially for those conditions associated with obesity.

It is unclear from these cross-sectional findings how quickly the health of African American and white women may be changing when controlling for genetic and contextual factors. Furthermore, it is not clear if these patterns are similar across educational groups within African American and white subgroups. This study addresses these questions by comparing health risk profiles of a cohort of non-Hispanic white and African American mothers (born 1957–1964) and daughters (born 1975–1992), age-matched to the same point in the life cycle when both were young adults (aged 17–24 years). Health risk profiles are examined using measures that are highly correlated with women's long-term health. Measures include height, weight, BMI, obesity, overweight, age of menarche, and self-reported health status (SRH). The early adult life stage was chosen because this period of transition into adulthood is seen as a benchmark for later adult health. The overall aim of this study is to determine if the health risk profiles of daughters are different than their mothers and to understand if and how daughter–mother dyad differences may vary by race and maternal education. We hypothesize that in both races the daughter's health profile will be worse than that of the mothers, but the differences by race and education will be similar. The study's strength is that by comparing biological daughters with their mothers, genetic and contextual factors are partially controlled for in ways not possible with large cross-sectional surveys. This study provides additional evidence to assess progress toward meeting the goals of improving health and eliminating disparities by race and education for African American and white women.

Methods

Sample

The study used data from the U.S.-based National Longitudinal Survey of Youth 1979 (NLSY79) and the Children and Young Adult Surveys of the NLSY79. The NLSY79 enrolled a nationally representative sample of young people living in the United States in December 1978, born between 1957 and 1964. Extensive data on these respondents (the mothers in this study) have been collected annually through 1994 and biennially thereafter. Data on biological children born to these mothers have been collected biennially beginning 1986.

The primary sample inclusion criterion for this study was a daughter born to an African American or non-Hispanic white woman in the NLSY79 between the years 1975 and 1992. The eligible sample consisted of 2925 girls (white $n = 1619$; African-American $n = 1306$) born to 2035 mothers (white $n = 1177$; African American $n = 858$). There was no missing data on maternal education and race. The study sample required mothers and daughters to have observations on height and weight at 17–24 years of age. This resulted in a study sample of 2411 girls (82% of the eligible sample) with 1311 white girls (81% of eligible) and 1100 African American girls (84% of eligible) born to 956 white and 745 African American mothers. The eligible and study sample were compared on race-specific distributions of maternal education and no differences were found. The sample sizes for analyses of age of menarche were smaller due to

missing data: for whites, sample size for daughters was 1300 and for mothers it was 946; for African Americans, sample size for daughters was 1088 and for mothers it was 740. Sample size for daughter–mother dyad differences in age of menarche was 1290 for whites and 1082 for African Americans. Analysis of maternal self-reported health was based on 911 white mothers (95% of study sample) and 710 African American mothers (95% of study sample). Sample size for daughters' self-reported health at 17–24 years of age was the same as the study sample.

Measures

Race. Maternal race was recorded during the initial interview. This value has been cross-checked against a question asked in subsequent surveys allowing women to self-identify race/ethnicity. Of women who were classified as African American during the initial survey, 99% self-identified as African American. Of women in the NLSY who were classified as non-African American, non-Hispanic, and non-Asian during the initial interview, 97% self-identified as white. Daughters were assigned the race of their mothers but this too has been cross-checked in subsequent surveys by asking daughters to self-identify race/ethnicity. For those who answered questions (approximately 60% of the daughters) about ethnicity and race, over 96% of girls self-identified with the race they were assigned.

Height and weight. For mothers and daughters, height in inches and weight in pounds were self-reported and taken from the first interview in which the respondent was between 17 and 24 years old.

Age of menarche. Age of menarche for mothers was collected in 1984 and 1985 when these women were between 19 to 28 years of age. About 75% of the mothers reported age in years and 25% reported age in months. Menarche age reported in months was converted to years. Mothers of daughters, who were at least 8 years of age and less than 14 years of age, were asked whether or not the daughter had reached menarche. If so, the mother reported the year and month of menarche. Girls 14 and older were asked these questions directly. This information was combined with the girls' year and month of birth to determine their age of menarche in months and then converted to years.

Maternal education. Highest education level attained after the age of 25 years.

Self-rated health status. Health status of mothers was collected in the interview following their 40th birthday. In the daughters, health status was taken from the first interview in which the girl was aged 17 to 24 years. Both questions asked the respondents to rate their health as excellent, very good, good, fair, or poor. This was collapsed to an indicator taking a value of 1 for fair or poor health and a value of zero for excellent, very good, or good health.

Body mass index. Relationship of height to weight; formula is weight in pounds times 703 divided by height in inches squared.

Overweight and obesity. Obesity is defined as a BMI > 30 ; overweight is defined as a BMI > 25 and < 30 .

Dyad differences. Height, weight, BMI, and menarche age differences were calculated as daughter value minus mother value.

Analysis

The analysis began by estimating means and 95% confidence interval for height, weight, BMI, and age of menarche for mothers and daughters separately by race. Since some mothers had multiple daughters in the sample, the means and confidence intervals for daughters were derived from mixed model regression that accounted for clustering within families. To control for this correlation within families, we ran mixed models clustering on mother identification code using the `xtmixed` command in Stata.¹⁷ Frequencies were reported for categorical variables: overweight, obese, maternal education categories, and SRH. The analysis proceeded with cross-sectional estimates of health gradients by maternal education for each generation by race. These estimates were used to test for mean differences in health outcomes by maternal education. The gradients for mothers were estimated by ordinary least squares for continuous outcomes with indicators for each education category, while the gradients for daughters were estimated from mixed model regressions. Since SRH was dichotomous, odds ratios were estimated from logistic regression for mothers and random effects logistic regression for daughters. To assess whether there was a race difference in how daughters fare relative to their mothers, dyad differences in height, weight, BMI, and age of menarche were estimated using mixed model regressions. *P* values for a two-sided test of the null hypothesis that no race differences in the dyads were reported. We also analyzed the race-specific daughter-mother dyad differences by maternal educational attainment. Since the literature suggests that declines in health have been greater for white women with low education,³ we conducted one-sided tests (*p* values reported) of the null hypothesis that the absolute value of the dyad difference in the maternal dropout group was greater than or equal to the absolute value of the dyad differences in the maternal college graduate group.

Results

Table 1 displays the sample characteristics by race and generation. Among both whites and African Americans, daughters had earlier menarche, weighed more, and had higher BMI than their mothers, suggesting deterioration in average health across the generations. The only evidence of an improvement in health was found in height, with daughters in both races being slightly taller than their mothers.

Table 2 reports cross-sectional estimates of generation 1 education gradients in health by race. There was no gradient in height, weight, or age of menarche for either white or African American women in generation 1. There were gradients in BMI and SRH at age 40. The BMIs of whites with some college or a college degree were lower than BMIs of dropouts, and the BMIs of African Americans with a college degree were lower than for dropouts. White mothers with some college or a college degree were less likely to rate their health at age 40 as poor/fair compared with those who dropped out of high school. African American mothers with a GED or greater education were less likely to report health at 40 as poor/fair than were high school dropouts. On balance, the health gra-

dients by educational attainment are similar for white and African American mothers, with threshold effects in BMI and SRH at 40 for both groups.

Table 3 reports mixed model estimates of generation 2 health gradients as a function of maternal education. Like their mothers, there was no gradient in height for either race. However, daughters of white mothers who had dropped out of high school were heavier than those whose mothers had graduated from college, with a difference of about 14.5 pounds. The BMI of daughters of white dropouts was over 2 BMI points greater than daughters of white college graduates. Daughters born to white high school dropouts had a lower age of menarche than daughters born to white college educated women. For whites, SRH at age 17–24 was more likely to be reported as fair/poor for daughters of dropouts than those born to mothers with at least some college. Thus, the gradients for white daughters in BMI and SRH showed a similar pattern to their mothers. There was no gradient in weight, BMI, or age of menarche for African American daughters. The threshold effect of education for BMI in mothers, that is, a higher BMI for dropouts than college graduates, disappeared in the daughters. However, there was a gradient in SRH at age 17–24 years for African Americans. Daughters of African American dropouts were more likely to report fair/poor health than were daughters of any of the other maternal education groups.

Table 4 reports mixed model estimates of daughter-mother dyad differences in health by race for the continuous variables. Chi-square tests of the null hypothesis of no race difference indicated that height dyad differences for whites and African Americans were not significantly different from each other. However, there were statistically significant race differences in the daughter-mother dyad measures in weight, BMI, and age of menarche. The daughter-mother differences in weight and BMI were about 50% greater for African Americans compared with whites. African American girls were heavier than their mothers by 21.35 pounds, whereas white girls were 14.14 pounds heavier than their mothers. African-American were 3.22 BMI points heavier than their mothers compared with white girls, who were 2.07 BMI points heavier. African American girls on average reached menarche earlier than their mothers by 0.81 years (about 9.72 months earlier), which was significantly earlier than white girls, who on average reached menarche earlier than their mothers by 0.29 years (about 3.5 months).

Table 5 reports mixed model estimates of race-specific educational gradients in the daughter-mother dyad differences in health. In whites, the daughters of mothers who dropped out of high school were over 16 pounds heavier than their mothers, with a BMI difference of more than 2 points, and had an earlier age of menarche by approximately 4 months. The daughters of college educated white women were almost 11 pounds heavier than their mothers, with a BMI difference of 1.65 and an earlier age of menarche by approximately 2.5 months. One-tailed tests did not reject the null hypothesis that generational declines in health among white maternal dropouts were at least as great as those observed among white college graduates. Among African Americans, the daughters of mothers who dropped out of high school were over 14 pounds heavier than their mothers, with a BMI difference of more than 2 points, and had an earlier age of menarche by approximately 3 months. However, the daughters of college

TABLE 1. SAMPLE CHARACTERISTICS (MEAN, CONFIDENCE INTERVAL, NUMBER, PERCENTAGE) BY RACE AND GENERATION

	Whites		African Americans	
	Gen 1: Mothers	Gen 2: Daughters	Gen 1: Mothers	Gen 2: Daughters
Mean age of menarche in years ^a	12.83	12.52	12.81	12.01
[95% CI]	[12.73, 12.93]	[12.45, 12.59]	[12.68, 12.94]	[11.92, 12.11]
Mean height in inches as young adult	64.70	65.15	64.29	64.72
[95% CI]	[64.54, 64.85]	[64.98, 65.32]	[64.09, 64.49]	[64.53, 64.91]
Mean weight in pounds as young adult	130.38	144.5	137.40	159.81
[95% CI]	[128.93, 131.82]	[142.56, 146.43]	[135.42, 139.39]	[157.22, 162.40]
Mean BMI as young adult	21.89	23.92	23.38	26.81
[95% CI]	[21.63, 22.14]	[23.62, 24.22]	[23.09, 23.67]	[26.40, 27.23]
Number (%) overweight as young adult	110 (12%)	247 (19%)	130 (17%)	288 (26%)
Number (%) obese as young adult	31 (3%)	151 (12%)	67 (9%)	288 (26%)
Number (%) maternal education categories				
Dropouts	67 (7%)	90 (7%)	75 (10%)	130 (12%)
GED	89 (9%)	129 (10%)	76 (10%)	147 (13%)
HS Diploma	356 (37%)	493 (38%)	258 (35%)	353 (32%)
Some college	251 (26%)	334 (25%)	238 (32%)	344 (31%)
College graduate	193 (20%)	265 (20%)	98 (13%)	126 (12%)
Number (%) health at 40: rated as fair/poor ^b	109 (12%)		149 (20%)	
Number (%) YA health: rated as fair/poor ^b		118 (9%)		154 (14%)
Sample size	956	1311	745	1100

Means and confidence intervals based on robust standard errors that account for clustering in generation 2.

^aSample size for whites, Gen 1, $n=946$; whites, Gen 2, $n=1300$; AA, Gen 1, $n=740$; AA, Gen 2, $n=1088$.

^bSample size for Gen 1 whites, $n=911$; sample size for Gen 1 AA, $n=710$.

BMI, body mass index; CI, confidence interval; Gen, generation; HS, high school; GED, General Education Test; YA, young adult.

educated African American women were almost 25 pounds heavier than their mothers, with a BMI difference of close to 4 points, and had an earlier age of menarche by approximately 9 months. For African Americans, one-sided tests rejected the null hypothesis that generational declines in age of menarche

and increases in weight were greater for dropouts than for the college educated. This suggests that the daughters of college educated African American women were doing worse relative to their mothers than daughters born to African American mothers who dropped out of high school.

TABLE 2. ESTIMATES OF HEALTH GRADIENTS BY EDUCATION CATEGORIES FOR GENERATION 1 BY RACE

	Generation 1: Whites				
	Height (inches) ^a	Weight (pounds) ^a	BMI ^a	Age at menarche (years) ^a	Health at 40 fair/poor ^b
Dropout	64.17	134.69	23.01	12.68	1
	[63.57, 64.78]	[129.14, 140.24]	[22.14, 23.87]	[12.29, 13.06]	
GED	64.14	131.69	22.46	12.50	0.96
	[63.63, 64.66]	[126.96, 136.43]	[21.72, 23.19]	[12.18, 12.82]	[0.38, 2.45]
HS diploma	64.72	131.23	22.01	12.97	0.61
	[64.46, 64.98]	[128.87, 133.58]	[21.64, 22.37]	[12.81, 13.13]	[0.27, 1.34]
Some college	64.75	129.10	21.64	12.74	0.37
	[64.44, 65.06]	[126.26, 131.94]	[21.19, 22.08]	[12.55, 12.94]	[0.15, 0.90]
College grad	65.01	128.39	21.35	12.89	0.37
	[64.66, 65.35]	[125.19, 131.59]	[20.85, 21.85]	[12.67, 13.11]	[0.15, 0.94]
No. of mothers	956	956	956	946	911
	Generation 1: African Americans				
	Height (inches) ^a	Weight (pounds) ^a	BMI ^a	Age at menarche (years) ^a	Health at 40 fair/poor ^b
Dropout	64.01	143.11	24.52	12.38	1
	[63.37, 64.64]	[136.88, 149.35]	[23.50, 25.53]	[11.98, 12.78]	
GED	64.23	136.90	23.40	12.81	0.42
	[63.59, 64.86]	[130.67, 143.14]	[22.38, 24.41]	[12.41, 13.21]	[0.18, 0.97]
HS diploma	63.84	137.55	23.79	12.90	0.32
	[63.50, 64.18]	[134.19, 140.90]	[23.24, 24.34]	[12.68, 13.11]	[0.16, 0.61]
Some college	64.77	137.81	23.05	12.90	0.28
	[64.41, 65.12]	[134.31, 141.31]	[22.48, 23.62]	[12.68, 13.13]	[0.14, 0.54]
College graduate	64.61	131.90	22.20	12.68	0.22
	[64.05, 65.17]	[126.36, 137.44]	[21.30, 23.11]	[12.32, 13.03]	[0.08, 0.54]
No. of mothers	745	745	745	740	710

^aOrdinary least square coefficients (group means) and 95% confidence intervals (in brackets).

^bOdds ratios and 95% confidence intervals (in brackets) from a logistic regression.

TABLE 3. ESTIMATES OF HEALTH GRADIENTS BY MATERNAL EDUCATION CATEGORIES FOR GENERATION 2 BY RACE

<i>Generation 2: Whites</i>					
	<i>Height (inches)^a</i>	<i>Weight (pounds)^a</i>	<i>BMI^a</i>	<i>Age at menarche (years)^a</i>	<i>Health at 17–24 fair/poor^b</i>
Dropout	65.24 [64.62, 65.87]	153.87 [146.77, 160.98]	25.33 [24.23, 26.44]	12.19 [11.91, 12.46]	1
GED	64.48 [63.95, 65.01]	147.14 [141.16, 153.12]	24.91 [23.98, 25.84]	12.34 [12.11, 12.57]	0.88 [0.39, 2.00]
HS diploma	65.11 [64.84, 65.38]	144.80 [141.76, 147.84]	24.02 [23.55, 24.50]	12.55 [12.43, 12.66]	0.49 [0.24, 1.00]
Some college	65.34 [65.02, 65.67]	144.83 [141.17, 148.48]	23.79 [23.22, 24.36]	12.55 [12.41, 12.69]	0.42 [0.19, 0.90]
College graduate	65.26 [64.89, 65.62]	139.20 [135.07, 143.34]	22.96 [22.32, 23.61]	12.62 [12.47, 12.78]	0.35 [0.16, 0.80]
No. daughters	1311	1311	1311	1300	1311
No. mothers	956	956	956	949 ^c	956
<i>Generation 2: African-Americans</i>					
	<i>Height^a (inches)</i>	<i>Weight^a (pounds)</i>	<i>BMI^a</i>	<i>Age Menarche years^a</i>	<i>Health at 17–24 fair/poor^b</i>
Dropout	64.32 [63.76, 64.87]	157.01 [149.34, 164.69]	26.68 [25.46, 27.91]	12.20 [11.93, 12.46]	1
GED	64.38 [63.84, 64.91]	160.01 [152.62, 167.40]	27.12 [25.95, 28.30]	11.88 [11.63, 12.14]	0.52 [0.29, 0.95]
HS diploma	64.57 [64.25, 64.89]	160.25 [155.84, 164.66]	27.05 [26.34, 27.75]	11.99 [11.83, 12.14]	0.39 [0.23, 0.65]
Some college	65.14 [64.82, 65.47]	160.64 [156.11, 165.18]	26.58 [25.85, 27.30]	12.04 [11.89, 12.20]	0.39 [0.23, 0.66]
College graduate	64.87 [64.35, 65.40]	156.92 [149.61, 164.23]	26.22 [25.05, 27.39]	11.97 [11.72, 12.22]	0.24 [0.11, 0.52]
No. daughters	1100	1100	1100	1088	1100
No. mothers	745	745	745	739 ^c	745

95% confidence intervals (shown in brackets) based on robust standard errors accounting for clustering within families.

^aMixed model coefficients and 95% confidence intervals.

^bOdds ratios and 95% confidence intervals from random effects logistic regression.

^cNote these are the number of mothers associated with the daughters who had an age of menarche in the data set; no requirement that mother also have age of menarche.

Discussion

Comparisons across the generations suggest that the daughters' overall health risk profiles, assessed when both were young adults, were generally worse than those of their mothers. The one exception was that both white and African American daughters were slightly taller than their mothers. There was no evidence that the height of African American women in this sample was decreasing, as Komlos⁸ found using the NHANES. Daughters arrived at adulthood heavier than their mothers did, with a significant portion at weights that place them in high risk categories associated with chronic health conditions. This is not surprising, given that the rates of overweight and obesity have increased significantly over the last 30 years. In our sample, 15% of white and 31% of African American mothers were either overweight or obese; 26% of white and 52% of African American daughters were either overweight or obese. What is noteworthy here is the magnitude of the change within a generation and within families, which allows for some control for genetic predisposition and an obesogenic environment. At comparable ages, daughters are heavier than their mothers among both African Americans and whites, and no education group was immune from this

change. The increases in BMI in generation 2 have possible long-term effects, as these young women were just entering their child-bearing years. Research over the past decade has established significant risk associated with maternal obesity for both the mother and fetus.^{18,19} In this study, 12% of the whites and 26% of the African Americans daughters were obese, thus placing their own and their future children's health at risk.

Daughters' age of menarche was earlier than their mothers', again not surprising given the population trends. In the 1963–1979 < Please expand abbreviation NHESNHES, the age of menarche for whites was 12.8 and for African American it was 12.5; in the 1988–1994 NHANES 3, the age of menarche for white females was 12.6 and for African American females it was 12.1.^{20,21} Our results were similar to these reports for whites, though the age of menarche in African American mothers was later at 12.85 years in our sample. In our sample, the daughters' average age of menarche was about 1 month earlier than the population reports for each race. The decrease in age of menarche across one generation in the daughter–mother dyads was striking. For African American women there was an approximately 9-month drop and for white women, a 3-month drop. An earlier age of menarche may

TABLE 4. ESTIMATES OF DAUGHTER-MOTHER DYAD DIFFERENCES IN MEAN HEALTH OUTCOMES BY RACE

	Whites	African Americans	p value of Chi-square test of no race difference
Height difference (inches)	0.42 [0.25, 0.58]	0.47 [0.28, 0.67]	0.5402
Weight difference (pounds)	14.14 [12.29, 15.99]	21.35 [18.92, 23.78]	0.0000
BMI difference	2.07 [1.77, 2.36]	3.22 [2.82, 3.63]	0.0000
Menarche difference ^a (years)	-0.29 [-0.39, -0.18]	-0.81 [-0.95, -0.67]	0.0000
No. of daughters	1311	1100	
No. of mothers	956	745	

Confidence intervals (shown in brackets) based on standard errors accounting for clustering within families.

^aBased on 1290 white dyads and 1082 African American dyads.

place these women at increased risk for a range of problems, a change that portends possible increased chronic disease in this cohort of daughters.

There were education gradients in health measured by BMI, age of menarche, and SRH among both generations of whites. When the daughter-mother dyad health differences were examined by maternal education, there was no evidence of change in the magnitude or direction of the education gradients. Thus, the educational gradient for whites, measured using mothers' education, appears to be stable across generations. This is in contrast to what was happening among African Americans. The education gradient in BMI found in mothers did not exist among daughters, although both generations showed an education gradient in SRH. A flattening of the education gradient might be viewed in a positive light as a reduction over time in education disparities in health among African American women. However, the reason for the flattening across African American generations in the education gradient for health was revealed by evidence from dyad differences, which showed that increases in weight and declines

in age of menarche were greater among the college educated than among dropouts. This is not the route to reducing education disparities in health envisioned by Healthy People 2020.

Despite significant efforts over the past 20 years to reduce health differences by race and economic status progress has been slow. The Healthy People 2010 Final Review² noted that there was no change in the racial health disparities in 69% of the objectives, and there was no change in health disparity by education level for 81% of these objectives. Our results are in line with these findings and suggest that in addition to the within race generation findings, the racial differences in generation 2 may be widening. For example, in generation 1, the African American mothers were approximately 7 pounds heavier than their white counterparts, and there was no difference in the age of menarche. In generation 2, the African American daughters were approximately 15 pounds heavier than their white counterparts, and there was a 6-month difference in the daughters' age of menarche. Mothers of different education attainment differ in SRH; this education gradient extended to their daughters' SRH. In generation 1

TABLE 5. ESTIMATES OF DAUGHTER-MOTHER DYAD DIFFERENCES IN MEAN HEALTH OUTCOMES BY RACE AND EDUCATION CATEGORY

	Whites			African Americans		
	Weight (pounds)	BMI	Age at menarch (years)	Weight (pounds)	BMI	Age at menarch (years)
Dropout	16.88 [9.82, 23.95]	2.12 [1.00, 3.23]	-0.34 [-0.76, 0.08]	14.84 [7.57, 22.12]	2.31 [1.10, 3.52]	-0.26 [-0.69, 0.17]
GED	16.52 [10.57, 22.46]	2.65 [1.71, 3.58]	-0.13 [-0.48, 0.22]	22.04 [15.06, 29.02]	3.51 [2.35, 4.68]	-1.09 [-1.50, -0.67]
Diploma	13.49 [10.47, 16.51]	2.02 [1.55, 2.50]	-0.41 [-0.59, -0.24]	21.16 [16.96, 25.36]	3.03 [2.33, 3.73]	-0.86 [-1.10, -0.63]
Some college	16.01 [12.38, 19.64]	2.22 [1.65, 2.80]	-0.20 [-0.42, 0.01]	22.19 [17.88, 26.50]	3.36 [2.64, 4.07]	-0.85 [-1.10, -0.61]
College graduate	10.90 [6.79, 15.00]	1.65 [1.00, 2.29]	-0.21 [-0.45, 0.03]	24.96 [18.00, 31.93]	3.93 [2.78, 5.09]	-0.79 [-1.18, -0.41]
p value 1-tailed test drop ≥ colgrad	0.075	0.237	0.300	0.024	0.058	0.035
n	1311	1311	1290	1100	1100	1082

Confidence intervals (in brackets) based on random effects regression with clustering on families.

Mixed model coefficients (group mean dyad differences) and 95% confidence intervals.

1-tailed test that absolute value of dyad difference in maternal dropout group ≥ absolute value of dyad difference in maternal college educated group.

n, no. of dyads.

there is a very wide gap in SRH at age 40 between the most advantaged women, college educated white women, and most disadvantaged women, African American dropouts. Only 5% of college educated white women reported fair/poor health, while 40% of the African American dropouts reported fair/poor health. In generation 2 there was a gap in SRH at age 17–24, with 6% of whites born to college graduates reporting fair/poor health compared to 26% of African Americans born to dropouts. When one considers the goal in Healthy People 2020 is to raise everyone to the healthiest group, the gap is wide and begins at an early age. This suggests that considerable work will need to be done to achieve the Healthy People 2020 goal of health equity.

There are limitations to this study. The mothers were a representative sample of their birth cohorts and the daughters were a representative sample of the daughters born to those women during the study years, but not a representative sample of their birth cohort. The health measures were self-reported, not clinician evaluated. The accuracy of self-reported heights and weights in other studies have been shown to depend upon sample characteristics, with differences noted by age and gender,^{22,23} but not by race.²⁴ Older ages were less accurate in reporting their heights and weights, and women generally underreport weight and overreport height, thus leading to a lower BMI.^{25,26} Because the study criteria limited the sample to only females, within the ages of 17 and 24, this likely limits the bias introduced by self-report, though it is likely that the overall BMI values may be on the low side. Menarche data were collected without the long time lags that occur in many studies. In the daughters, the question was asked of the mother or of the young women every 2 years until menarche had occurred. In the mother's generation the question was asked while she was still a young woman, thus reducing the time between menarche and the reporting.

This measure of SRH status has been used widely as an indicator of an individual's overall perception of their own health. For adults, there is a large body of literature that has shown SRH to be a robust predictor of adult health^{27–30} and in prospective studies SRH was a significant predictor for later morbidity, mortality, and the use of health services.^{29,31–34} Based upon data from the Behavioral Risk Factor Surveillance Survey (BRFSS), the CDC found that 11.34% of whites and 18.4% of African American females aged 35 to 44 reported fair/poor health.³⁵ Our results were similar with 11% of whites and 21% of African Americans mothers reporting fair/poor health at age 40 years. In adolescents, the literature also supports the use of SRH as a general health assessment measure. The SRH question has been shown to correspond closely with objective clinical assessments by health professionals,³⁶ and SRH has been shown to be a stable measure from adolescent to young adulthood.^{37,38} Using data from the BRFSS, the CDC reported fair/poor health in the 18- to 24-year-old group to be 8.7%. We found a similar overall value for whites in this study, 8% reported fair/poor health, with a greater percentage of African-Americans reporting fair/poor health (14%).

Conclusion

There are four key results: (1) In both races, daughters were taller but entered adulthood at greater risk for the develop-

ment of chronic illness than their mothers. (2) Racial differences were greater in the daughters' generation than in the mothers' generation. (3) Whites in both generations experienced educational differences in health based upon the mother's educational level, with fewer years of maternal education associated with poorer health. (4) African Americans of both generations experienced differences by maternal education in self-reported health; however, when African American daughters were compared with their mothers, daughters born to college educated women gained more weight and had earlier menarche than daughters born to high school dropouts. This led to a generational flattening in the education gradient in health among African American women, but it is not the desired path to health equity laid out in Healthy People 2020. These results, in combination, indicate that there is much work to do to improve the health and reduce disparities between African American and white women.

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Disclosure Statement

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