HAIR-RELAXER USE AND RISK OF PRETERM BIRTH AMONG AFRICAN-AMERICAN WOMEN

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Purpose: To assess whether hair-relaxer use is associated with an increased risk of preterm birth among African-American women.

Methods: We used data from the Black Women's Health Study. The participants were enrolled in 1995 and provided follow-up information in 1997, 1999, and 2001. Among 6130 singleton births reported by women <45 years of age during follow-up, 497 were preterm (<37 weeks gestation) because of premature rupture of membranes or spontaneous preterm labor for no known reason. In a case-control analysis, we compared the 497 preterm births with the 5633 births of longer gestation, and we used generalized estimation equation models to estimate multivariable odds ratios of preterm birth for users of hair relaxers.

Results: With control for confounding factors, the odds ratio for preterm birth among ever users of hair relaxers relative to never users was 1.0 (95% confidence interval, 0.6–1.8). No elevations were seen in risk for use started at a young age or for frequent use for long durations.

Conclusions: These data suggest that hair-relaxer use does not play a role in the etiology of preterm birth in Black women. (*Ethn Dis.* 2005;15:768–772)

Key Words: African-American, Hair Preparations, Preterm Birth, Women

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INTRODUCTION

Black babies in the United States are born preterm (<37 weeks gestation) more frequently than White babies,[1,2] and known risk factors do not satisfactorily explain the excess.[3,4] Hair relaxers are widely used for hair straightening by African-American women, and because hair relaxers are not regulated by the Food and Drug Administration, they may contain unknown harmful constituents.[5] The active ingredient in lye relaxers is sodium hydroxide.[6] "No lye" relaxers contain calcium hydroxide and guanidine carbonate, while "thio" relaxers contain thioglycolic acid salts. All of these chemicals break the disulfide bonds in the hair shaft, can cause hair damage and skin irritation, and are absorbed through the skin.[6–10] Product labels warn against their use in women who have damaged or lacerated scalps. Foreign substances have been found in places in the body distant from the entry point; eg, nicotine in nipple aspirates of smokers.[11] Thus, constituents of hair relaxers may reach and affect substances or organs involved in parturition. Prompted by a report that cosmetologists may be at increased risk of spontaneous abortion,[12] Blackmore-Prince et al examined the relation of hair treatments to preterm birth among Black women in North Carolina[13]; the odds ratio for exposure to hair relaxers in the three months before the pregnancy or during the pregnancy was 0.7 (95% confidence interval [CI], 0.4–1.1). In our study, we assessed the relation of hair-relaxer use to preterm birth in a nested case-control study carried out within a large follow-up study of African-American women, the Black Women's Health Study (BWHS).

MATERIALS AND METHODS

The BWHS began in 1995, when 64,500 women aged 21–69 years completed postal questionnaires that had been mailed to them with an invitation to participate in a follow-up study of the health of African-American women.[14,15] The study was approved by the institutional review boards of Boston University Medical Center and Howard University Cancer Center. The participants indicated their informed consent by completing the questionnaires. Written consent for the release of medical records was obtained from women who reported particular illnesses or outcomes during follow-up. More than 80% of the women were from California, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New York, South Carolina, Virginia, and the District of Columbia, and 97% had completed high school or a higher level of education. The 59,000 women whose addresses were deemed to be valid a year after baseline have been followed through biennial mail questionnaires. More than 80% of 1995 participants completed follow-up questionnaires during each follow-up cycle.

On each follow-up questionnaire, the women were asked to report the most recent singleton birth in the previous two years, including whether they had been told that the child was born three or more weeks early. Those who responded affirmatively were asked the number of weeks early and the reason: premature labor for no known reason, rupture of membranes, or medically induced labor or Caesarian section. The 1997 questionnaire contained five questions on use of chemical hair straighteners: the age at first use

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(<10,10–19, 20–29, ≥30), the frequency of use per year (1, 2, 3–4, 5–6, ≥7 or more), total years of use (<1, 1–4, 5–9, 10–14, 15–19, ≥20), the frequency of experiencing burns during the application (never, 1–2 times, 3–4 times, 5–9 times, ≥10 times), and which was used more often, a lye or no-lye straightener.

We conducted a nested case-control study confined to women who: completed the hair-relaxer questions on the 1997 questionnaire; reported a singleton birth on any of the 1997, 1999, and 2001 follow-up questionnaires; and were <45 years of age at the time of the birth. Among 6691 singleton births, 1058 (15.8%) were reported to be three or more weeks early (preterm). In national data, 16.1% of singleton births to Black women in 1997 were born at <37 weeks of gestation.[2] The distribution of birth weights of the babies reported to have been born three or more weeks early in the BWHS was similar to national data for African-American babies of <37 weeks gestation.[16] We obtained the doctor's report on the length of gestation for a sample of 25 women who reported that their baby was born three or more weeks early; 23 (92%) of the women's reports of the child being born three or more weeks early were corroborated by the doctor's report (including 15 of 15 women who reported that the reason for the premature birth was premature labor or rupture of membranes for no known reason). Thus, "born three or more weeks early" in the BWHS generally corresponds to the usual definition of preterm birth, <37 weeks of gestation.

We excluded 561 preterm births due to medically-indicated induction of labor or Caesarian section; this left 6130 births, of which 497 were preterm because of premature labor or rupture of membrane for no known reason. Of the 6130 births, 2675 were reported on the 1997 questionnaire, 2049 on the 1999 questionnaire, and 1406 on the 2001 questionnaire; 1698 were born to mothers who reported a birth on at least two of the follow-up questionnaires. The median age of the mothers was 31 years, and 99% had completed high school or a higher level of education.

Multivariable odds ratios of preterm birth were estimated by using generalized estimation equation models.[17] These models account for the fact that some mothers contributed more than one birth to the analysis. We compared the 497 preterm births to the 5633 babies born at longer gestations (full-

Table 1. Characteristics of mothers of 497 preterm babies (<37 weeks gestation) and 5633 full term babies, Black Women's Health Study

Characteristic	Preterm (*n*=497) *n* (%)	Full Term (*n*=5633) *n* (%)
Time period of birth		
1995–1997	234 (47.1)	2441 (43.3)
1997–1999	268 (33.8)	1881 (33.4)
1999–2001	95 (19.1)	1311 (23.3)
Age at delivery		
<25	34 (6.8)	286 (5.1)
25–29	142 (28.6)	1662 (29.5)
30–34	181 (36.4)	2243 (39.8)
35–39	120 (24.1)	1205 (21.4)
40–44	20 (4.0)	237 (4.2)
Parity before the pregnancy		
Nulliparous	239 (48.1)	2557 (45.4)
Parous	257 (51.7)	3075 (54.6)
Missing	1 (.2)	1 (.1)
Previous preterm birth		
No	397 (79.9)	5223 (92.7)
Yes	100 (20.1)	410 (7.3)
Mother herself born preterm		
No	260 (52.3)	3614 (65.2)
Yes	66 (13.3)	367 (6.5)
Not sure/unknown	171 (34.4)	1652 (29.3)
Education in 1995 (years)		
≤12	48 (9.7)	522 (9.3)
13–15	187 (37.6)	1938 (34.4)
16	151 (30.4)	1734 (30.8)
≥17	107 (21.5)	1370 (24.3)
Missing	4 (.8)	69 (1.2)
Smoked during the pregnancy		
No	453 (91.2)	5222 (92.7)
Yes	43 (8.6)	387 (6.9)
Missing	1 (.2)	24 (.4)
Marital status		
Married or living as married	330 (66.4)	4145 (73.6)
Divorced/separated/widowed	44 (8.9)	433 (7.7)
Single	120 (24.1)	1017 (18.0)
Missing	3 (.6)	38 (.7)

term births). PROC GENMOD with the "logit link" function in SAS was used to estimate the regression parameters and 95% confidence intervals (SAS version 8.2). In addition to terms for hair relaxer use, the models included terms for age at delivery, years of education, smoking during pregnancy, marital status, parity status before the birth, previous preterm birth, the mother having been born preterm, and the questionnaire on which the birth was reported. We did not control for prenatal care because almost all the women reported having received prenatal care during the first trimester.

Models were repeated without control for previous preterm birth because of the possibility of over-controlling for factors that predict more than one preterm birth in the same woman; the results were similar to those presented. Because of the possibility of reporting bias among women who reported births on the same questionnaire as hair relaxer use, the 1997 questionnaire, we repeated the analyses after excluding the births reported on the 1997 questionnaire; the results were similar to those presented.

Table 2. Hair-relaxer use among mothers of 497 preterm babies and 5633 full term babies, Black Women's Health Study

Hair-Relaxer Use	Preterm *n*	Full Term *n*	Multivariable OR*	95% CI*
Ever	483	5461	1.0	.6–1.8
Never	14	172	Ref	—
Age started (years)				
<10	50	532	.9	.6–1.4
10–19	350	4191	.8	.6–1.1
≥20	80	718	Ref	—
Unknown	3	20	—	—
Duration (years)				
<5	42	426	Ref	—
5–9	57	641	.8	.5–1.3
10–14	161	1760	.9	.6–1.3
15–19	135	1725	.8	.6–1.2
≥20	82	883	.9	.6–1.4
Unknown	6	26	—	—
Frequency of use (per year)				
1–2	57	514	Ref	—
3–4	116	1285	.8	.6–1.1
5–6	136	1591	.8	.6–1.1
≥ 7	166	2018	.7	.5–1.0
Unknown	8	53	—	—
Number of burns				
None	73	770	Ref	—
1–2	113	1358	.9	.6–1.2
3–4	107	1127	1.0	.7–1.4
5–9	81	921	.9	.6–1.3
≥10	105	1265	.9	.6–1.2
Unknown	4	20	—	—
Type of relaxer				
Lye	77	1027	.9	.7–1.1
No lye	371	3928	Ref	—
Unknown	35	506	.7	.5–1.1

* Adjusted for time period, age at delivery, education, smoking during pregnancy, marital status, parity, previous preterm birth, and mother herself born preterm.

RESULTS

The mothers of preterm babies more often had a previous preterm birth, had been born preterm themselves, smoked during the pregnancy, were single, were nulliparous before the pregnancy, and had lower educational attainment than mothers of full-term babies (table 1). The two groups were similar in age.

Hair-relaxer use was reported by 97% of both the mothers of preterm babies and the mothers of full-term babies (Table 2); the multivariable odds ratio for ever use relative to never use was 1.0 (95% confidence interval [CI], 0.6–1.8). When the analysis was confined to one birth per woman (the first), the results were similar: the odds ratio was 0.9 (95% CI, 0.5–1.6) for preterm birth in ever users of hair relaxers relative to never users.

Table 2 gives data on the age at which hair-relaxer use was begun, the total duration of use, the frequency of use, the number of burns, and whether the product used contained lye. The odds ratios ranged from 0.7 to 1.0 and the 95% confidence intervals included 1.0 for all categories of age started use, duration of use, frequency of use, number of burns, and type of relaxer.

Table 3 gives data on women who used hair relaxers ≥7 times a year according to the total duration of use. Because the number of cases in the two lowest categories of use, <5 years and 5–9 years, was small, we used 10–14 years duration as the reference category for the computation of odds ratios. The odds ratios were 1.0 or 1.1 for all categories relative to 10–14 years; for the longest duration category, ≥20 years, the estimate was 1.0 (95% CI 0.6–1.7). Subgroup analyses within categories of age showed no evidence of increased risk (data not shown).

DISCUSSION

The present study and the only known previous study of hair-relaxer use and preterm birth[13] show no

Table 3. Duration of hair relaxer use ≥7 times per year among mothers of 166 preterm babies and 2018 full term babies, Black Women's Health Study

Duration of Use (years)	Preterm *n*	Full term *n*	Multivariable OR*	95% CI
<5	3	37	1.0	—
5–9	16	164	1.1	.6–2.1
10–14	53	654	Ref	—
15–19	56	752	1.0	.7–1.5
≥20	37	406	1.0	.6–1.7
Unknown	1	5	—	—

* Adjusted for time period, age at delivery, education, smoking during pregnancy, marital status, parity, previous preterm birth, and mother born preterm.

association of hair-relaxer use with preterm birth; in both studies all the odds ratios were compatible with 1.0., but the studies differed in several important respects. The previous study assessed hair-relaxer use immediately before or during the pregnancy, whereas the present study assessed lifetime use. The preterm births in the previous study included medically indicated births, whereas the preterm births in the present study included only those due to premature labor or rupture of membranes for no known reason. The previous study included teenage pregnancies whereas the present study did not. The women in the previous study were less educated; 22% had not completed high school compared with 1% in the present study.

In the previous study,[13] 59% of the mothers of control infants reported use of hair straighteners, which indicates a high prevalence of use during pregnancy. In the present study, the timing of use in relation to the pregnancy was unknown, but a considerable amount of use was habitual and long term, at least seven times a year for many years. Such use likely extended into the pregnancies of many users because inserts on hair-relaxer packages do not warn that women should cease use during pregnancy. Nevertheless, if exposure during a particular period of time was critical, misclassification could have obscured a small effect.

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Strengths of the present study are the large number of preterm and full-term births, the high prevalence of habitual use of hair relaxers, and the control for important predictors of preterm birth. Follow-up rates were high, lessening the possibility of selective losses. The results were unchanged when the analyses included only births that occurred after the data on hair-relaxer use were collected, eliminating the possibility of reporting bias. The exclusion of preterm births resulting from medically indicated induction of labor or Casesarian section eliminated dilution of an effect by including an outcome etiologically different from the outcome of interest.[3,18] The participants in the BWHS are not a representative sample of US Black women. However, their educational levels represent the levels of most African-American women nationally, ie, the 85% who have graduated from high school or completed a higher level of education.[19] In addition, the preterm birth rate among BWHS participants was similar to that among Black women nationally.[2] In sum, the evidence to date suggests that hair relaxers are unlikely to play a role in the occurrence of preterm birth among African-American women.

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