Childhood Abuse and Early Menarche: Findings From the Black Women's Health Study

| Lauren A. Wise, ScD, Julie R. Palmer, ScD, Emily F. Rothman, ScD, and Lynn Rosenberg, ScD

Age at menarche is an important predictor of women's health across the lifespan. Early age at menarche is associated with earlier age at initiation of sexual activity[1] and first pregnancy[1,2] and is a risk factor for several adult conditions, including gynecologic disorders,[3] obesity,[4] cardiovascular disease,[5] autoimmune diseases,[6–8] and cancer.[9,10] Established risk factors for early menarche include increased growth velocity,[11] overweight or obesity,[11] physical inactivity,[11,12] high fat intake,[13] and genetics.[11,12] Several psychosocial risk factors for early menarche have also been identified, including absence of the father,[14–16] parental conflict,[16,17] and family tension.[15,18–20] US studies indicate a decrease in pubertal age over the past several decades of 6 months to 1 year in all ethnic groups.[21–23] In addition, national data show that non-Hispanic Black girls experience menarche at a significantly earlier age than do non-Hispanic White and Mexican American girls.[23] The reasons for the racial discrepancy in menarcheal age are largely unknown, but differences in early life nutritional factors or adiposity may play a role.[23]

Some studies suggest that childhood abuse can influence reproductive end points, including ovarian hormone metabolism,[24] preterm birth,[25] and timing of the menopausal transition.[26] To our knowledge, 4 studies have evaluated the association of childhood abuse with age at menarche.[27–30] All 4 found a positive association between childhood sexual abuse and early menarche.[27–30] Of the 2 studies that examined the role of childhood physical abuse,[28,29] 1 found a weak positive association for physical abuse after control for sexual abuse,[29] and the other found a strong positive association for physical abuse but did not adjust for sexual abuse.[28]

An association between childhood abuse and early onset of menarche is biologically plausible. Childhood sexual trauma can affect the hypothalamic–pituitary–adrenal axis, the limbic system, and possibly gene expression of hormone receptors in the brain, with abuse being associated with chronic activation of the

Objectives. We examined the association between childhood abuse and early menarche in a sample of US Black women.

Methods. We conducted multivariable log-binomial regression on data from 35 330 participants in the Black Women's Health Study to estimate risk ratios and 95% confidence intervals for the relation of childhood physical and sexual abuse with early age at menarche (i.e., <12 years).

Results. In adjusted analyses, sexual abuse was positively associated with early menarche, and the risk of early menarche increased with increasing frequency of sexual abuse incidents. We observed a weak but statistically significant association between physical abuse and early menarche. Associations between sexual abuse and early menarche were stronger when we used a more stringent cutpoint for early menarche (i.e., <11 years).

Conclusions. Our data suggest an increased risk of early menarche among Black women who experienced childhood sexual abuse. Evidence for an association between childhood physical abuse and early menarche was equivocal. (*Am J Public Health.* 2009;99:S460–S466. doi:10.2105/AJPH.2008.149005)

hypothalamic–pituitary–adrenal axis.[31–34] Chronic activation of this axis, in turn, may influence gonadotropin levels and ovarian function via alterations in the hypothalamic–pituitary–ovarian axis.[35–37] Less is known about how physical abuse may influence ovarian function, but results of 1 earlier study suggest that its effects, assuming the same mechanism, may be smaller than that of sexual abuse.[29]

Retrospective surveys indicate that 5% to 25% of North American women have experienced some form of childhood sexual abuse,[38–43] and the prevalence of childhood physical abuse is estimated to be 13% to 28%.[39–44] Although the prevalence of childhood sexual abuse is estimated to be greater for Blacks (8%–19%) than for Whites (6%–9%) or Hispanics (5%–8%), these differences attenuate after adjustment for sociodemographic and family background characteristics.[38,44]

Studies conducted to date on childhood abuse and age at menarche were limited in sample size (ranging from 323[27] to 816[29] participants) and included few Black women. All but 1 study[29] either focused exclusively on sexual abuse[27,30] or failed to control for sexual abuse in the assessment of physical abuse.[28] A larger study was needed to assess the independent

associations of childhood sexual and physical abuse with early menarche, particularly among Black women, who experience menarche earlier on average than do other ethnic groups and, possibly, more childhood abuse. To investigate these associations, we analyzed data collected from more than 35 000 Black women participating in a national cohort study.

METHODS

The Black Women's Health Study is a national prospective cohort study of self-identified Black women that was established in 1995. The study is funded by the National Cancer Institute, and its primary aims are to identify environmental determinants of health and illness among US Black women. Respondents were recruited through several sources: the *Essence* magazine subscriber list, professional organization rosters, and friends and relatives of early respondents.[45] Study respondents come from across the United States, with the majority residing in California, New York, New Jersey, Illinois, Michigan, and Georgia. The study collects updated data from original cohort members every 2 years. After 12 years of follow-up, cohort retention was approximately 80%.

Study Sample

The Black Women's Health Study cohort comprised approximately 59 000 volunteers who were aged 21 to 69 years at baseline. We excluded women who did not complete the 2005 questionnaire (n=15 888), did not provide their age at menarche (n=201), or did not complete the childhood abuse questions on the 2005 follow-up questionnaire (n=7632), leaving 35 330 women for analysis.

Women who completed the abuse questions were similar to those who did not with respect to mean age at menarche (12.3 vs 12.4 years), age at baseline (39.1 vs 39.7 years), education (14.9 vs 14.5 years), and attained height (65.0 inches for both groups).

Measures

On the 1995 (baseline) questionnaire, participants were asked, "How old were you when your menstrual periods began?" Response categories were ≤9, 10, 11, 12, 13, 14, 15, 16, or ≥17 years, or never had periods.

On the 2005 follow-up questionnaire, participants were asked multiple questions about experiencing violence across the lifespan, including any exposure that occurred up to age 11 years. The 9-item abuse assessment instrument was adapted from the Conflict Tactics Scales[46] and the Pregnancy Abuse Assessment Screen.[47] Response categories for all items were never, 1–3 times, or ≥4 times.

Childhood physical abuse was defined as any report that a perpetrator "pushed, grabbed, or shoved me"; "threw something at me that could hurt me"; "kicked, bit, or punched me"; "hit me with something including hand or fist"; or "physically attacked me in some other way" 4 or more times or either "choked or burned me" or "seriously harmed someone I loved" at any frequency. We created a physical abuse summary score variable by assigning respondents 1 point for each report of a physical abuse item that occurred 4 or more times, with the exception of "choked or burned" or "seriously harmed someone I loved," for which we assigned 1 point if they occurred 1 to 3 times and 2 points if they occurred 4 or more times, because we considered these events to be more severe. The resulting physical abuse severity score, which ranged from 0 to 9, was further categorized as low (score=1), intermediate (score=2), or high (score≥3).

Childhood sexual abuse was defined as any report of a perpetrator having "exposed genitals against my will" 4 or more times or "been sexual with me against my will" at any frequency. For respondents who reported sexual abuse, we created a summary variable that distinguished those who reported 4 or more incidents of sexual assault (i.e., "been sexual with me against my will") from those who experienced 1 to 3 incidents.

From the baseline survey, we collected data on several correlates of early menarche, including date of birth, height, weight at age 18 years, and years of education. In addition, the 2003 questionnaire asked about current household income, and the 2005 questionnaire asked about maternal age at participant's birth and state of residence at birth.

Data Analysis

We conducted a principal components factor analysis of the physical and sexual abuse data with an orthogonal rotation. This analysis revealed 2 factor loadings, which confirmed the predetermined physical and sexual domains of the abuse questions. The first factor, which included 7 questions assessing physical abuse, had factor loadings ranging from 0.26 to 0.82. The second factor, which included 2 questions assessing sexual abuse, had loadings that ranged from 0.87 to 0.88. The promax rotation, which allowed correlation between the abuse items, yielded a similar 2-factor solution. The Cronbach α for the 7 physical items and the 2 sexual abuse items were 0.80 and 0.82, respectively, indicating high internal consistency.

Duplicate questionnaires were inadvertently returned by 690 women in 2005. We assessed the reproducibility over time of responses to the abuse questions (median duration between receipt dates=61 days; interquartile range=36–102 days). Weighted κ values indicated good reproducibility of responses (range=0.48–0.78). In general, the childhood sexual abuse questions (κ=0.68–0.78) showed higher agreement than did the childhood physical abuse questions (κ=0.48–0.60). The level of agreement did not vary appreciably by the length of the interval between the 2 questionnaires (<60 vs ≥60 days) or by age at baseline.

Those who completed duplicate questionnaires were similar to other cohort members with respect to age at menarche (mean=12.3 vs 12.3 years) and reporting of abuse (physical abuse, 45.4% vs 43.4%; sexual abuse, 18.1% versus 18.8%).

We created a mutually exclusive variable to identify women who had experienced 0, 1, or both types of childhood abuse. We compared means and frequency distributions of selected sample characteristics across levels of this mutually exclusive abuse variable. We then examined the risk of early menarche (defined as <12 years) in association with any childhood abuse, type of abuse, and frequency of abuse according to abuse type. Log-binomial regression models were used to estimate risk ratios (RRs) and 95% confidence intervals (CIs) for abuse in relation to early age at menarche (<12 years).[48] We chose a cutpoint of 12 years of age for early menarche for 2 reasons: to remain consistent with the definition of early menarche most commonly used in studies of this association[27,28] and to increase certainty about the directionality of the association, given that childhood abuse in our study was defined as occurring up to age 11 years.

In addition to calculating unadjusted effect estimates, we constructed a multivariable model that controlled for age at baseline (years), maternal age at the participant's birth (<20 vs ≥20 years), attained height (inches), education (<12, 13–15, 16, or ≥17 years), household income (≤$25 000, $25 001–$50 000, $50 001–$100 000, or >$100 000), and region of residence at birth (Northeast, South, Midwest, West, not born in United States). To evaluate the independent effects of physical and sexual abuse with early menarche, we included variables for each type of abuse simultaneously in the regression models. The reference category for all analyses was women who reported no childhood abuse. Indicator variables were used to model missing covariate data.

Recall of age at menarche has been shown to have greater accuracy among higher educated[49] and younger[50] women. Therefore, we repeated all analyses after stratifying the data by having received a college education (<16 vs ≥16 years of education) and by age at baseline (<40 vs ≥40 years). As a formal test of interaction, we conducted likelihood ratio tests that

compared models with and without cross-product terms between the abuse variables and both education and age. A 2-sided *P* value lower than .05 was considered statistically significant. Finally, we repeated analyses with a more stringent definition of early age at menarche (<11 years).

All analyses were carried out with SAS statistical software, version 9.1 (SAS Institute, Cary, NC).

RESULTS

The median age of participants at baseline was 38 years (interquartile range=31–46 years), and the mean and median ages at menarche were 12.3 and 12.0 years, respectively (frequency distribution: ≤9 years, 4.2%; 10 years, 7.4%; 11 years, 17.0%; 12 years, 28.2%; 13 years, 24.5%; 14 years, 9.8%; 15 years, 4.6%; 16 years, 3.1%; ≥17 years, 1.2%). Frequency distributions of the abuse items are shown in Table 1. The percentage of participants who reported experiencing each of the physical and sexual abuse items 4 or more times ranged from 0.8% ("choked or burned me") to 27.0% ("hit me with something including hand or fist").

Selected characteristics of study participants according to type of childhood abuse are shown in Table 2. Almost 50% of women reported any childhood abuse; 30.9% reported physical abuse only, 6.2% reported sexual abuse only, and 12.6% reported both physical and sexual abuse. Abuse was inversely related to age at

baseline, maternal age at participant's birth, household income, and having been born in the South (Table 2). No appreciable differences were found in educational attainment, height, or body mass index at age 18 years.

In adjusted analyses, women who reported any childhood abuse had 1.12 times the risk of early menarche as women who reported no childhood abuse (95% CI=1.08, 1.16; Table 3). Adjusted RRs for early menarche were 1.05 (95% CI=1.01, 1.09) for physical abuse only, 1.27 (95% CI=1.20, 1.35) for sexual abuse only, and 1.22 (95% CI=1.16, 1.28) for both physical and sexual abuse relative to no abuse. Adjusted RRs for early menarche were similar for low (1.05), intermediate (1.04), and high (1.05) physical abuse severity scores relative to no abuse. Those who reported a higher frequency of sexual abuse had a higher likelihood of early menarche: RRs for early menarche for 1 to 3 and 4 or more incidents of sexual abuse relative to no abuse were 1.26 (95% CI=1.18, 1.34) and 1.34 (95% CI=1.23, 1.45), respectively.

Associations between childhood abuse and early menarche were also present within strata of age at baseline and education (Table 4), and we found no evidence of effect modification

TABLE 1—Frequency of Childhood Abuse Among Black Women (N=35330): Black Women's Health Study, 2005

Abuse Item[a]	No. (%)
Pushed, grabbed, or shoved me	
Never	13371 (37.8)
1–3 times	13938 (39.5)
≥4 times	8021 (22.7)
Threw something at me that could hurt me	
Never	23173 (65.6)
1–3 times	9136 (25.9)
≥4 times	3021 (8.5)
Kicked, bit, or punched me	
Never	20390 (57.7)
1–3 times	10937 (31.0)
≥4 times	4003 (11.3)
Hit me with something, including hand or fist	
Never	13476 (38.1)
1–3 times	12314 (34.9)
≥4 times	9540 (27.0)
Choked or burned me	
Never	33801 (95.6)
1–3 times	1257 (3.6)
≥4 times	272 (0.8)
Physically attacked me in some other way	
Never	28441 (80.5)
1–3 times	4767 (13.5)
≥4 times	2122 (6.0)
Exposed genitals against my will	
Never	28728 (81.3)
1–3 times	4830 (13.7)
≥4 times	1762 (5.0)
Was sexual with me against my will	
Never	28849 (81.7)
1–3 times	4342 (12.3)
≥4 times	2139 (6.0)
Seriously harmed someone I loved	
Never	29835 (84.5)
1–3 times	3577 (10.1)
≥4 times	1918 (5.4)

[a]Ordered and phrased as they appeared on survey instrument.

TABLE 2—Selected Characteristics, by Type of Childhood Abuse: Black Women's Health Study, 2005

	No Abuse (n=17770)	Physical Abuse Only (n=10922)	Sexual Abuse Only (n=2202)	Physical and Sexual Abuse (n=4436)
Age at baseline, y, mean	40.3	38.5	37.7	36.9
Maternal age at participant's birth, y, mean	25.7	25.3	25.1	24.1
Education, y, mean	14.8	15.0	14.9	14.8
Adult height, in, mean	64.9	65.0	65.1	65.1
Body mass index at age 18 y, kg/m^2, mean	21.2	21.4	21.8	21.7
Income, %				
≤$25000	10.8	11.1	11.8	13.8
$25001–$50000	29.0	27.6	28.7	30.4
$50001–$100000	36.2	37.1	36.2	34.3
>$100000	15.8	17.2	16.7	14.7
Missing	8.2	7.0	6.7	6.7
Region of residence at birth, %				
Northeast	22.5	23.5	25.6	23.3
South	41.2	38.9	36.2	35.9
Midwest	21.1	21.8	21.7	23.7
West	8.3	9.4	9.5	9.9
Outside United States	4.6	4.8	5.2	5.3

Note. Characteristics are presented as means or percentages within abuse categories and are age standardized to distribution of cohort at baseline.

TABLE 3—Association Between Childhood Abuse and Early Menarche: Black Women's Health Study, 2005

	Total, No. (%)	Age at Menarche <12 y, %	Unadjusted RR (95% CI)	Adjusted RR[a] (95% CI)
No abuse (Ref)	17 770 (50.3)	26.7	1.00	1.00
Any abuse	17 560 (49.7)	30.5	1.14 (1.10, 1.18)	1.12 (1.08, 1.16)
Type of abuse				
Physical abuse only	10 922 (30.9)	28.4	1.06 (1.02, 1.11)	1.05 (1.01, 1.09)
Sexual abuse only	2 202 (6.2)	34.6	1.29 (1.21, 1.38)	1.27 (1.20, 1.35)
Physical and sexual abuse	4 436 (12.6)	33.5	1.25 (1.19, 1.31)	1.22 (1.16, 1.28)
Physical abuse severity[b]				
Low	6 768 (19.2)	29.4	1.10 (1.05, 1.15)	1.05 (1.00, 1.10)
Intermediate	3 356 (9.5)	29.7	1.11 (1.05, 1.18)	1.04 (0.98, 1.10)
High	5 234 (14.8)	30.6	1.15 (1.09, 1.20)	1.05 (1.00, 1.11)
Sexual abuse frequency[c]				
1–3 times	4 499 (12.7)	33.2	1.24 (1.18, 1.30)	1.26 (1.18, 1.34)
≥ 4 times	2 139 (6.1)	35.3	1.32 (1.24, 1.40)	1.34 (1.23, 1.45)

Note. RR = risk ratio; CI = confidence interval.
[a]Adjusted for age at baseline, maternal age at participant's birth, height, education, income, region of residence at birth, and foreign-born status. Mutually adjusted for both types of abuse.
[b]This excluded women who reported sexual abuse only.
[c]This excluded women who reported physical abuse only.

(statistical interaction) by age or education on the main associations of interest (all, *P* > .05). When we repeated analyses after excluding from our definition of physical abuse the 1594 women who gave a positive answer only to the item "seriously harmed someone I loved," which could be defined as witnessing rather than experiencing physical abuse, the physical abuse results were nearly identical (physical abuse only: RR = 1.05; 95% CI = 1.01, 1.09; low severity: RR = 1.05; 95% CI = 1.00, 1.10; intermediate severity: RR = 1.04; 95% CI = 0.98, 1.11; high severity: RR = 1.05; 95% CI = 1.00, 1.11).

Associations between sexual abuse and early menarche were stronger when we used a more stringent cutpoint for early menarche (age < 11 years; 11.6% of cohort). With this new cutpoint, relative to no abuse, adjusted RRs for early menarche were 1.20 (95% CI = 1.13, 1.27) for any abuse, 1.07 (95% CI = 1.00, 1.14) for physical abuse only, 1.50 (95% CI = 1.35, 1.67) for sexual abuse only, and 1.40 (95% CI = 1.29, 1.52) for both physical and sexual abuse. Relative to no abuse, adjusted RRs for early menarche were 1.07, 1.03, and 1.08 for low, intermediate, and high physical abuse severity scores, respectively; adjusted RRs for early menarche for 1 to 3 and 4 or more incidents of

sexual abuse were 1.47 (95% CI = 1.32, 1.64) and 1.60 (95% CI = 1.39, 1.84), respectively.

DISCUSSION

We found that self-reported childhood sexual abuse was positively associated with early menarche among US Black women and that the risk of early menarche increased with increasing frequency of sexual abuse incidents. There was a weak but statistically significant association between physical abuse and early menarche. Associations between childhood abuse and early menarche did not vary appreciably by age or education. Associations between sexual abuse and early menarche were stronger when we used a more stringent cutpoint for early menarche (age < 11 years). To our knowledge, this is the first study of these associations among a large population of US Black women.

Our results are consistent with previous investigations that found a positive association between sexual abuse and early menarche[27–30] and a weaker association between physical abuse and early menarche.[29] Our findings expand the existing literature in several ways: we used a larger sample than any of the previous studies; we studied Black women, who have been

underrepresented in earlier investigations; we controlled for several potential confounders that were not controlled previously; and we simultaneously accounted for sexual and physical abuse in all multivariable analyses, reducing the possibility that the physical abuse findings were confounded by sexual abuse.

Epidemiologic studies have demonstrated good recall of age at menarche among adult women.[49–53] Research suggests that menarche is recalled within 1 year of the actual event by 79%[51] to 90%[52] of women surveyed and that there is higher accuracy of recall among women with higher educational attainment[49] and a shorter interval between menarche and recall.[50] When we stratified the results by education, we found that our results were slightly stronger among the most educated women in our sample, suggesting that our positive results overall are not attributable to error in women's recall of age at menarche. Furthermore, we do not believe that our results were affected by selection bias, because the average age at menarche was similar among women who did and did not answer the abuse questions.

Limitations

Several limitations of our study should be noted. As with all studies that assess childhood abuse, reporting of abuse history is susceptible to misclassification, and we were unable to validate abuse occurrence, type, or severity.[54,55] Although participants were unaware of the study hypothesis, differential recall of abuse between women with and without an early menarche cannot be ruled out. For example, if women with an early menarche were more likely than were those with a later menarche to recall childhood abuse, then a spurious positive association would be observed. Random errors in reporting would generally result in bias toward the null. Given that we observed a stronger association with early menarche for sexual than for physical abuse, errors in reporting would have had to be differential according to the type of abuse to explain our findings.

Abuse victimization may have been underreported. The instruments on which we based our abuse questions have been widely used and have demonstrated high reproducibility both within our cohort and in other studies.[47,56] The Conflict Tactics Scales,[46] on which our questionnaire was partly based, is widely

TABLE 4—Association Between Childhood Abuse and Early Age at Menarche, by Age at Baseline and Education: Black Women's Health Study, 2005

	Total, No. (%)	Age at Menarche <12 y, %	Adjusted RR[a] (95% CI)
Baseline age <40 y			
No abuse (Ref)	8939 (46.8)	27.9	1.00
Any abuse	10140 (53.2)	31.6	1.12 (1.07, 1.17)
Type of abuse			
Physical abuse only	6147 (32.2)	29.9	1.06 (1.02, 1.17)
Sexual abuse only	1272 (6.7)	35.1	1.25 (1.15, 1.35)
Physical and sexual abuse	2721 (14.3)	33.9	1.20 (1.12, 1.27)
Physical abuse severity[b]			
Low	3747 (19.6)	30.5	1.05 (0.99, 1.12)
Intermediate	1900 (10.0)	30.8	1.05 (0.97, 1.14)
High	3221 (16.9)	32.1	1.08 (1.01, 1.16)
Sexual abuse frequency[c]			
1–3 times	2637 (13.8)	33.9	1.25 (1.14, 1.35)
≥4 times	1356 (7.1)	34.8	1.27 (1.14, 1.41)
Baseline age ≥40 y			
No abuse (Ref)	8831 (54.3)	25.5	1.00
Any abuse	7420 (45.7)	28.9	1.12 (1.06, 1.17)
Type of abuse			
Physical abuse only	4775 (29.4)	26.5	1.03 (0.97, 1.09)
Sexual abuse only	930 (5.7)	33.9	1.31 (1.19, 1.44)
Physical and sexual abuse	1715 (10.6)	32.9	1.27 (1.17, 1.37)
Physical abuse severity[b]			
Low	3021 (18.5)	28.1	1.04 (0.97, 1.12)
Intermediate	1456 (9.0)	28.2	1.01 (0.92, 1.11)
High	2013 (12.4)	28.3	1.00 (0.92, 1.09)
Sexual abuse frequency[c]			
1–3 times	1862 (11.5)	32.1	1.28 (1.16, 1.41)
≥4 times	783 (4.8)	36.0	1.46 (1.28, 1.67)
Education <16 y			
No abuse (Ref)	9120 (50.7)	25.8	1.00
Any abuse	8865 (49.3)	29.3	1.11 (1.06, 1.16)
Type of abuse			
Physical abuse only	5291 (29.4)	27.3	1.04 (0.98, 1.10)
Sexual abuse only	1133 (6.3)	32.3	1.22 (1.11, 1.34)
Physical and sexual abuse	2441 (13.6)	32.4	1.21 (1.13, 1.30)
Physical abuse severity[b]			
Low	3313 (18.4)	28.0	1.02 (0.96, 1.10)
Intermediate	1707 (9.5)	28.8	1.03 (0.95, 1.13)
High	2712 (15.1)	30.0	1.06 (0.98, 1.14)
Sexual abuse frequency[c]			
1–3 times	2381 (13.3)	31.6	1.20 (1.10, 1.32)
≥4 times	1093 (6.6)	33.9	1.29 (1.15, 1.45)
Education ≥16 y			
No abuse (Ref)	8650 (49.9)	27.8	1.00
Any abuse	8695 (50.1)	31.6	1.13 (1.08, 1.18)

Continued

recognized as broadly inclusive of many types of victimization, because it also includes witnessed acts of violence.

Within our cohort, exploratory factor analysis confirmed the preconceptualized domains of abuse, suggesting that these questions captured the underlying constructs they were intended to measure. However, it is still possible that sexual abuse was underreported, because our prevalence estimate (18.8%) was slightly lower than estimates derived from community-based investigations.[57,58] For instance, a study combining 16 community-based cross-sectional surveys of child abuse among North Americans estimated a prevalence of sexual abuse among women of 22%, which ranged from 8% (narrow definition of abuse) to 36% (broad, noncontact definition).[59] Abuse might have been underreported because of social desirability factors or because the inability to recall abuse is a common posttraumatic symptom.[54,60] Another source of underreporting might have been the interpretation of the words "against my will," because young children may not form will or accurately remember whether they did so.

The retrospective nature of our analysis prevented us from determining the temporal relation between abuse onset and menarche. Reverse causation (i.e., menarche preceding abuse) would be a concern if girls who matured faster were more likely to be targeted by perpetrators.[61] However, recent national data show that the peak onset of sexual abuse for girls is age 7 to 8 years, suggesting that most sexual abuse in our study was initiated prior to menarche.[62]

We cannot rule out confounding by unmeasured factors given we did not measure a variety of predictors of age at menarche, such as genetics (e.g., maternal age at menarche), early-life family environment, early-life nutritional status, and childhood socioeconomic status.[15,63,64] We controlled for various indicators of maternal and adult socioeconomic status with the assumption that they are strongly correlated with childhood socioeconomic status.

The Black Women's Health Study is a convenience sample of women with higher levels of education than the general population. Nonetheless, prevalence estimates of age at menarche[22] and childhood abuse[38–44] are generally similar to those found in nationally representative studies. Because the overall association between abuse and menarche did not vary appreciably by other

TABLE 4—*Continued*

Type of abuse			
Physical abuse only	5631 (32.4)	29.5	1.06 (1.00, 1.11)
Sexual abuse only	1069 (6.2)	36.9	1.32 (1.21, 1.44)
Physical and sexual abuse	1995 (11.5)	34.8	1.23 (1.15, 1.32)
Physical abuse severity[b]			
Low	3455 (19.9)	30.8	1.07 (1.00, 1.14)
Intermediate	1649 (9.5)	30.6	1.04 (0.96, 1.13)
High	2522 (14.6)	31.3	1.04 (0.97, 1.12)
Sexual abuse frequency[c]			
1–3 times	2118 (12.2)	34.9	1.31 (1.20, 1.43)
≥ 4 times	946 (5.5)	37.0	1.38 (1.22, 1.55)

Note. RR = risk ratio; CI = confidence interval.
[a]Adjusted for age, education, maternal age at participant's birth, height, education, income, region of residence at birth, and foreign-born status. Mutually adjusted for both types of abuse.
[b]This excluded women who reported sexual abuse only.
[c]This excluded women who reported physical abuse only.

factors, such as education and age at baseline, we expect the positive findings to be generalizable to a broader population of US Black women and to women of other ethnic groups.

Conclusions

Childhood abuse is a prevalent and pervasive problem in the United States that has been linked to adverse mental and physical health outcomes.[65–68] Our results suggest that an important event in reproductive life—menarche—may also be influenced by childhood abuse. Although the effect estimates observed in our study are modest, a link between abuse and early menarche, if real, could have important public health implications given the high prevalence of sexual abuse.[38–43]

Screening for sexual abuse is increasingly a part of general pediatric practice, but many pediatricians lack a consistent approach to patient evaluation.[69,70] Menarche may provide clinicians with an opportunity to raise the topic of sexual initiation and screen for past abuse. Although our findings do not imply that early menarche would be a useful screen for sexual abuse victimization, the presence of early menarche in combination with other physical or behavioral signs and symptoms should prompt clinicians to obtain a detailed history.

Further studies are needed to establish the time sequence between abuse and menarche. In addition, replication of our results in a study population with additional measures of early life factors and additional components of abuse that we did not assess (e.g., relationship of perpetrator to victim) is warranted. ■

About the Authors

Lauren A. Wise, Julie R. Palmer, and Lynn Rosenberg are with the Slone Epidemiology Center and the Department of Epidemiology, Boston University of Public Health, Boston. Emily F. Rothman is with the Department of Social and Behavioral Sciences, Boston University School of Public Health, Boston.

Requests for reprints should be sent to Lauren A. Wise, Slone Epidemiology Center, 1010 Commonwealth Ave, Boston, MA, 02215 (e-mail: lwise@slone.bu.edu).

This article was accepted October 17, 2008.

Contributors

L. A. Wise led the design and collection of the violence questions and carried out all data analyses. J. R. Palmer and L. Rosenberg conceptualized the parent study and have overseen the study's operation and data collection since 1995. E. F. Rothman provided feedback on the design of the violence questions. All authors participated in interpreting the data, writing the article, and revising it critically for intellectual content.

Human Participant Protection

The institutional review boards of Boston University Medical Center and Howard University Cancer Center approved the study.

References

1. Zabin LS, Smith EA, Hirsch MB, Hardy JB. Ages of physical maturation and first intercourse in Black teenage males and females. *Demography.* 1986;23: 595–605.

2. Goodman MJ, Grove JS, Gilbert F Jr. Age at first pregnancy in relation to age at menarche and year of birth in Caucasian, Japanese, Chinese and part-Hawaiian women living in Hawaii. *Ann Hum Biol.* 1980; 7:29–33.

3. Wise LA, Palmer JR, Harlow BL, et al. Reproductive factors, hormonal contraception and risk of uterine leiomyomata in African-American women: a prospective study. *Am J Epidemiol.* 2004;159:113–123.

4. Laitinen J, Power C, Jarvelin MR. Family social class, maternal body mass index, childhood body mass index, and age at menarche as predictors of adult obesity. *Am J Clin Nutr.* 2001;74:287–294.

5. Cooper GS, Ephross SA, Weinberg CR, et al. Menstrual and reproductive risk factors for ischemic heart disease. *Epidemiology.* 1999;10:255–259.

6. Karlson EW, Mandl LA, Hankinson SE, Grodstein F. Do breast-feeding and other reproductive factors influence future risk of rheumatoid arthritis? Results from the Nurses' Health Study. *Arthritis Rheum.* 2004;50:3458–3467.

7. Operskalski EA, Visscher BR, Malmgren RM, Detels R. A case-control study of multiple sclerosis. *Neurology.* 1989;39:825–829.

8. Costenbader KH, Feskanich D, Stampfer MJ, Karlson EW. Reproductive and menopausal factors and risk of systemic lupus erythematosus in women. *Arthritis Rheum.* 2007;56:1251–1262.

9. Elwood JM, Cole P, Rothman KJ, Kaplan SD. Epidemiology of endometrial cancer. *J Natl Cancer Inst.* 1977;59:1055–1060.

10. Kelsey JL, Gammon MD, John EM. Reproductive factors and breast cancer. *Epidemiol Rev.* 1993;15: 36–47.

11. Petridou E, Syrigou E, Toupadaki N, et al. Determinants of age at menarche as early life predictors of breast cancer risk. *Int J Cancer.* 1996;68:193–198.

12. Trentham-Dietz A, Nichols HB, Remington PL, et al. Correlates of age at menarche among sixth grade students in Wisconsin. *WMJ.* 2005;104:65–69.

13. Merzenich H, Boeing H, Wahrendorf J. Dietary fat and sports activity as determinants for age at menarche. *Am J Epidemiol.* 1993;138:217–224.

14. Surbey M. Family composition, stress and human menarche. In: Ziegler TE, Bercovitch FB, eds. *Socioendocrinology of Primate Reproduction: Proceedings of a Symposium From the XII Congress of the International Primatological Society Held in Brasilia, Brazil, July 24–29, 1988.* New York, NY: Wiley-Liss; 1990:11–32.

15. Moffitt TE, Caspi A, Belsky J, Silva PA. Childhood experience and the onset of menarche: a test of a sociobiological model. *Child Dev.* 1992;63:47–58.

16. Wierson M, Long PJ, Forehand RL. Toward a new understanding of early menarche: the role of environmental stress in pubertal timing. *Adolescence.* 1993;28: 913–924.

17. Kim K, Smith PK. Family relations in early childhood and reproductive development. *J Reprod Infant Psychol.* 1999;17:133–148.

18. Steinberg L. Reciprocal relation between parent-child distance and pubertal maturation. *Dev Psychol.* 1988;24:122–128.

19. Graber JA, Brooks-Gunn J, Warren MP. The antecedents of menarcheal age: heredity, family environment, and stressful life events. *Child Dev.* 1995;66:346–359.

20. Hulanicka B. Acceleration of menarcheal age of girls from dysfunctional families. *J Reprod Infant Psychol.* 1999;17:119–132.

21. Kaplowitz P. Pubertal development in girls: secular trends. *Curr Opin Obstet Gynecol.* 2006;18:487–491.

22. McDowell MA, Brody DJ, Hughes JP. Has age at menarche changed? Results from the National Health and Nutrition Examination Survey (NHANES) 1999–2004. *J Adolesc Health.* 2007;40:227–231.

23. Anderson SE, Must A. Interpreting the continued decline in the average age at menarche: results from two nationally representative surveys of US girls studied 10 years apart. *J Pediatr.* 2005;147:753–760.

24. Allsworth JE, Zierler S, Krieger N, Harlow BL. Ovarian function in late reproductive years in relation to lifetime experiences of abuse. *Epidemiology.* 2001;12:676–681.

25. Noll JG, Schulkin J, Trickett PK, et al. Differential pathways to preterm delivery for sexually abused and comparison women. *J Pediatr Psychol.* 2007;32:1238–1248.

26. Allsworth JE, Zierler S, Lapane KL, et al. Longitudinal study of the inception of perimenopause in relation to lifetime history of sexual or physical violence. *J Epidemiol Community Health.* 2004;58:938–943.

27. Zabin LS, Emerson MR, Rowland DL. Childhood sexual abuse and early menarche: the direction of their relationship and its implications. *J Adolesc Health.* 2005;36:393–400.

28. Romans SE, Martin JM, Gendall K, Herbison GP. Age of menarche: the role of some psychosocial factors. *Psychol Med.* 2003;33:933–939.

29. Brown J, Cohen P, Chen H, Smailes E, Johnson JG. Sexual trajectories of abused and neglected youths. *J Dev Behav Pediatr.* 2004;25:77–82.

30. Vigil JM, Geary DC, Byrd-Craven J. A life history assessment of early childhood sexual abuse in women. *Dev Psychol.* 2005;41:553–561.

31. Heim C, Newport DJ, Heit S, et al. Pituitary-adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *JAMA.* 2000;284:592–597.

32. Penza KM, Heim C, Nemeroff CB. Neurobiological effects of childhood abuse: implications for the pathophysiology of depression and anxiety. *Arch Womens Ment Health.* 2003;6:15–22.

33. Heim C, Nemeroff CB. The role of childhood trauma in the neurobiology of mood and anxiety disorders: preclinical and clinical studies. *Biol Psychiatry.* 2001;49:1023–1039.

34. De Bellis MD, Chrousos GP, Dorn LD, et al. Hypothalamic-pituitary-adrenal axis dysregulation in sexually abused girls. *J Clin Endocrinol Metab.* 1994;78:249–255.

35. Kam K, Park Y, Cheon M, et al. Effects of immobilization stress on estrogen-induced surges of luteinizing hormone and prolactin in ovariectomized rats. *Endocrine.* 2000;12:279–287.

36. Tilbrook AJ, Canny BJ, Serapiglia MD, Ambrose TJ, Clarke IJ. Suppression of the secretion of luteinizing hormone due to isolation/restraint stress in gonadectomised rams and ewes is influenced by sex steroids. *J Endocrinol.* 1999;160:469–481.

37. Breen KM, Billings HJ, Wagenmaker ER, Wessinger EW, Karsch FJ. Endocrine basis for disruptive effects of cortisol on preovulatory events. *Endocrinology.* 2005;146:2107–2115.

38. Finkelhor D. Current information on the scope and nature of child sexual abuse. *Future Child.* 1994;4:31–53.

39. Felitti VJ, Anda R, Nordenberg D, et al. The relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the Adverse Childhood Experiences (ACE) Study. *Am J Prev Med.* 1998;14:245–258.

40. Finkelhor D, Dziuba-Leatherman J. Children as victims of violence: a national survey. *Pediatrics.* 1994;94:413–420.

41. Kilpatrick DG, Saunders BE. Prevalence and consequences of child victimization: results from the national survey of adolescents, final report. Submitted to the US Department of Justice, Office of Justice Programs, National Institute of Justice, November 1997. Available at: http://www.ncjrs.gov/pdffiles1/nij/grants/181028.pdf. Accessed November 25 2008.

42. Kilpatrick DG, Acierno R, Saunders B, et al. Risk factors for adolescent substance abuse and dependence: data from a national sample. *J Consult Clin Psychol.* 2000;68:19–30.

43. Finkelhor D, Ormrod RK, Turner H. Re-victimization patterns in a national longitudinal sample of children and youth. *Child Abuse Negl.* 2007;31:479–502.

44. Barnett OW, Miller-Perrin CL, Perrin RD. Physical child abuse. In: Barnett OW, Miller-Perrin CL, Perrin RD, eds. *Family Violence Across the Lifespan.* Thousand Oaks, CA: Sage Publications; 1996.

45. Rosenberg L, Adams-Campbell LL, Palmer JR. The Black Women's Health Study: a follow-up study for causes and preventions of illness. *J Am Med Womens Assoc.* 1995;50:56–58.

46. Straus MA. Measuring intrafamily conflict and violence: the Conflict Tactics (CT) Scales. *J Marriage Fam.* 1979;41:75–88.

47. McFarlane J, Parker B, Soeken K, Bullock L. Assessing for abuse during pregnancy. Severity and frequency of injuries and associated entry into prenatal care. *JAMA.* 1992;267:3176–3178.

48. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. *Am J Epidemiol.* 2005;162:199–200.

49. Cooper R, Blell M, Hardy R, et al. Validity of age at menarche self-reported in adulthood. *J Epidemiol Community Health.* 2006;60:993–997.

50. Koprowski C, Coates RJ, Bernstein L. Ability of young women to recall past body size and age at menarche. *Obes Res.* 2001;9:478–485.

51. Must A, Phillips SM, Naumova EN, et al. Recall of early menstrual history and menarcheal body size: after 30 years how well do women remember? *Am J Epidemiol.* 2002;155:672–679.

52. Bean JA, Leeper JD, Wallace RB, Sherman BM, Jagger H. Variations in the reporting of menstrual histories. *Am J Epidemiol.* 1979;109:181–185.

53. Casey VA, Dwyer JT, Coleman KA, et al. Accuracy of recall by middle-aged participants in a longitudinal study of their body size and indices of maturation earlier in life. *Ann Hum Biol.* 1991;18:155–166.

54. Fergusson DM, Horwood LJ, Woodward LJ. The stability of child abuse reports: a longitudinal study of the reporting behaviour of young adults. *Psychol Med.* 2000;30:529–544.

55. Kendall-Tackett K, Becker-Blease K. The importance of retrospective findings in child maltreatment research. *Child Abuse Negl.* 2004;28:723–727.

56. Straus MA. The Conflict Tactics Scales and its critics: an evaluation and new data on validity and reliability. In: Straus MA, Gelles RJ, eds. *Physical Violence in American Families: Risk Factors and Adaptations to Violence in 8,145 Families.* New Brunswick, NJ: Transaction Publishers; 1990.

57. Amodeo M, Griffin ML, Fassler IR, Clay CM, Ellis MA. Childhood sexual abuse among black women and white women from two-parent families. *Child Maltreat.* 2006;11:237–246.

58. Hamptom RL, Gelles RJ. Violence toward Black women in a nationally representative sample of Black families. *J Comp Fam Stud.* 1994;25:105–119.

59. Gorey KM, Leslie DR. The prevalence of child sexual abuse: integrative review adjustment for potential response and measurement biases. *Child Abuse Negl.* 1997;21:391–398.

60. Acierno R, Resnick HS, Kilpatrick DG. Health impact of interpersonal violence. 1: Prevalence rates, case identification, and risk factors for sexual assault, physical assault, and domestic violence in men and women. *Behav Med.* 1997;23:53–64.

61. Golub MS, Collman GW, Foster PM, et al. Public health implications of altered puberty timing. *Pediatrics.* 2008;121(suppl 3):S218–S230.

62. Trickett PK, Putnam FW. Impact of child sexual abuse on females: toward a developmental, psychobiological integration. *Psychol Sci.* 1993;4:81–87.

63. Zacharias L, Wurtman RJ. Age at menarche. Genetic and environmental influences. *N Engl J Med.* 1969;280:868–875.

64. Campbell BC, Udry JR. Stress and age at menarche of mothers and daughters. *J Biosoc Sci.* 1995;27:127–134.

65. Kendall-Tackett K. The health effects of childhood abuse: four pathways by which abuse can influence health. *Child Abuse Negl.* 2002;26:715–729.

66. Goodwin RD, Stein MB. Association between childhood trauma and physical disorders among adults in the United States. *Psychol Med.* 2004;34:509–520.

67. Molnar BE, Buka SL, Kessler RC. Child sexual abuse and subsequent psychopathology: results from the National Comorbidity Survey. *Am J Public Health.* 2001;91:753–760.

68. Springer KW, Sheridan J, Kuo D, Carnes M. Long-term physical and mental health consequences of childhood physical abuse: results from a large population-based sample of men and women. *Child Abuse Negl.* 2007;31:517–530.

69. Leder MR, Emans SJ, Hafler JP, Rappaport LA. Addressing sexual abuse in the primary care setting. *Pediatrics.* 1999;104:270–275.

70. Kellogg N. American Academy of Pediatrics Committee on Child Abuse and Neglect. The evaluation of sexual abuse in children. *Pediatrics.* 2005;116:506–512.