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# Biological and socio-cultural factors during the school years predicting women's lifetime educational attainment

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## Abstract

**BACKGROUND—**Lifetime educational attainment is an important predictor of health and well-being for women in the United States. In the current study, we examine the roles of socio-cultural factors in youth and an understudied biological life event, pubertal timing, in predicting women's lifetime educational attainment.

**METHODS—**Using data from the National Longitudinal Survey of Youth 1997 cohort (N = 3889), we conducted sequential multivariate linear regression analyses to investigate the influences of macro-level and family-level socio-cultural contextual factors in youth (region of country, urbanicity, race/ethnicity, year of birth, household composition, mother's education, mother's age at first birth) and early menarche, a marker of early pubertal development, on women's educational attainment after age 24.

**RESULTS—**Pubertal timing and all socio-cultural factors in youth, other than year of birth, predicted women's lifetime educational attainment in bivariate models. Family factors had the strongest associations. When family factors were added to multivariate models, geographic region in youth and pubertal timing were no longer significant.

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**CONCLUSION—**Our findings provide additional evidence that family factors should be considered when developing comprehensive and inclusive interventions in childhood and adolescence to promote lifetime educational attainment among girls.

## Keywords

educational attainment; women; puberty; family

Lower educational attainment among women in the United States (US) is associated with numerous behavioral and physical health risk factors across the life course. These include unintended pregnancy,[1] divorce and single-motherhood,[2] intimate partner violence,[3] smoking,[4] obesity,[5] coronary heart disease,[6] and cancer.[7] Further, women with lower educational attainment have higher all-cause mortality rates than more educated women from ages 25 through 64.[8] Attaining lower levels of education impacts not only the lifelong health of women, but also the health of their children. Specifically, women with lower educational attainment more often have babies that are premature[9,10] and low birth weight,[11] and have lower rates of breast feeding,[12,13] which are all associated with poor health outcomes throughout these children's lives.[14–16]

Overall, women in the US are currently achieving all-time high levels of education, but dramatic disparities remain.[17] Social ecological models explain how socio-cultural factors influence individuals' developmental trajectories over the life course,[18] including educational developmental trajectories.[19] Whereas there is variation in how these models are presented and understood,[20–23] social ecological models assert that the interrelated levels of an individual's socio-cultural context together influence the development and behavior of the individual. Many well-documented socio-cultural factors in childhood and adolescence predict US women's educational attainment. Some influential socio-cultural contexts include more distal, macro-level factors of geographic context[24,25] and race/ethnicity,[26] and more proximal, family-level factors such as household composition.[27] For example, in the US, women from southern and rural regions of the country have historically attained less education than women from other geographic settings.[24,25] According to social ecological models, experiencing the norms and resources of these environments in part shapes a woman's educational trajectory and explains this disparity. Similarly, women of color, women living in households with lower socioeconomic status, and women from single-parent households attain fewer years of education than their peers.[26,27]

Beyond socio-cultural factors, there are known biological factors in youth associated with women's academic achievement and educational attainment such as childhood working memory capacity,[28] developing an early-onset mental disorder,[29] and experiencing a chronic disease or major injury in childhood.[30–32] However, one understudied biological factor that may influence educational attainment is the timing of girl's pubertal development. Pubertal development is a dynamic biological, psychological, and social process occurring during the school years. In addition to experiencing the neuroendocrine and physical body changes that accompany puberty, girls are interpreting these changes as well as the responses of peers and adults to these changes. The developmental readiness theory, also known as stage termination theory, is one of the primary developmental theories guiding research related to

how girls' early pubertal timing influences behavioral and emotional health.[33] According to this theory, girls entering puberty early are not cognitively or emotionally mature enough to effectively cope with the social challenges associated with a more physically-developed body compared to their same-age peers. This can lead to difficulties with self-concept and healthy decision-making, and maladaptive coping behaviors in adolescence, such as substance use or romantic involvement with older boys. Early-developing girls are at elevated risk for deleterious health behaviors and outcomes in adolescence including eating disorders, conduct disorders, substance use, sexual risk-taking, and psychological distress.[34] These adolescent health behaviors and outcomes have the potential to impact a girl's academic achievement and her ability to continue her education.[35,36]

Life course theory[37] proposes that life events, such as the timing of puberty, embedded within larger socio-cultural contexts (eg, macro and family-level factors) continuously shape a person's developmental trajectory throughout life.[38] For example, life course theory suggests the risk behaviors associated with early pubertal timing experienced during the middle and high school years have the potential to impact a girl's long-term educational attainment. As life events, as well as the socio-cultural contexts in which they occur, together shape an individual's life course, researchers must examine both life events and socio-cultural contextual factors in youth to comprehensively explore their impact on lifetime educational achievement (Figure 1).

Life course theory supports the notion that the combination of events and socio-cultural contexts in childhood would influence academic achievement and school engagement in adolescence, which would in turn impact educational attainment into adulthood. One study tested this hypothesis and found that girls with early menarche had more academic problems during the transition into high school leading to lower academic achievement (as measured by grade point average) and higher dropout rates by the end of high school.[39] Beyond high school, the evidence is mixed with some literature demonstrating pubertal timing differences in postsecondary school attainment[40,41] and others finding no difference in educational attainment in young adulthood.[42] Some research suggests that the problematic behaviors and health outcomes associated with early pubertal timing may dissipate by young adulthood or that later maturing girls' behavior patterns "catch up" with early maturers by young adulthood.[42] Conversely, early maturing girls have demonstrated elevated risk for symptoms of psychopathology,[42,43] a higher number of lifetime sexual partners,[42] as well as lower educational and occupational outcomes[41] beyond adolescence, suggesting that some deleterious outcomes associated with early pubertal development persist further in the life course.

The purpose of the current study was to examine the associations between socio-cultural contextual factors in youth and an understudied biological life event—early menarche—and women's lifetime educational attainment. We hypothesized that girls who experienced early pubertal timing would have lower educational attainment than their on-time and later developing peers. We also predicted that macro-level socio-cultural contextual factors of minority race/ethnicity, living in a southern or rural region of the country, and an earlier year of birth would each be associated with lower levels of educational attainment. Finally, we hypothesized family factors, including father absence in youth, and having mothers with

lower educational attainment and that were younger at their first birth would be associated with lower educational attainment.

## METHODS

### Participants

Data were from the female participants of National Longitudinal Surveys of Youth 1997 cohort (NLSY97) which is a nationwide, ongoing cohort study of US residents born between 1980 and 1984.[44] Participants turned 25 years of age between 2004 and 2010 and continue to be interviewed annually. The original NLSY97 cohort consisted of 4385 women. The currently analytic sample of 3889 women was obtained by excluding the 428 women who did not report their highest grade completed after age 24, and the additional 68 women who did not report their age at menarche. As the analytic sample consisted of a sub-sample of the original female cohort, we did not use sampling weights per the NLSY97 sample weighting recommendations.[45]

### Instruments

**Educational attainment—**We measured women's highest grade completed after age 24 as a continuous variable (M=13.90, SD=2.92). Although some women continue to pursue education throughout their lives, women's educational attainment after age 24 is considered a standard approximation for women's overall lifetime educational attainment in the US.[5]

**Pubertal timing—**Participants began reporting if they had reached menarche, and at what age, in wave 1 in 1997 (when respondents were 12–17 years old). Participants that did not know their month or year of menarche reported age at menarche. Participants that had not reached menarche by wave 1 were asked about their menarcheal status (yes/no) and month/year or age at menarche in subsequent waves until menarche was reported. Over 98% of the analytic sample reported their month and year or age of menarche during an interview prior to age 18 and over 99% reported prior to age 19. For girls reporting their month and year of menarche, age at menarche was calculated using their month and year of birth and then converted to a dichotomous variable: early menarche (<1 standard deviation below the mean, <11.02 years) versus non-early menarche (11.02 years and older) based on prior research with the NLSY.[46,47] and the distribution in menarcheal ages among our analytic sample (M=12.48, SD=1.46). Whereas age at menarche is only one of many indicators of pubertal timing among women and occurs late in the pubertal process,[48] it is generally considered an appropriate approximate measurement of pubertal stage and timing for women.[48,49]

**Macro-level socio-cultural contextual factors in youth—**In the current study, we examined macro-level socio-cultural contexts in childhood and adolescence demonstrated to influence the life course, particularly women's lifetime educational achievement: geographic location in youth, race/ethnicity, and temporality.[24–26,50]

Participants and their parents each retrospectively reported the participant's location of residence at age 12. Parents reported during the first wave of interviews and participants

reported during wave 6 (at 17 to 24 years of age). The residence location was pre-coded in the NLSY97 data set as urban or rural and by Census region. We dichotomized Census region into "Southern" and "All Other Regions" for the current analyses. We primarily used parent-reported data for geographic context variables. For any participant missing parent-reported location for which participant-reported location was not missing, participant-reported location was substituted.

We considered participants' race and ethnicity as socially constructed factors historically associated with US women's educational attainment.[26] These included non-Hispanic white, Non-Hispanic black, and Hispanic. The NLSY97 also included race/ethnicity categories of non-Hispanic American Indian or Eskimo or Aleut, non-Hispanic Asian or Pacific Islander, non-Hispanic Mixed Race, and non-Hispanic "something else."[51] However, due to variations in women's educational attainment by race and ethnicity in the US, and because these race/ethnicity categories made up less than 1.5% of the analytic sample, their race/ethnicity was recoded as "missing" for the current analyses.

Additionally, we considered the year of the participants' births (1980–1984) as a potentially influential temporal context factor as average US women's educational attainment continues to increase over time.[50] Year of birth was treated as a continuous variable in analyses.

**Family-level socio-cultural contextual factors in youth—**We chose family factors a priori based on previous research linking them to both girls' pubertal timing and women's educational attainment.[27,52–54] These included mother's educational attainment, mother's age at first birth, and father absence in youth. Mother's educational attainment was reported by mothers of participants during the first wave of data collection as a continuous variable and by participants during the first wave of data collection as a categorical variable. For any participant missing mother-reported education level, participant report of mother's education was substituted and all data was divided into 3 categories: did not graduate high school, high school diploma only, and at least some college. Mother's age at first birth was dichotomized: younger than 20 years old and 20 years or older. Women were coded as having biological father absence in youth if they reported that their father did not live in their household at any point prior to and including the first wave of the study (ie, ages 2, 4, 6, 12–17).

## Data Analysis

We conducted descriptive analyses (t-tests and F-tests, as appropriate) to determine the bivariate relationships of pubertal timing and socio-cultural contextual factors in youth with educational attainment after age 24. We further conducted chi-square tests to determine the prevalence of early menarche among participants by socio-cultural contextual factors and educational attainment.

We next conducted sequential multiple linear regression models to assess the direct effects of early menarche and macro and family-level socio-cultural factors on educational attainment. Linear regression diagnostics (assessing the normality and homoscedasticity of residuals and the multicollinearity of exposure variables) were satisfactory for all models. In the first step, we regressed women's number of years of education attained on early

menarche, the biological life event of interest. Next, we added macro-level socio-cultural factors in youth (region of country, urbanicity, race/ethnicity, year of birth). In the final model we added family factors in childhood (mother's education, mother's age at first birth, father absence) to the model to assess the influence of these factors above and beyond the influence of macro-level factors.

## RESULTS

### Sample Characteristics

In the bivariate models, all socio-cultural contextual factors except year of birth were significantly associated with participants' educational attainment (Table 1). Hispanic participants had the lowest educational attainment in the sample, followed by non-Hispanic blacks participants, and non-Hispanic white participants. Participants who were from southern communities, were missing urbanicity information, had experienced father absence in youth, had mothers who were under age 20 at first birth, had mothers with lower educational attainment, or experienced early menarche all had significantly lower lifetime educational attainment.

Turning to differences by pubertal timing, participants experiencing early menarche were more likely to drop out of high school and less likely to enroll in college, were less likely to be Non-Hispanic white, had mothers with lower educational attainment, had mothers who were more likely to be under age 20 at their first birth, were more likely to have experienced biological father absence in youth, and were more likely to be either from the South or missing geographic region information at age 12 (Table 1).

**Model 1: Biological Life Event - Timing of Menarche—**Women reporting early menarche attained approximately 0.6 years less education by age 25 than women reporting on-time or later menarche. Menarcheal timing explained only 0.5% of the variance in women's lifetime educational attainment—a small, but statistically significant effect ($p < .005$).

**Model 2: Macro-level Socio-cultural Contextual Factors in Youth—**Macro-level socio-cultural contextual factors were added to the model and explained an additional 5% of the variance in respondents' educational attainment (Table 2). Early menarche continued to predict lower levels of educational attainment after controlling for macro-level socio-cultural contextual factors in youth. Hispanic and non-Hispanic black participants attained less education than non-Hispanic white participants ($p < .001$). Women growing up in Southern communities attained slightly less education than women from other regions of the country; women missing geographic region data in youth attained less education than women from non-southern communities and women reporting urbanicity in youth (all $p < .05$). Participants' year of birth and whether they grew up in an urban or rural community did not significantly predict their educational attainment.

**Model 3: Family-level Socio-cultural Contextual Factors in Youth—**After adding father absence, mother's educational attainment, and mother's age at first birth to the model, pubertal timing and geographic factors were no longer predictive of participants' educational

attainment (Table 2). Further, the difference between non-Hispanic black and non-Hispanic white participants' educational attainment was no longer significant. However, Hispanic participants continued to attain lower levels of education compared to non-Hispanic white participants after controlling for these family factors ($p < .005$). These family factors explained an additional 17% of the variance in participants' educational attainment. Participants whose mothers attended at least some college attained on average 2.24 additional years of education ($p < .001$) compared to participants whose mothers did not graduate from high school, after controlling for other childhood and adolescent contextual factors. When controlling for all other macro and family-level socio-cultural contextual factors, participants with mothers under age 20 at their first birth, and those that experienced father absence in youth, attained on average one less year of education than participants with mothers over age 20 at their first births and those whose fathers were present in the household throughout youth, respectively (all $p < .005$).

### *Post Hoc* Analyses

Given the significant relationships between geographic region, race/ethnicity, pubertal timing, and educational attainment (Table 1), we conducted *post hoc* analyses to determine if specific macro-level socio-cultural contexts modify early developing girls' risk for discontinuing education. All tests for moderation were non-significant, suggesting the relationship between early age at menarche and educational attainment does not vary by race/ethnicity or geographic variables among this population.

## DISCUSSION

The purpose of the current study was to assess the influence of socio-cultural factors in youth and an understudied biological life event—early menarche—on women's lifetime educational attainment. Early menarche, was inversely associated with number of years of education attained after age 24 in bivariate models. Participants with early menarche reported achieving approximately a half year less education overall than women reporting on-time or late menarche. Although the effect size was small, this relationship held when also considering macro-level socio-cultural contextual factors from the participants' childhood and adolescence. When family factors were added to the model, however, pubertal timing no longer predicted women's lifetime educational attainment. This suggests family factors explained away the relationships between girls' pubertal timing and educational attainment by age 25. These findings support Copeland et al's conclusions that the impact of early pubertal timing appears to dissipate over the life course for some psychosocial outcomes.[42]

Our hypotheses regarding the influence of macro-level socio-cultural factors were partially supported. Participants from southern communities and non-white participants had lower educational attainment after age 24. However, participants' year of birth and whether they grew up in an urban or rural community did not significantly predict their educational attainment. Whereas women in the US continue to attain higher levels of education,[50] the participants in this study were separated at most by 5 years of age which may not have been enough time to demonstrate age cohort variations in educational attainment. Further, rural

communities in the US currently have higher high school graduation rates but maintain lower college entry and graduation rates than their urban counterparts.[24] As educational attainment is more homogenous in rural communities, the larger disparity in educational attainment among urban women may explain why the average level of educational attainment did not significantly differ by urbanicity in our study.

Family factors were each strongly associated with educational attainment and explained away some of the influence of the macro-level socio-cultural factors: geographic location at age 12 and the difference between non-Hispanic black and non-Hispanic white participants' educational attainment. Participants with fathers living in the household throughout girls' youth, mothers with higher educational attainment, and mothers who were older at their first birth had higher educational attainment, after adjusting for the more distal, macro-level influential socio-cultural factors. These findings support a social ecological perspective of influence on women's lifetime educational attainment[18] in that the more proximal socio-cultural factors (family-level) had stronger influence than the more distal factors (macro-level) and even explained away the effects of the more distal contextual factors of geographic location and the difference between non-Hispanic black and non-Hispanic white participants' educational attainment in multivariate models. However, in this study, Hispanic women continued to attain significantly lower levels of education than non-Hispanic white women after accounting for all other socio-cultural factors and pubertal timing. Whereas Hispanic women have historically attained less education than non-Hispanic women, high school dropout and college enrollment rates have dramatically improved among Hispanic women in recent years.[55] These current trends in increasing educational attainment may not have been evident yet in our study population, as the NLSY97 cohort reached 25 years of age between 2004 and 2010.

This study had several strengths. First, the data are from a national, ethnically diverse sample, offering useful insight into the factors associated with lifetime educational attainment among women across multiple racial/ethnic groups and geographies. This builds upon others' work that has been more regional in scope.[40,42] Second, the longitudinal data structure allows for an examination of individuals from adolescence into adulthood, and includes information from childhood. By going beyond high school to consider complete educational trajectories, we add to Cavanagh's work[39] and support Copeland et al's findings.[42] Third, the National Longitudinal Survey of Youth provides rich sociodemographic data to allow us to understand and account for the role of influential socio-cultural contexts in childhood.

## Limitations

Geographic location at age 12 and age at menarche were retrospectively reported. Given that respondents reported their address, which was then geocoded to determine geographic region and urbanicity, we are relatively confident that there is little self-reporting error for these measures. Research similarly suggests that self-reported age at menarche is relatively accurate.[49] However, it is unknown whether other indicators of pubertal timing not present in this data set (eg, breast development, hormone levels, and self-perception of pubertal timing) would be more salient predictors of lower educational attainment for women. Future

research should include a variety of measurements of pubertal timing to assist in determining which aspects of pubertal timing are most influential in predicting educational attainment.

Ideally, prepubertal BMI would have been considered as a covariate as it has been linked to both girls' pubertal timing[56,57] and girls' educational outcomes[58,59] in previous research. Because menarche typically occurs later in the pubertal development process and puberty is associated with drastic weight and height changes,[48] BMI at wave 1 (when participants were ages 12 and older) was not considered to be an appropriate proxy for prepubertal BMI.

As is common with large cohort studies, some variables contained missing data. We excluded all respondents for whom age at menarche and/or educational attainment after age 24 was missing. Whereas the descriptive characteristics of those missing age at menarche were not statistically different from those with menarche data, those missing educational attainment data after age 24 were different in some descriptive characteristics. They were more often missing data for urbanicity and region of country in youth, were less often southern, more often non-Hispanic white, had mothers older at first birth, and less often experienced father absence in youth. The resulting sample was therefore slightly more at-risk for lower educational attainment than would be expected if all data were present. Participants missing both self-reported and parent-reported geographic data at age 12 were more often Hispanic, with younger and less educated mothers, and had lower educational attainment. Hence, missing geographic context information at age 12 was considered as its own category in analyses. This could have resulted in a less significant association between geographic context and educational attainment than would have been expected.

In the current analyses, we did not detect any moderation effects for biological-environmental interactions by race/ethnicity and geographic location, potentially due to the small direct effect size of early menarche on educational attainment and missing data. Also, the aim of this study was to examine 2 specific levels of socio-cultural contextual factors – the macro and family level – as the factors within these levels have previously been associated with both pubertal timing and women's educational attainment. Future work exploring the influence of socio-cultural factors and life events in childhood and adolescence on women's lifetime educational attainment should incorporate the influence of other levels, including peer and school-level contextual factors.

### Conclusion

Although pubertal timing can be relevant for educational attainment, these findings provide additional evidence of the paramount importance of the childhood family context in influencing girls' educational outcomes into adulthood. Maternal education, father presence in youth, and mother's age at first birth should all be considered when developing more comprehensive and inclusive interventions promoting educational attainment among girls.

## IMPLICATIONS FOR SCHOOL HEALTH

The findings of this study have important and challenging implications for schools. If it were simply that early menarche were associated with lower educational attainment, schools

could focus on providing health education about pubertal development earlier in elementary schools, *before* early developing girls begin puberty. This education could be provided to girls and their families along with training for teachers and school health clinicians on the additional psychosocial support early developing girls may need to avoid the risks associated with early development. However, because family factors, such as father absence and maternal education, appear to potentially be the root causes for the menarche-educational attainment association, and these family characteristics are often immutable by the time girls reach adolescence, we must identify ways in which schools can help provide some of the benefits we assume higher-educated mothers and father presence in the home may provide. For example, well-supported mentoring programs in which early adolescent girls are paired with college students and graduates could help them as they transition through puberty and stay on track for academic success.[60–63]

Schools can also nurture the family ties that exist. Increasingly, school districts are developing family engagement programming, in which schools provide multiple venues for families to become meaningfully involved in their children's education.[64–66] Several of these initiatives have been associated with increased academic achievement.[66] Relatedly, schools must focus on developing family engagement interventions that are considerate and inclusive of the diversity of family structures within their schools, in particular single-parent families and parents with low educational attainment. In practice, schools note challenges in reaching families that may benefit most from family engagement interventions.[67–69] Even when providing multi-lingual activities at various times during the day and week and offering food and child care, barriers still exist that prevent families from participating in family engagement initiatives. Some schools have attempted to identify and mitigate these barriers by involving community-based organizations, training already-involved parents as parent leaders, employing parent-school liaisons, providing transportation to families to school-based events, and visiting families in their homes.[68,70–73] Further, schools can help connect families to resources for adults to advance their own education, through English lessons, computer/internet classes, and GED and college courses, so parents and guardians may serve as educational role models to their daughters.[70]

As young women with higher academic achievement are also at lower risk for teenage childbearing[74] and more likely to have the father involved in childrearing,[75] our findings emphasize the importance of embarking on these types of interventions to break the cycle of intergenerational low educational attainment among women.

## Human Subjects Approval Statement

The NLSY97 procedures and questionnaires were reviewed and approved by the US Office of Management and Budget and the institutional review boards (IRBs) at The Ohio State University and the National Opinion Research Center (NORC) at the University of Chicago.[76] The present study was deemed not to be human subjects research by the Institutional Review Board at the University of Texas at Austin as it involved secondary use of de-identified data (FWA #2030).

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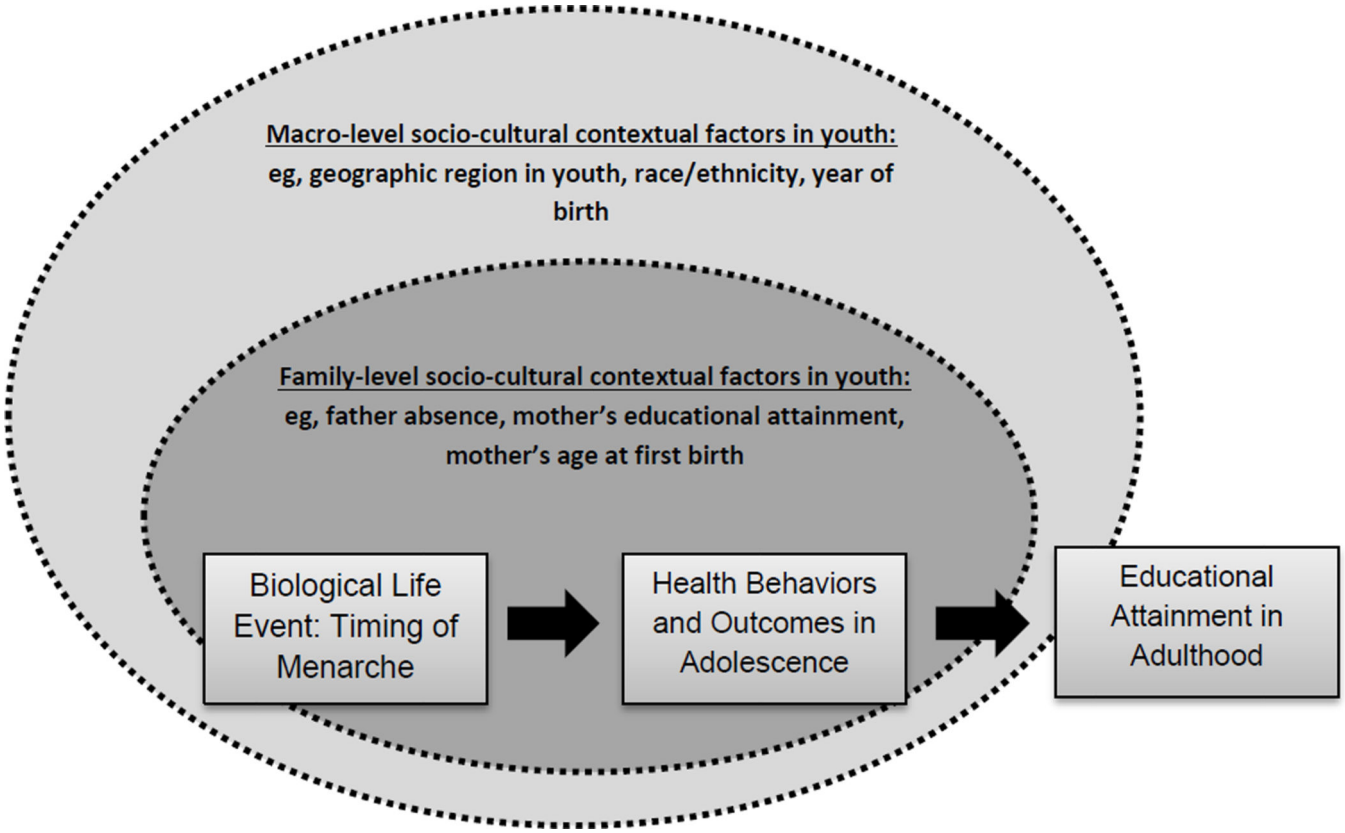


**Figure 1.**
Conceptual Model of the Influence of Macro and Family-level Socio-cultural Contextual Factors in Youth and Pubertal Timing on Women's Lifetime Educational Achievement

**Table 1**

Unweighted Descriptive Characteristics of Analytic Sample and Univariate Relationships with Women's Educational Attainment and Menarcheal Timing

| | | Highest Grade Completed by age 25 (years) | | | Early Menarche (<1 SD below mean) | |
|---|---|---|---|---|---|---|
| | N(%)[1] | M | SD | test statistic | % | $X^2$ |
| All | 3,889 | 13.90 | 2.93 | | 15.4 | |
| High School Graduation | | | | t=−54.51** | | 8.45** |
| Graduated HS | 3234 (83.1) | 14.76 | 0.04 | | 14.6 | |
| Did Not Graduate HS | 655 (16.8) | 9.62 | 0.05 | | 19.1 | |
| Attended College | | | | t=−81.46** | | 7.28* |
| At Least Some College | 2394 (61.6) | 15.73 | 0.04 | | 14.1 | |
| Did Not Attend College | 1495 (38.4) | 10.96 | 0.04 | | 17.3 | |
| Age at Menarche (years) | | | | t=4.52** | | |
| ≥1 SD below mean | 3292 (84.7) | 13.99 | 0.05 | | | |
| <1 SD below mean | 597 (15.4) | 13.40 | 0.12 | | | |
| Year of Birth | | | | F=0.24 | | 6.62 |
| 1980 | 741 (19.1) | 13.90 | 2.86 | | 16.2 | |
| 1981 | 823 (21.2) | 13.97 | 2.92 | | 16.1 | |
| 1982 | 813 (20.9) | 13.92 | 3.13 | | 17.1 | |
| 1983 | 762 (19.6) | 13.85 | 2.94 | | 13.9 | |
| 1984 | 750 (19.3) | 13.84 | 2.77 | | 13.2 | |
| Race/Ethnicity | | | | F=69.05 ** | | 60.62** |
| Non-Hispanic White | 1853 (47.7) | 14.39 | 2.96 | | 11.2 | |
| Non-Hispanic Black | 1057 (27.2) | 13.51 | 2.81 | | 21.8 | |
| Hispanic | 830 (21.3) | 13.10 | 2.75 | | 17.0 | |
| Mother's Educational Attainment | | | | F=340.38** | | 23.64** |
| At Least Some College | 1510 (38.8) | 15.25 | 2.67 | | 12.2 | |
| Graduated HS, No College | 1402 (36.1) | 13.55 | 2.69 | | 16.3 | |
| Did Not Graduate HS | 884 (22.7) | 12.41 | 2.66 | | 18.3 | |
| Mother's Age at First Birth (years) | | | | t=17.77** | | 9.16* |

| | | Highest Grade Completed by age 25 (years) | | | Early Menarche (<1 SD below mean) | |
|---|---|---|---|---|---|---|
| | N(%)[1] | M | SD | test statistic | % | $X^2$ |
| ≥20 | 2573 (66.2) | 14.48 | 0.06 | | 14.1 | |
| <20 | 1013 (26.1) | 12.63 | 0.08 | | 18.0 | |
| Biological Father Absence in Youth | | | | t=15.61** | | 30.00** |
| Father Present | 1790 (46.0) | 13.13 | 0.07 | | 12.5 | |
| Father Absent | 2090 (53.7) | 14.56 | 0.06 | | 18.6 | |
| Region of US in Youth | | | | F=27.58** | | 15.37** |
| All Other Regions | 2166 (55.7) | 14.15 | 2.87 | | 13.3 | |
| Southern | 1363 (35.1) | 13.73 | 2.97 | | 17.7 | |
| Missing Region | 360 (9.3) | 13.01 | 2.87 | | 18.6 | |
| Urbanicity in Youth | | | | F=14.40** | | 1.52 |
| Urban | 2505 (64.4) | 13.99 | 2.94 | | 15.4 | |
| Rural | 677 (17.4) | 14.09 | 2.84 | | 14.0 | |
| Missing Urbanicity | 707 (18.2) | 13.37 | 2.91 | | 16.4 | |

[1] Not all percentages add to 100% due to missing data

* $p < .05$.

** $p < .005$

**Table 2**

Unstandardized Coefficients (B) Standard Errors (SE B) and Standardized Coefficients (β) from Unweighted Sequential Multivariate Linear Regression Models of Women's Educational Attainment after Age 24 on Biological and Sociocultural Factors in Childhood and Adolescence

| | Model 1 (N = 3889) | | | Model 2 (N = 3889) | | | Model 3 (N = 3581) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **B** | **SE B** | **β** | **B** | **SE B** | **β** | **B** | **SE B** | **β** |
| Timing of Menarche (years) | | | | | | | | | |
| ≥1 SD below mean[r] | | | | | | | | | |
| <1 SD below mean | −0.59 | 0.13 | −0.07** | −0.41 | 0.13 | −0.03** | −0.19 | 0.12 | −0.02 |
| Participant's Birth Year (1980–1984) | | | | −0.05 | 0.03 | −0.02 | −0.05 | 0.03 | −0.02 |
| Race/Ethnicity | | | | | | | | | |
| Non-Hispanic White[r] | | | | | | | | | |
| Non-Hispanic Black | | | | −0.83 | 0.11 | −0.13** | 0.12 | 0.12 | 0.02 |
| Hispanic | | | | −1.34 | 0.12 | −0.19** | -0.35 | 0.12 | −0.05** |
| Region of US in Youth | | | | | | | | | |
| All Other Regions[r] | | | | | | | | | |
| Southern | | | | −0.28 | 0.10 | −0.05* | -0.17 | 0.10 | −0.03 |
| Missing Region | | | | −0.58 | 0.22 | −0.06* | −0.16 | 0.21 | −0.02 |
| Urbanicity in Youth | | | | | | | | | |
| Urban[r] | | | | | | | | | |
| Rural | | | | −0.19 | 0.13 | −0.02 | −0.06 | 0.12 | −0.01 |
| Missing Urbanicity | | | | −0.50 | 0.16 | −0.07** | −0.25 | 0.16 | −0.03 |
| Mother's Education | | | | | | | | | |
| Did Not Graduate HS[r] | | | | | | | | | |
| HS Diploma Only | | | | | | | 0.79 | 0.12 | 0.13** |
| At Least Some College | | | | | | | 2.24 | 0.13 | 0.37** |
| Mother's Age at First Birth (years) | | | | | | | | | |
| ≥20[r] | | | | | | | | | |
| <20 | | | | | | | −0.91 | 0.10 | −0.14** |

| | Model 1 (N = 3889) | | | Model 2 (N = 3889) | | | Model 3 (N = 3581) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **B** | **SE B** | **β** | **B** | **SE B** | **β** | **B** | **SE B** | **β** |
| Biological Father Absence in Youth | | | | | | | | | |
| Father Present[r] | | | | | | | | | |
| Father Absent | | | | | | | −1.09 | 0.09 | −0.18** |
| $R^2$ Change Model | 0.005 | | | 0.048 | | | 0.172 | | |
| F for $R^2$ Change | 20.50** | | | 28.00** | | | 202.90** | | |

*p < .05.

**p < .005

*r* reference category