Early Childhood Maltreatment and Pubertal Development: Replication in a Population-Based Sample

Jane Mendle
Cornell University

Rebecca M. Ryan
Georgetown University

Kirsten M. McKone
Cornell University

Early experiences are critically important for female reproductive development. Although a number of early childhood hardships predict earlier physical development in girls, research on specific populations suggests a distinct effect of childhood sexual abuse compared to other adversities. This study leverages the National Longitudinal Study of Adolescent Health ($N = 6{,}273$ girls) to test the generalizability of these findings, examining associations of early physical abuse, sexual abuse, and physical neglect with pubertal timing. Child sexual abuse predicted earlier menarche and development of secondary sexual characteristics, whereas other types of maltreatment did not. In addition to replicating results from smaller, more specialized samples, these findings reinforce the value of considering puberty within a broader "life span" continuum of birth to adolescence.

Early life experiences play a key role in female reproductive development, with timing of pubertal maturation accelerated in girls whose childhood environments are marked by high levels of adversity. Because earlier pubertal timing predicts a variety of detrimental medical and psychological outcomes, the mechanisms underlying this association have been of particular interest to public health initiatives (e.g., Golub et al., 2008). Although a number of childhood hardships have been correlated with pubertal timing in girls, emerging research on specific populations has suggested a distinct effect of childhood sexual abuse compared to other adversities, including other types of maltreatment (e.g., Mendle, Leve, Van Ryzin, Natsuaki, & Ge, 2011). This study tests the generalizability of these findings by examining associations of different forms of early maltreatment with age at menarche and secondary sexual characteristics in a population-based, nationally representative sample.

Maltreatment and Pubertal Timing

Associations between child sexual abuse (CSA) and pubertal timing are robust. Both secondary sexual characteristics, such as changes in skin or breast development, and age at menarche tend to occur at younger chronological ages among children with documented histories of CSA (Herman-Giddens, Sandler, & Friedman, 1988; Mendle et al., 2011; Negriff, Blankson, & Trickett, 2014; Turner, Runtz, & Galambos, 1999) or adults who retrospectively report CSA and pubertal timing (Boynton-Jarrett et al., 2013; Romans, Martin, Gendall, & Herbison, 2003; Wise, Palmer, Rothman, & Rosenberg, 2009; Zabin, Emerson, & Rowland, 2005). This correlation has been attributed to a variety of mechanisms, including stress-related activation of the hypothalamic–pituitary–adrenal axis (e.g., Trickett & Putnam, 1993), an evolved psychophysiological response to a harsh environment (Belsky, Steinberg, & Draper, 1991; Vigil, Geary, & Byrd-Craven, 2005) or an early signal of physical "weathering" or faster aging process (Allsworth, Weitzen, & Boardman, 2005; Geronimus, 1994; see Ellis, 2004 for an extended review of the role of stress in pubertal development).

These mechanisms are not mutually exclusive, and all may play a partial or overlapping role in explaining associations of CSA with pubertal timing. However, reliance on these theories introduces an additional conundrum. Each explanation applies to other forms of maltreatment, including physical abuse and physical neglect (e.g., inadequate food, shelter, or clothing), because they implicate broad, cumulative stress—commonly termed "allostatic

load"—as the operative mechanism. While CSA correlates with earlier puberty, very few studies have considered multiple types of maltreatment and findings tend to be weak and inconsistent. For example, Wise and colleagues (2009) reported a small association between physical abuse and earlier ages at menarche, and Boynton-Jarrett et al. (2013) suggested that physical abuse related to both early *and* late menarche. Among studies that consider multiple forms of maltreatment in conjunction with each other, the effects of sexual abuse are either considerably stronger or uniquely predictive of earlier puberty (e.g., Mendle et al., 2011; Negriff et al., 2014; Romans et al., 2003; Wise et al., 2009). Moreover, effects of CSA do not vary in magnitude when other forms of maltreatment have occurred (Mendle et al., 2011).

The specificity of the CSA–pubertal timing association suggests this link may not stem from a physiological response to broad, cumulative stress. Rather, it raises the possibility that CSA conveys a distinct physiological response that accelerates development in ways that other forms of stress— including other forms of maltreatment—do not. An alternative worth considering, however, is that the association might be an artifact of the special or limited populations used in previous studies: children residing in foster care (Mendle et al., 2011), African American women (Wise et al., 2009), or internationally adopted children (Johnson, 2000). If allostatic load does accelerate development, then nonmaltreated individuals in these studies may exhibit earlier puberty relative to national norms simply because these populations tend to have experienced higher levels of life stress. Importantly, this biased comparison group would actually deflate associations of other forms of maltreatment with pubertal development—particularly if those associations exist but are smaller than the CSA effect. Because this topic has yet to be investigated within a nationally representative U.S. sample, it is presently impossible to determine whether current findings are indicative of limited sample populations or a true effect.

Lastly, it is worth noting that earlier puberty is the most frequently documented sequela of CSA, but conditions of extreme physical stress (also known as ecological stress) have actually been associated with *delayed* physical development. Such circumstances are generally due to grossly inadequate nutrition or disease (e.g., Bosch, Willekins, Baqui, Van Ginnekin, & Hutter, 2008). Both human and animal models suggest that perilous conditions require energy and resources be devoted to basic survival, rather than the physically demanding process of maturation (Olsson, deJonge, Schuurman, & Helmond, 1999; Surbey, 1998). If children are removed from hazardous conditions early in childhood—as in the case of international adoptees—they may experience a flood of "catch-up growth" which stimulates the endocrine system, and results in atypically early pubertal development (Dominé, Parent, Rasier, Lebrethon, & Bourguignon, 2006; Teilmann, Pedersen, Skakkebaek, & Jensen, 2006).

The Present Study

The present study leverages the National Longitudinal Study of Adolescent Health (Add Health), a population-based sample, to test the generalizability and replicability of these previous, foundational studies. The primary aim was to establish whether physical abuse, sexual abuse, and physical neglect early in childhood differentially predict age at menarche and the development of secondary sexual characteristics. Identifying how different experiences calibrate developmental trajectories can help establish mechanistic associations between early life events and later maturation.

METHOD

Data were drawn from the National Longitudinal Study of Adolescent Health (Add Health; Harris, 2009), a nationally representative study assessing adolescent health and risk behavior collected in four waves between 1994 and 2008. Of the 20,745 participants interviewed in-home at Wave I, 10,480 were females ($M = 15.8$ years, range: 11–21 years). Three follow-up interviews were completed in 1995–1996 (Wave II; $M = 16.1$ years, range: 12–23 years), 2001–2002 (Wave III; $M = 21.7$ years, range: 18–27 years), and 2007–2009 (Wave IV; $M = 28.7$ years, range: 24–34 years). The current analyses comprise $N = 6,273$ female participants for whom data were available on puberty and maltreatment at the relevant waves (see Measures for details on timing of puberty and maltreatment measurement). Sample characteristics are reported in Table 1.

Measures

Age at menarche. Participants reported at Waves I and II if they had "ever had a menstrual period" and, if so, during which month and year they had experienced their first menstrual cycle. At

TABLE 1
Sample Characteristics

	M/%	SD
Age at menarche	12.20	1.42
Breast and curve development (raw score)	6.69	1.92
Sexual abuse	0.08	0.58
Physical abuse	0.14	0.81
Physical neglect	0.23	0.90
Undetermined	0.06	0.45
Emotional harshness	0.34	1.17
Father always absent	0.15	–
Father left 0–5 years	0.09	–
Father left 6–13 years	0.12	–
Child age at Wave 1	15.83	1.69
Mother has <HS	0.33	–
Mother has HS/GED	0.21	–
Mother has some college	0.25	–
Mother has college+	0.21	–
Child is White	0.69	–
Child is African American	0.16	–
Child is Hispanic	0.11	–
Child is other race	0.04	–
AFDC receipt	0.07	–
Family income to needs	3.12	3.81

Note. All means and percentages are weighted using Add Health Wave IV survey weights. Numbers which indicate means include standard deviations as well; numbers which indicate percentages do not. Range of raw scores for breast and curve development is 2–10 and drawn from Wave 1 reports. HS = high school. GED = graduate equivalency diploma. AFDC = Aid to Families with Dependent Children and indicates the participant's family received public assistance benefits in Wave 1.

Wave III, they were asked "how old were you when you got your period for the first time?" The first report of age at menarche was used to avoid telescoping bias (Janssen, Chessa, & Murre, 2006), which occurs when individuals remember events as closer to the date of the interview than they actually are. This was most often the Wave I report (91.2% of the sample). The mean age at menarche was 12.20 years (*SD* = 1.42; range: 7–24 years).

Secondary sexual characteristics. At Wave I, participants were asked about level of pubertal development. Changes in breast development were rated on a scale where 1 = *my breasts are about the same size as when I was in grade school* and 5 = *my breasts are a whole lot bigger than when I was in grade school*. Likewise, curviness was rated from 1 = *my body is about as curvy as when I was in grade school* to 5 = *my body is a whole lot more curvy then when I was in grade school*. Responses to each question were summed to create scores that ranged from 2 to 10 (*M* = 6.69; *SD* = 1.92). To account for age differences among participants, scores were then stan-dardized within year of chronological age, so that higher scores indicate more physical changes relative to girls of the same age.

Sexual abuse. At Wave IV, participants were asked *how often did a parent or other adult caregiver touch you in a sexual way, force you to touch him or her in a sexual way, or force you to have sexual relations?* If endorsed, participants were then asked *how old were you the first time this happened?* If a participant reported abuse at age 6 years or older, the variable was recoded to 0 to ensure all experiences of maltreatment were prepubertal and occurred early in childhood. This coding scheme is consistent with major theories of maturation and environmental adversity, which emphasize the early childhood environment (for a review, see Ellis, 2004). As the earliest age of menarche in our sample was age 7, it also ensured that maltreatment occurred prepubertally. Sensitivity analyses with children who experienced maltreatment for the first time after the age of six were also conducted and are available upon request. In analyses, sexual abuse was measured as the frequency of instances as categorized by Add Health, where *never* (= 0), *one time* (= 1), *two times* (= 2), *three to five times* (= 3), *six to ten* (= 4), and *more than ten* (= 5). Three percent of the sample reported one or more instances of sexual abuse before age 6 years.

Physical abuse. At Wave IV, participants reported *Before your 18th birthday, how often did a parent or adult caregiver hit you with a fist, kick you, or throw you down on the floor, into a wall, or down stairs?* and the age at which this first occurred. Frequency categories were identical to those used for sexual abuse (*never* = 0, *one time* = 1, *two times* = 2, *three to five times* = 3, *six to ten* = 4, and *more than ten* = 5), and items were similarly recoded to 0 if abuse first occurred after 6 years of age. Three percent of the sample endorsed physical abuse prior to age 6 years.

Physical neglect. At Wave III, participants reported how often *a parent or adult caregiver had not taken care of your basic needs, such as keeping you clean or providing food or clothing*, with frequency categories identical to those used for physical and sexual abuse questions at Wave IV. Unlike the Wave IV questions, participants were only asked how often physical neglect occurred before entering the sixth grade (approximately 11 years of age). Nine percent of participants endorsed physical neglect before entering the sixth grade.

Undetermined. At Wave III, participants were asked how often prior to sixth grade *Social Services had investigated how you were taken care of or tried to take you out of your living situation.* Response categories were identical to those used for other forms of maltreatment, although the variable ranged from 0 to 6 because frequency of investigation was coded 0–5 and summed with whether child was ever removed from the home (0 = *no*, 1 = *yes*). If a participant did not report sexual abuse, physical abuse, or physical neglect but responded affirmatively to this question, the participant was coded as experiencing an undetermined form of maltreatment. (If a participant reported other forms of maltreatment *and* also responded affirmatively to this question, she received a score of 0 for "undetermined maltreatment" because the type of maltreatment could be established.) Three percent of the sample reported at least one instance of undetermined maltreatment.

Additional covariates. Models also included a number of demographic and familial covariates commonly associated with earlier pubertal timing: race/ethnicity, father absence (coded as absent from birth, early childhood, or middle childhood), and socioeconomic indicators as indexed by receipt of public assistance, household income-to-needs ratio at Wave I, and maternal education (Bogaert, 2008; James-Todd, Tehranifar, Rich-Edwards, Titievsky, & Terry, 2010). In models predicting age at menarche, child age at Wave I was included as a covariate to account for cohort effects as well as telescoping bias for older teens at Wave I. An additional marker of family environment was also included: participant's subjective assessment of parental warmth and sensitivity before age 6 years, labeled Emotional Harshness (*How often did a parent or other adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?*). This variable was coded identically to the maltreatment variables and was assessed Wave IV.

Missing data. The analytic sample includes all individuals with complete data on the key independent and dependent variables but not necessarily all covariates. To address missing data for covariates only, data were multiply imputed using the ICE command in Stata 12.0 (StataCorp, College Station, TX, United States), which is based on a regression switching protocol using chained equations (Royston, 2007). Missingness on covariates ranged from <1 to 24%. Ten imputed data sets were generated and coefficients and standard errors were combined using the MI estimate command. Although imputing data on covariates substantially minimizes sample bias due to attrition, the analytic sample still differed systematically from those excluded from analyses. Overall, girls with complete data on key variables had higher family income-to-needs ratios ($M = 3.1$ for analytic sample vs. 2.6 for excluded girls; $p < .001$), reported being more religious ($M = 7.0$ for analytic sample vs. 6.5 for excluded girls; $p < .001$), were more likely to be European American and less likely to be African American (55.6 for analytic sample vs. 49.2 for excluded girls), and had mothers with higher levels of education (26.5% with a college degree for analytic sample vs. 21.3 for excluded girls).

Analyses

Ordinary least-squares (OLS) regression models were used to examine associations between different forms of maltreatment and pubertal development. Continuous measures of each form of maltreatment were entered simultaneously. Maltreatment types tend to co-occur (e.g., 25% of those who reported CSA also reported physical abuse and 15% reported neglect; likewise, 20% of those who reported physical abuse also reported neglect). This approach isolates the impact of each maltreatment type while holding constant the effects of all others. To test for multicollinearity, we computed pairwise correlations between the ordinal variables and generated variance inflation factors (VIFs) for each maltreatment variable from regressions predicting age at menarche; despite some overlap among maltreatment experiences, the variables showed no signs of multicollinearity. Separate models were run for age at menarche and secondary sexual characteristics. All analyses included the full set of covariates. Models were weighted using the Add Health Wave IV survey and design weights to account for the clustered nature of the sample and to produce nationally representative point and variance estimates based on sampling design and attrition (Biemer & Aragon-Logan, 2009).

RESULTS

Full results are displayed in Table 2. According to the regression models, each unit increase in sexual abuse significantly predicted a younger age at menarche ($b = -.08$, $p < .05$). Given the 0–5 scaling of the sexual abuse variable, a child who experienced more than ten instances of sexual abuse would therefore be predicted to have an age of menarche

TABLE 2
Regression Models Predicting Pubertal Development From
Maltreatment Type

	Age at menarche		Breast and curve development	
	b	SE	b	SE
Sexual abuse	−0.08	0.04*	0.07	0.03*
Physical abuse	0.04	0.03	0.03	0.02
Physical neglect	0.01	0.03	−0.05	0.02**
Undetermined	−0.11	0.05*	−0.06	0.03
Emotional harshness	−0.04	0.02*	0.02	0.02
Father always absent	−0.14	0.09	0.05	0.05
Father left 0–5 years	−0.16	0.08	0.06	0.06
Father left 6–13 years	−0.06	0.09	0.12	0.05*
Child age at Wave 1	0.10	0.02***	–	–
Mother has <HS	0.10	0.07	0.01	0.06
Mother has HS/GED	0.12	0.07	0.09	0.05
Mother has college+	0.18	0.08*	0.08	0.05
Child is African American	−0.25	0.08**	−0.14	0.05**
Child is Hispanic	−0.29	0.08**	−0.12	0.05*
Child is other race	−0.11	0.10	−0.25	0.09**
AFDC receipt	−0.12	0.11	−0.09	0.08
Family income to needs	0.01	0.01	0.00	0.00
Constant	12.25	0.08***	0.01	0.05

Note. $N = 6{,}273$ for all analyses. The omitted category for child race/ethnicity is European American. AFDC receipt indicates whether the child's family received Aid to Families with Dependent Children (public assistance) benefits in Wave 1. Analyses conducted in STATA's design-based weighting program, to account for the clustered nature of the sample; this program does not provide R-squared values. HS = high school. GED = graduate equivalency diploma.
*$p < .05$; **$p < .01$; ***$p < .001$.

approximately 5 months prior to a child who did not experience CSA. Undetermined forms of maltreatment also predicted earlier age at menarche ($b = −.11$, $p < .05$, approximately 1.33 months per unit increase). There were no significant effects of physical abuse or physical neglect, once taking into account other maltreatment types. Similarly, each unit increase in sexual abuse was significantly associated with reports of more advanced breast or body development relative to peers. Because the dependent variable in this model was standardized, the coefficient reflects an effect size of .07 of a standard deviation. Surprisingly, physical neglect was significantly associated with reports of *lesser* rather than greater development of secondary sexual characteristics.

DISCUSSION

There has been recent, growing interest in child maltreatment. This increased inquiry has been fueled by the sobering realization that the sequelae associated with maltreatment are broad-reaching and encapsulate physiological as well as psychological correlates (reviewed in Trickett, Noll, & Putnam, 2011). The present study is no exception, and results highlight the unique role CSA seems to play in pubertal timing relative to other forms of maltreatment. This study replicates previous findings from smaller or more specialized populations and suggests these earlier findings were not solely attributable to sample characteristics. More importantly, these findings present new questions for public policy and future research.

The first question is a mechanistic one. Among the most compelling explanations for the early adversity–pubertal timing association is activation of the hypothalamic–pituitary–adrenal axis, which governs both stress response and adrenarche, the first phase of pubertal maturation. HPA dysregulation has been observed both in adult and in child survivors of sexual assault (Heim et al., 2000; Trickett, Noll, Susman, Shenk, & Putnam, 2010). It is believed that the initial, stress-related *hyper*activity of the HPA axis may eventually downregulate in response to chronic stress, resulting in hypoactivity during adolescence and early adulthood (or "blunted" cortisol; Miller, Chen, & Zhou, 2007).

Although it may be intuitive to draw parallels between HPA hyperactivity and pubertal onset, a complicating factor is the unique influence of sexual abuse found in both this and previous research. That is, sexual abuse seems to carry a specific risk of earlier pubertal timing above and beyond other stressful experiences which may be present in childhood. Yet physical abuse and physical neglect have also been correlated with HPA activation (Tarullo & Gunnar, 2006), as have other hypothesized mechanisms linking CSA to earlier puberty, such as psychosocial acceleration and "weathering." If the HPA axis were the primary link between sexual abuse and menarche, it would be hard to explain the unique effects of sexual abuse relative to other forms of maltreatment. However, scientific understanding of the neuroendocrine system is still evolving. It is possible that different stressors result in different patterns of HPA response. Alternatively, there may be physiological links between puberty and stress aside from the HPA axis. For example, in their seminal paper, Trickett and Putnam (1993) proposed that the trauma of CSA accelerates maturation by activating both the HPA *and* the hypothalamic–pituitary–gonadal (HPG) axes. It may be that other forms of

stress dysregulate the stress–response HPA system, but only sexual abuse produces the sorts of HPA and concomitant HPG activation that precipitate adrenarche and gonadarche.

The second question generated by these findings is one of consequences: What does it mean for sexually abused children to reach puberty earlier? Certainly, maltreatment carries devastating risks of psychological health (e.g., Green et al., 2010). But earlier puberty is, in and of itself, a psychological risk, linked to greater vulnerability for depression, suicidality, disordered eating, substance abuse, and delinquency (Mendle, Turkheimer, & Emery, 2007). Although early puberty presents challenges for all girls, it may be particularly distressing for girls with histories of sexual abuse, who have already powerlessly endured one premature sexual transition. In support of this, timing of puberty has been shown to mediate associations of CSA with internalizing symptoms (Mendle, Leve, Van Ryzin, & Natsuaki, 2014). Therefore, policies, programs, and interventions for maltreated children may benefit from taking a more proactive approach as children age, anticipating that puberty may be both early and challenging for these girls. When possible, increasing education about physical development and building coping skills in the prepubertal years may defuse some of the psychological impact of earlier development.

While this study builds on gaps in the previous research literature—most importantly, limited generalizability—it holds its own limitations. Chief among these is that the data are retrospective and self-report. Self-reports of early adversities may be subject to memory or perceptual biases. More importantly, these data leave several questions unresolved. First, the meanings of undetermined maltreatment (Social Services investigation and/or removal from the home without a specific maltreatment report) and emotional harshness are unclear. Emotional harshness was determined through the question *"how often did a parent or other adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?"* Although it is likely that this variable indexes a broad range of conditions—from minor insensitivity to emotional maltreatment—the nature of the question does not establish what processes are at stake. Moreover, while it was possible to ascertain that reports of physical and sexual maltreatment preceded menarche, physical neglect was assessed prior to sixth grade only. Because some girls in the sample experienced menarche before sixth grade

and virtually all girls show some level of pubertal development by this time, the temporal pattern is undetermined. Therefore, although some research has found that physical neglect is associated with delayed or slower development (e.g., Negriff et al., 2014), the ambiguous sequencing in the Add Health data requires caution in interpreting (or "over-interpreting") results.

With regard to reports of pubertal timing, women are typically able to report year of menarche with 85%–90% accuracy compared to historical medical records (e.g., Casey et al., 1991). Yet reports of sexual secondary characteristics tend to be less accurate and may primarily reflect perceptions of development rather than actual development; the questions in Add Health, moreover, are not taken from a commonly used, validated scale. This imprecision may account for the small effect of CSA on secondary sexual characteristics. In addition, a careful look at the covariates in Table 2 indicates that European American participants tended to report greater breast and curve development than participants from other backgrounds but later ages at menarche. This somewhat contradictory pattern of results may actually be attributable to qualities of the Add Health questions, as participants from different backgrounds may have interpreted the response categories through the lens of their own social norms and beauty ideals. European American girls may have systematically overestimated physical changes, and African American/Latina girls systematically underestimated physical changes. Confidence in the results is bolstered, however, by congruence of findings across both indicators of pubertal timing and with previous research from more specialized samples.

CONCLUSION

All forms of early childhood maltreatment place children on a psychologically vulnerable path, calibrating both physiological and emotional development. The present research supports reports from studies conducted on smaller, more focused samples that CSA early in life predicts earlier pubertal development. Notably, the transition from childhood to adolescence is a transition which is already filled with risk and susceptibility, particularly for those who mature ahead of peers. The current results are a sobering reminder that children do not arrive at this point in development de novo, but shaped—physically and psychologically—by their preceding experiences.

REFERENCES

Allsworth, J. E., Weitzen, S., & Boardman, L. A. (2005). Early age at menarche and allostatic load: Data from the Third National Health and Nutrition Examination Survey. *Annals of Epidemiology*, *15*, 438–444. doi:10.1016/j.annepidem.2004.12.010

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*, 647–670. doi:10.1111/j.1467-8624.1991.tb01558.x

Biemer, P. P., & Aragon-Logan, E. D. (2009). National longitudinal study of adolescent health: Wave IV weights. Retrieved December 13, 2013, from http://www.cpc.unc.edu/projects/addhealth/codebooks/wave4

Bogaert, A. F. (2008). Menarche and father absence in a national probability sample. *Journal of Biosocial Science*, *40*, 623–636. doi:10.1017/S0021932007002386.

Bosch, A. M., Willekins, F. J., Baqui, A. H., Van Ginnekin, J. K. S., & Hutter, I. (2008). Association between age at menarche and early life nutritional status in rural Bangladesh. *Journal of Biosocial Science*, *40*, 223–237. doi:10.1017/S0021932007002490

Boynton-Jarrett, R., Wright, R. J., Putnam, F. W., Hibert, E. L., Michels, K. N., & J. Rich-Edwards (2013). Childhood abuse and age at menarche. *Journal of Adolescent Health*, *52*, 241–247. doi:10.1016/j.jadohealth.2012.06.006

Casey, V. A., Dwyer, J. T., Coleman, K. A., Krall, E. A., Gardner, J., & Valadian, I. (1991). Accuracy of recall by middle-aged participants in a longitudinal study of their body size and indices of maturation earlier in life. *Annals of Human Biology*, *18*, 155–166. doi:10.1080/03014469100001492

Dominé, F., Parent, A. S., Rasier, G., Lebrethon, M. C., & Bourguignon, J. P. (2006). Assessment and mechanism of variations in pubertal timing in internationally adopted children: A developmental hypothesis. *European Journal of Endocrinology*, *155*, S17–S25. doi:10.1530/eje.1.02252

Ellis, B. J. (2004). Timing of pubertal maturation in girls: An integrated life history approach. *Psychological Bulletin*, *130*, 920–958. doi:10.1037/0033-2909.130.6.920

Geronimus, A. T. (1994). The weathering hypothesis and the health of African American women and infants: Implications for reproductive strategies and policy analysis. In G. Sen & R.C Snow (Eds.), *Power and decision: The social control of reproduction* (pp. 77–100). Cambridge, MA: Harvard University Press.

Golub, M. S., Collman, G. W., Foster, P. M., Kimmel, C. A., Rajpert-DeMeyts, E., & Skkakebaek, N. (2008). Public health implications of altered pubertal timing. *Pediatrics*, *121*(Suppl. 3), S218–S230. doi:10.1542/peds.2007-1813g

Green, J. G., McLaughlin, K. A., Berglund, P. A., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) I: Associations with first onset of DSM-IV disorders. *Archives of General Psychiatry*, *67*, 113–123. doi:10.1001/archgenpsychiatry.2009.186

Harris, K. M. (2009). *The National Longitudinal Study of Adolescent Health (Add Health), Waves I & II, 1994–1996; Wave III, 2001–2002; Wave IV, 2007–2009* [machine-readable data file and documentation]. Chapel Hill, NC: Carolina Population Center, University of North Carolina at Chapel Hill. doi:10.3886/ICPSR27021.v9

Heim, C., Newport, D. J., Heit, S., Graham, Y. P., Wilcox, M., Bonsall, R., Miller, A. H., & Nemeroff, C. B. (2000). Pituitary-adrenal and autonomic responses to stress in women after sexual and physical abuse in childhood. *Journal of the American Medical Association*, *284*, 592–597. doi:10.1001/jama.284.5.592

Herman-Giddens, M. E., Sandler, A. D., & Friedman, N. E. (1988). Sexual precocity in girls: An association with sexual abuse. *American Journal of Diseases in Childhood*, *142*, 431–433. doi:10.1001/archpedi.1988.02150040085025

James-Todd, T., Tehranifar, P., Rich-Edwards, J., Titievsky, L., & Terry, M. B. (2010). The impact of socioeconomic status across early life on age at menarche among a racially diverse population of girls. *Annals of Epidemiology*, *20*, 836–842. doi:10.1016/j.annepidem.2010.08.006

Janssen, S. M. J., Chessa, A. G., & Murre, J. M. J. (2006). Memory for time: How people date events. *Memory and Cognition*, *34*, 138–147. doi:10.3758/BF03193393

Johnson, D. E. (2000). Long term medical issues in international adoptees. *Pediatric Annals*, *29*, 234–241. doi:10.3928/0090-4481-20000401-09

Mendle, J., Leve, L. D., Van Ryzin, M., & Natsuaki, M. N. (2014). Linking childhood maltreatment with adolescent internalizing symptoms: Early puberty as a tipping point. *Journal of Research on Adolescence*, *24*, 689–702. doi:10.1111/jora.12075

Mendle, J., Leve, L. D., Van Ryzin, M., Natsuaki, M. N., & Ge, X. (2011). Associations between early life stress, child maltreatment, and pubertal development in foster care girls. *Journal of Research on Adolescence*, *21*, 871–880. doi:10.1111/j.1532-7795.2011.00746.x

Mendle, J., Turkheimer, E., & Emery, R. E. (2007). Detrimental psychological outcomes associated with early pubertal timing in adolescent girls. *Developmental Review*, *27*, 151–171. doi:10.1016/j.dr.2006.11.001

Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological Bulletin*, *133*, 25–45. doi:10.1037/0033-2909.133.1.25

Negriff, S., Blankson, A. N., & Trickett, P. K. (2014). Pubertal timing and tempo: Associations with childhood Maltreatment. *Journal of Research on Adolescence*. Advance online publication. doi:10.1111/jora.12128

Olsson, I. A. S., deJonge, F. H., Schuurman, T., & Helmond, F. A. (1999). Poor rearing conditions and social stress in pigs: Repeated social challenges and the effect on behavioral and physiological responses to

stressors. *Behavioural Processes*, *46*, 201–215. doi:10.1016/s0376-6357(99)00036-4

Romans, S. E., Martin, M., Gendall, K., & Herbison, G. P. (2003). Age of menarche: The role of some psychosocial factors. *Psychological Medicine*, *33*, 933–939. doi:10.1017/S0033291703007530

Royston, P. (2007). Multiple imputation of missing values: Further update of ICE, with an emphasis on interval censoring. *The Stata Journal*, *7*, 445–464.

Surbey, M. K. (1998). Parent and offspring strategies in the transition at adolescence. *Human Nature*, *9*, 67–94. doi:10.1007/s12110-998-1012-3

Tarullo, A. R., & Gunnar, M. R. (2006). Child maltreatment and the developing HPA axis. *Hormones and Behavior*, *50*, 632–639. doi:10.1016/j.yhbeh.2006.06.010

Teilmann, G., Pedersen, C. B., Skakkebaek, N. E., & Jensen, T. K. (2006). Increased risk of precocious puberty in internationally adopted children in Denmark. *Pediatrics*, *118*, 391–399. doi:10.1542/peds.2005-2939

Trickett, P. K., Noll, J. G., & Putnam, F. W. (2011). The impact of sexual abuse on female development: Lessons from a multigenerational, longitudinal research study. *Development and Psychopathology*, *23*, 453–476. doi:10.1017/s0954579411000174

Trickett, P. K., Noll, J. G., Susman, E. J., Shenk, C. E., & Putnam, F. W. (2010). Attenuation of cortisol across development for victims of sexual abuse. *Development and Psychopathology*, *22*, 165. doi:10.1017/s0954579409990332

Trickett, P. K., & Putnam, F. W. (1993). Impact of child sexual abuse on females: Toward a developmental, psychobiological integration. *Psychological Science*, *4*, 81–87. doi:10.1111/j.1467-9280.1993.tb00465.x

Turner, P. K., Runtz, M. G., & Galambos, N. L. (1999). Sexual abuse, pubertal timing, and subjective age in adolescent girls: A research note. *Journal of Reproductive and Infant Psychology*, *17*, 111–118. doi:10.1080/02646839908409091

Vigil, J. M., Geary, D. C., & Byrd-Craven, J. (2005). A life history assessment of early childhood sexual abuse in women. *Developmental Psychology*, *41*, 553. doi:10.1037/0012-1649.41.3.553

Wise, L. A., Palmer, J. R., Rothman, E. F., & Rosenberg, L. (2009). Childhood abuse and early menarche: Findings from the Black Women's Health Study. *American Journal of Public Health*, *99*, 1–7. doi:10.2105/AJPH.2008.149005

Zabin, L. S., Emerson, M. R., & Rowland, D. L. (2005). Childhood sexual abuse and early menarche: The direction of their relationship and its implications. *Journal of Adolescent Health*, *36*, 393–400. doi:10.1016/j.jadohealth.2004.07.013