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Childhood Experience and the Development of Reproductive Strategies: An Evolutionary Theory of Socialization Revisited

Jay Belsky

2012

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Draper & Harpending, 1982

Reinterpreting of Effects of Father Absence

JOURNAL OF
ANTHROPOLOGICAL RESEARCH

VOLUME 38 • NUMBER 3 • FALL • 1982

FATHER ABSENCE AND REPRODUCTIVE STRATEGY: AN EVOLUTIONARY PERSPECTIVE[1]

Patricia Draper
Henry Harpending
Department of Anthropology, University of New Mexico, Albuquerque, NM 87131

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Draper & Harpending, 1982

Females raised in father absent households:

"show early expression of sexual interest and assumption of sexual activity, negative attitudes toward males, and poor ability to establish long-term relationships with one male"

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Developmental Critique

--Old wine in a new bottle?
--Law of Parsimony
--Developmental mechanism/process?
--Original Prediction?

[*Child Development*, 1991, 62, 647–670. 0009-3920/91/6204-0010$01.00]

Theoretical Paper

Childhood Experience, Interpersonal Development, and Reproductive Strategy: An Evolutionary Theory of Socialization

Jay Belsky
The Pennsylvania State University

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Patricia Draper
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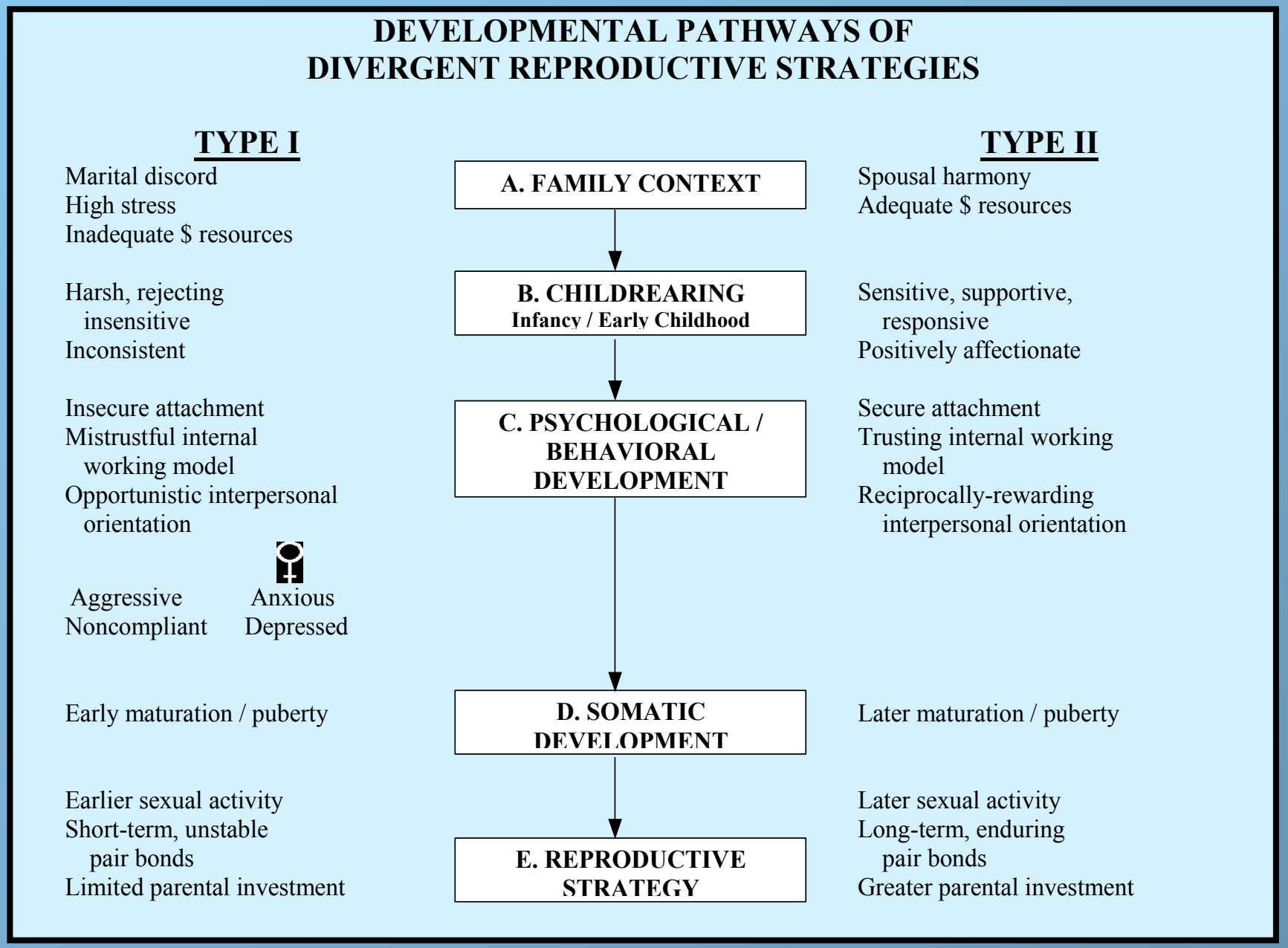
DEVELOPMENTAL PATHWAYS OF DIVERGENT REPRODUCTIVE STRATEGIES



Child Development, Vol. 63, No. 1. (Feb., 1992), pp. 47-58.

Childhood Experience and the Onset of Menarche: A Test of a Sociobiological Model

Terrie E. Moffitt and Avshalom Caspi
University of Wisconsin at Madison

Jay Belsky
The Pennsylvania State University

Phil A. Silva
Dunedin Multidisciplinary Health and Development Research Unit, Dunedin, New Zealand

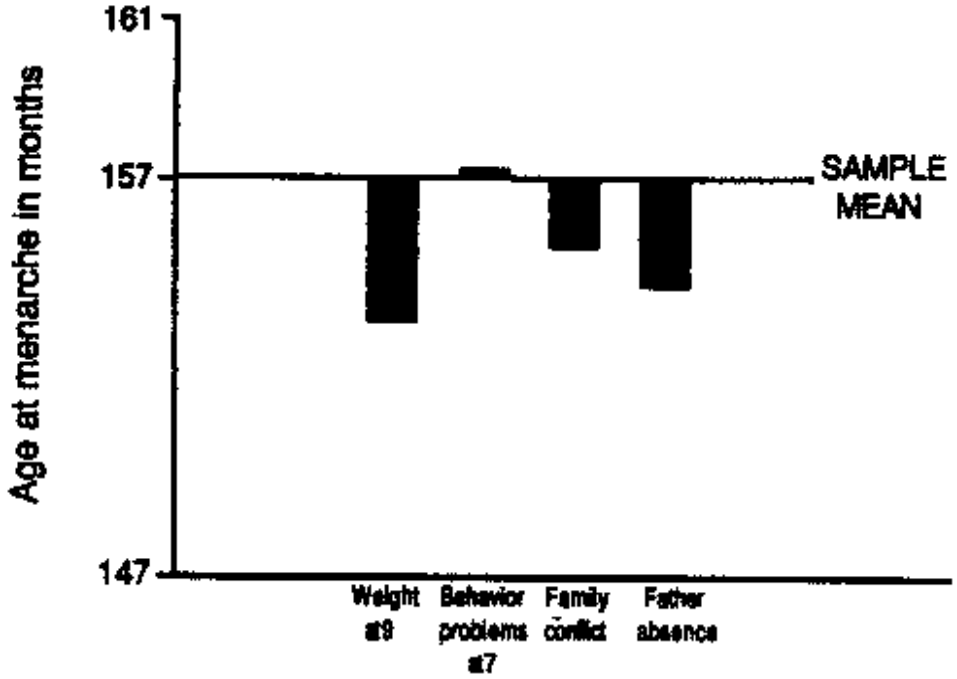
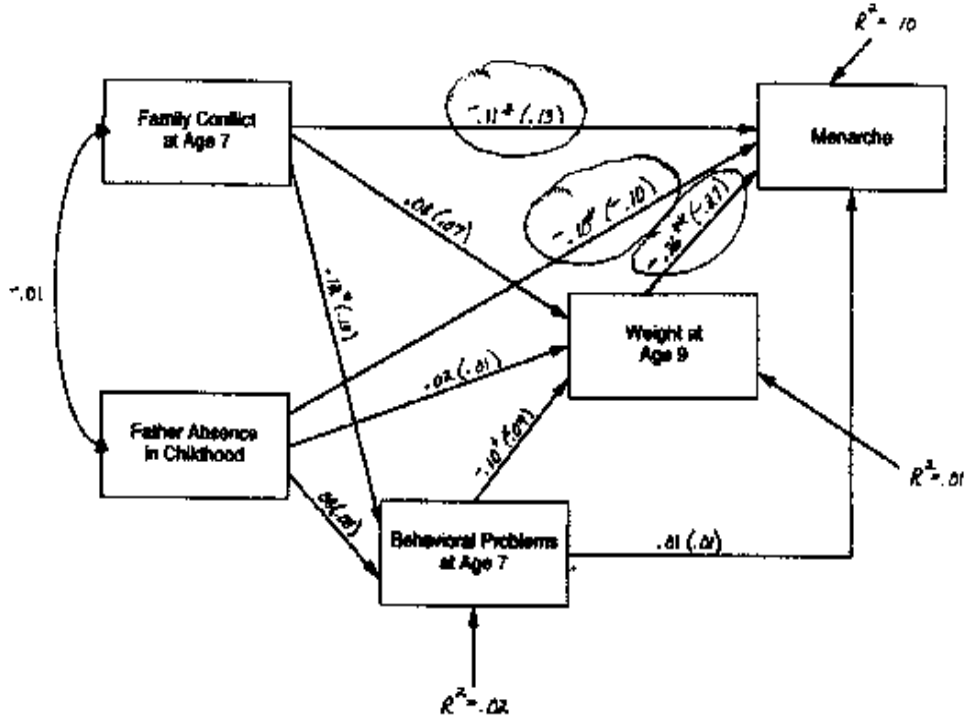


FIG. 1.—Main effects of four risk factors on girls' age at menarche



Note: Zero Order correlation in parentheses; +p < .10; *p < .05; **p < .01.

FIG. 4.—A mediational model of contextual stress on girls' age at menarche: relations observed in the present study of New Zealand girls.

Psychological Bulletin
2004, Vol. 130, No. 6, 920–958

0033-2909/04/$12.00 DOI: 10.1037/0033-2909.130.6.920

Timing of Pubertal Maturation in Girls: An Integrated Life History Approach

Bruce J. Ellis
University of Arizona

Summary. Psychosocial acceleration theory posits that warm, cohesive family environments slow down pubertal development, whereas dangerous or conflictual family environments accelerate it. Empirical research to date has provided reasonable, though incomplete, support for the theory. On the one hand, there is converging evidence from a number of methodologically sound studies that greater parent–child warmth and cohesion is associated with later pubertal development. This research also suggests that greater frequency of parent–child interactions predicts later puberty. On the other hand, the proposed accelerating effect of parent–child conflict and coercion on pubertal development is yet to be clearly established.

Source: Ellis, 2004, p. 935-936.

MORE RECENT STUDIES HIGHLIGHTING EFFECTS OF ADVERSE REARING CONDITIONS

Available online at www.sciencedirect.com
ScienceDirect
Drug and Alcohol Dependence 88S (2007) S50–S59
DRUG and ALCOHOL DEPENDENCE
www.elsevier.com/locate/drugalcdep

Pubertal maturation and the development of alcohol use and abuse

E. Jane Costello[a,*], Minje Sung[b], Carol Worthman[c], Adrian Angold[a]

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Received 1 June 2006; accepted 20 December 2006

SAMPLE

1,420 children (approximately 50% female) from a representative sample of 4500 9-, 11- and 13-year olds recruited through the public school systems of 11 counties in western North Carolina, with over-sampling of children scoring high on problem behavior.

ASSESSMENT OF PUBERTAL TIMING

Child Report of breast and pubic-hair development by means of self ratings using schematic drawings of secondary sexual characteristics, scored in terms of Tanner (1962) staging system (stage I: prepubertal; stage V-adult level of development).

EARLY MATURER CLASSIFICATION

Age of pubertal maturation defined in terms of achieving Stage IV.

	Prop.	Mean Age Tanner IV
Early Maturers	30.1%	12.05 yrs. (sd=1.74)
Other	59.9%	14.24 yrs. (sd=1.82)

EFFECTS OF CHILD MALTREATMENT

By age 13, 14.3% of sample had been maltreated according to own or parental report (4.3% physical abuse, 10.0% sexual abuse).

	Mean Age of Tanner IV
Maltreated	11.6 years (sd = 1.0)
Non-maltreated	12.1 years (sd = 1.3)

(OR: 0.75, p<.011)

Child Development, November/December 2007, Volume 78, Number 6, Pages 1799 – 1817

Family Environments, Adrenarche, and Sexual Maturation: A Longitudinal Test of a Life History Model

Bruce J. Ellis
University of Arizona

Marilyn J. Essex
University of Wisconsin—Madison

SAMPLE

180 girls of an original 570 children followed from birth and enrolled in the Wisconsin Study of Families and Work (Hyde et al., 1995), selected for intensive study in middle childhood, insuring adequate representation of kindergarteners scoring high and low on problem-behavior.

TWO ASSESSMENTS OF PUBERTAL DEVELOPMENT

Adrenarche status, reflecting maturation of the adrenal axis, was determined by salivary DHEA, collected four times during a 4-hour home visit in 3rd grade, including before and after social challenge. Increasing DHEA levels at adrenarche causes pubic hair growth and was related to self-reported pubic hair growth in this sample.

Secondary Sexual Characteristics reported by mother and child at 5th grade, regarding breast and pubic hair development, composited after adjusting for child age.

EARLY vs. LATER MATURING CLASSIFICATION:

Adrenarcheal vs. Preadrenarcheal

Children were coded as preadrenarcheal if at least 6 of 8 DHEA assays were below the detection threshold (10.0 pg/mL) and all DHEA scores were <16 pg/mL.

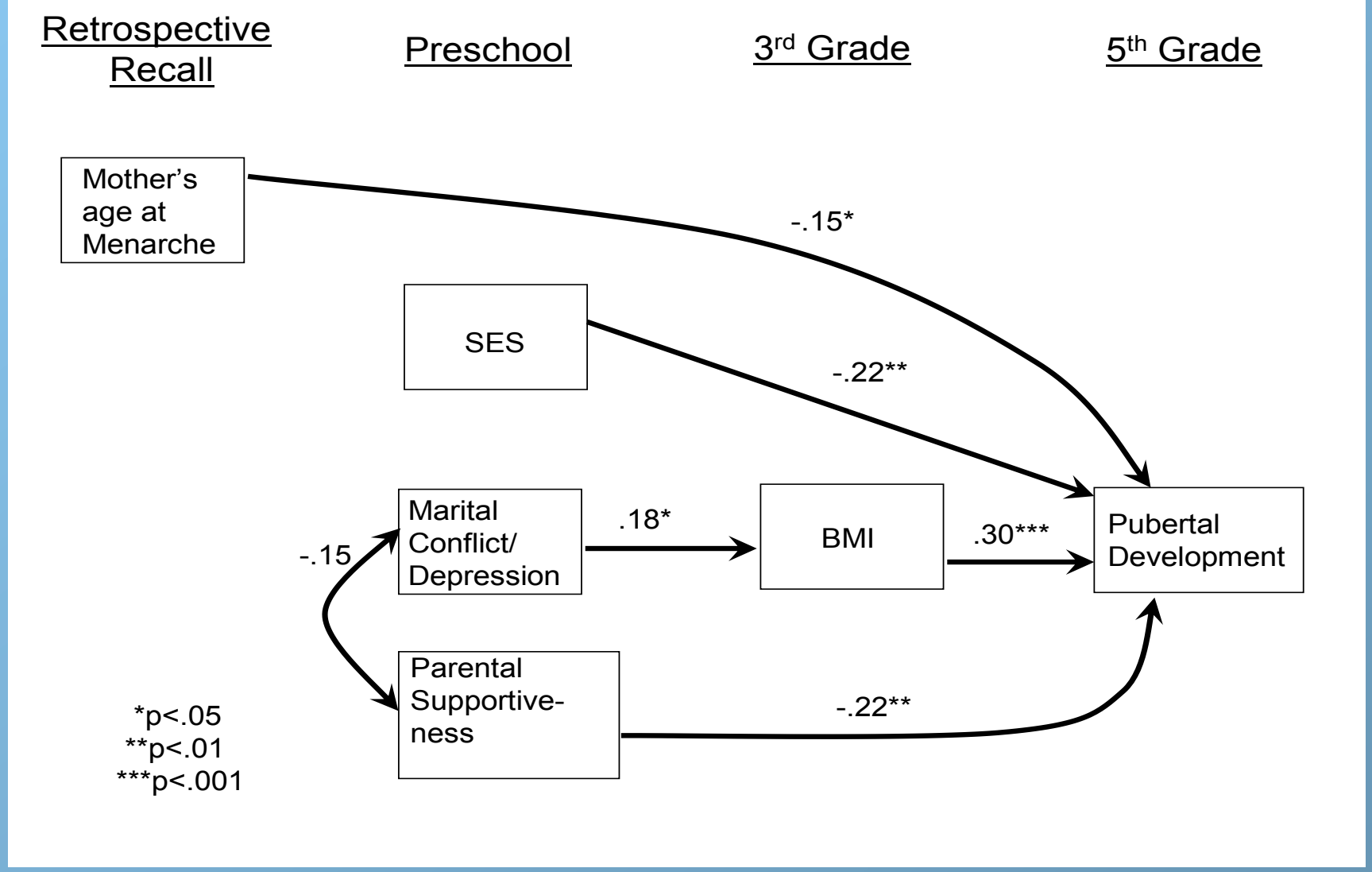
	Prop.
Preadrenarcheal/Later Maturing	56%
Adrenarcheal/Early maturing	44%

Table 2: ***Mean Levels of Preschool Family Environment Measures as a Function of Age 7 Adrenarcheal Status and Correlation of Environment Measures with 5th-Grade Secondary-Sex Characteristics (all adjusted for mother's age of menarche).***

Preschool Family Environment Measures	Age 7 Adrenarcheal Status: Pre-adrenarcheal		Age 7 Adrenarcheal Status: Adren-archeal	5th-Grade Second-Sex Characteristics: r
SES	-.02		-.11	-.25**
Mothering Composites				
Parental Supportiveness[a]	.30	*	-.09	-.29***
Marital Conflict/Depression	-.09		.18	.07
Fathering Composites				
Parental Supportiveness[a]	.29	*	-.15	-.15+
Marital Conflict/Depression	-.22	*	.23	.13

+ p=.06, * p<.05, ** p<.01, *** p<.001

a: supportiveness: warm parenting + family positive emotional climate + authoritative/democratic style - parental negativity



High Pubertal Development Score reflects accelerated development (i.e., greater secondary sex characteristics).

Child Development, July/August 2007, Volume 78, Number 4, Pages 1302 – 1321

Family Rearing Antecedents of Pubertal Timing

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Sarah L. Friedman
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Elizabeth Cauffman
University of California, Irvine

Bonnie L. Halpern-Felsher
University of California, San Francisco

Elisabeth Susman
The Pennsylvania State University
and
The NICHD Early Child Care Research Network

SAMPLE

410 white girls and their families participating in the NICHD Study of Early Child Care and Youth Development followed since birth in 1991, with repeat measurements of family processes at multiple ages.

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MEASURES: PREDICTOR

Maternal Harsh Control

At 54 months, mothers completed a 10-item self-report parenting scale:

spanked child for doing something wrong,

expected child to obey without asking questions,

expected child to be quiet and respectful when adults were around,

regarded respect for authority as the most important thing for the child to learn,

believed praise spoiled the child,

provided few hugs and kisses.

GOLD STANDARD ASSESSMENT OF PUBERTAL TIMING

Physical Exam: Trained nurse (or physician) scored breast and pubic-hair development annually, from 9.5 to 13.5 years, using Tanner staging criterion; pubertal onset then estimated by means of latent-transition analysis.

Child Report: Age of first period (i.e., menarche)

CONTROL VARIABLE

Mother's Age of Menarche: reported by mother. It correlated significantly and positively with both dependent variables:

Girl's Age of Menarche: .37 ($p<.001$)

Girl's Pubertal Onset: .23 ($p<.001$)

EFFECTS OF REARING (with maternal age of menarche controlled)

Girls experienced menarche at an earlier age when they experienced greater maternal harsh control at

(1) 54 months ($\beta = -.11$, $p<.05$)

(2) in Grades 1+3 ($\beta =-.15$, $p<.05$).

Developmental Psychology 2010, Vol. 46, No. 1, 120–128

The Development of Reproductive Strategy in Females: Early Maternal Harshness → Earlier Menarche → Increased Sexual Risk Taking

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Bonnie L. Halpern-Felsher
University of California, San Francisco

the NICHD Early Child Care Research Network

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To test a proposition central to Belsky, Steinberg and Draper's (1991) evolutionary theory of socialization—that pubertal maturation plays a role in linking early rearing experience with adolescent sexual risk taking (i.e., frequency of sexual behavior) and, perhaps, other risk taking (e.g., alcohol, drugs, delinquency)

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OUTCOME MEASURES: RISK TAKING (15 YEARS)

Sexual and *Other Risk Taking* over the preceding 12 months were assessed at age 15 when adolescent participants completed a survey using audio computer-assisted self-interview.

Sexual Risk Taking: four items assessing the number of times the adolescent had oral sex, vaginal sex, been diagnosed with an STD, or had been pregnant.

Other Risk Taking: 36 items assessing how often the adolescent had used alcohol, tobacco or other drugs, behaved in ways that threatened their own safety (e.g., rode in a vehicle without the use of seatbelts), used or threatened to use a weapon, stolen something, or harmed property.

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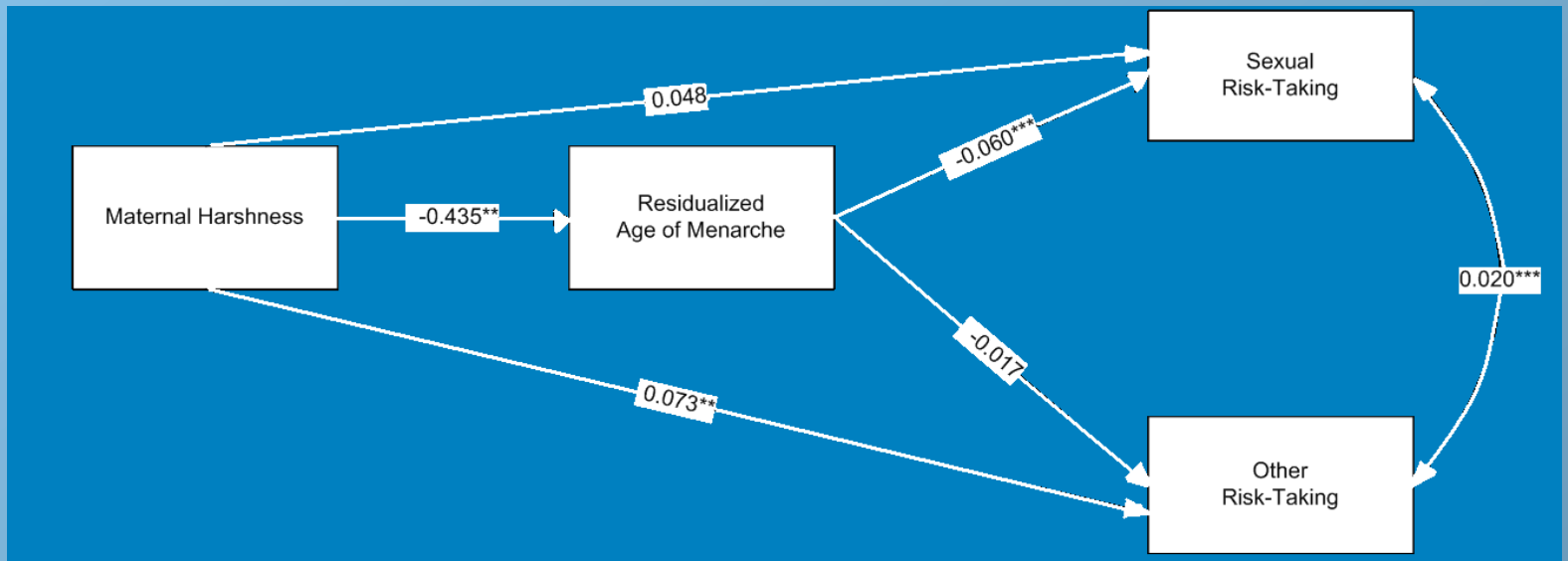
Unstandardized model estimates connecting maternal harshness with sexual and other risk-taking via residualized age of menarche



Tests of Model Fit:

χ^2 (12, N = 526) = 14.380; p = 0.2771

Comparative Fit Index (CFI)	0.979
Tucker-Lewis Index (TLI)	0.968
Root Mean Square Error of Approximation (RMSEA)	0.034
95% Confidence Interval	(0.000, 0.088)

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Can Very Early Experience/Development Predict Pubertal Timing?

Belsky, J., Houts, R.M. & Fearon, R.M.P (2010). Infant Attachment Security and Timing of Puberty: Testing an Evolutionary Hypothesis. *Psychological Science, 21,* 1195-1201

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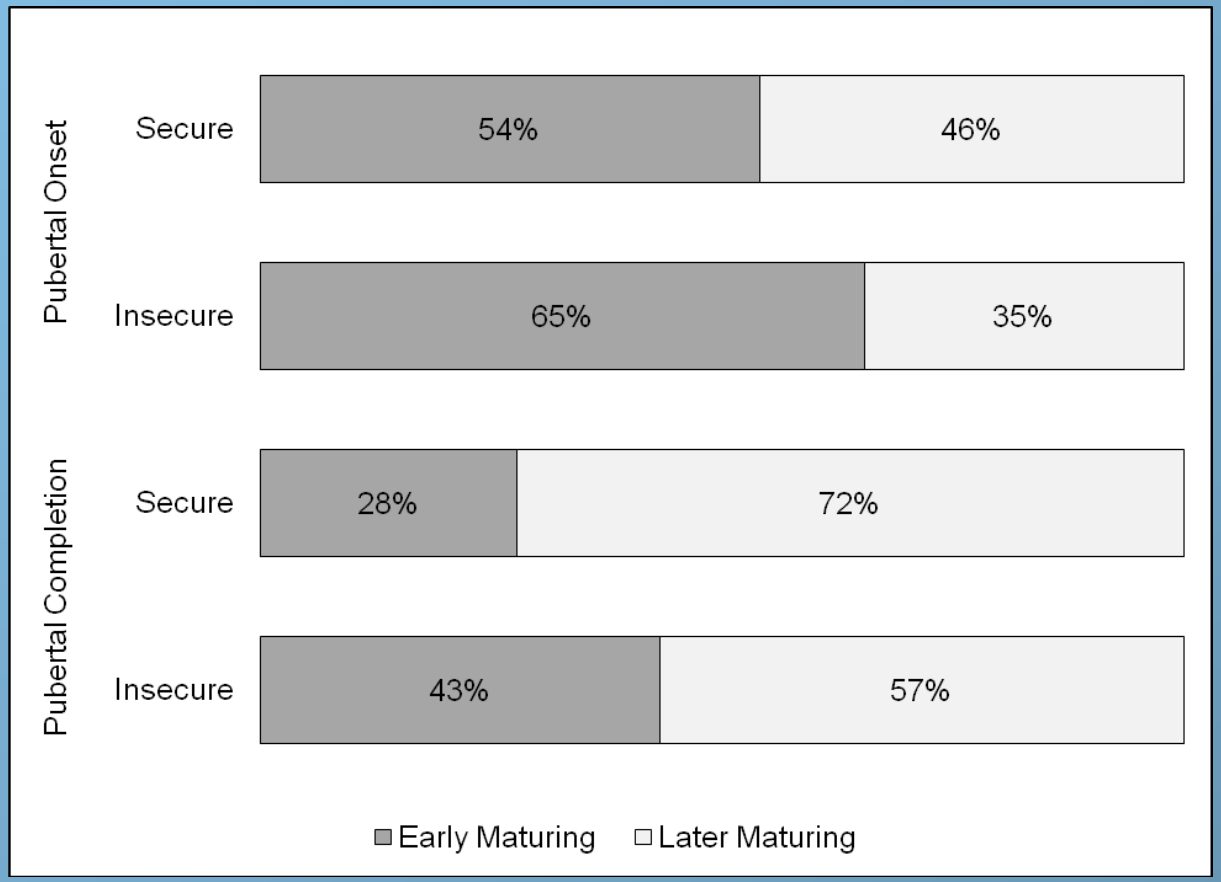
Attachment security and timing of pubertal onset and completion

(Early onset: pubertal onset <10½ years; early completion: <13½ years.)



What About Males?

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Jenee James, Bruce Ellis and their colleagues (2012) extended the study of the development of reproductive strategy by casting BSD in a sex differentiated manner by drawing on sexual selction theory, which highlights fundamental differences in risk and opportunity for males and females. Most notably, the principal trade off for girls should be early vs. later reproduction, whereas for males it should be between mating and parenting.

What About Males?

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Application of sexual selection thinking led to the prediction that:

-- for girls only would pubertal timing mediate the effect of family experiences on (a) timing of sexual debut (i.e., first sex, first intercourse) and (b) sexual risk taking (i.e., non-contraceptive use, pregnancy), consistent with Belsky et al.'s (2007) findings and that

--for boys self-perceived mate value—as reflected in social, competence, athletic competence and physical appearance--would mediate the effect of pubertal timing on sexual debut and risk taking.

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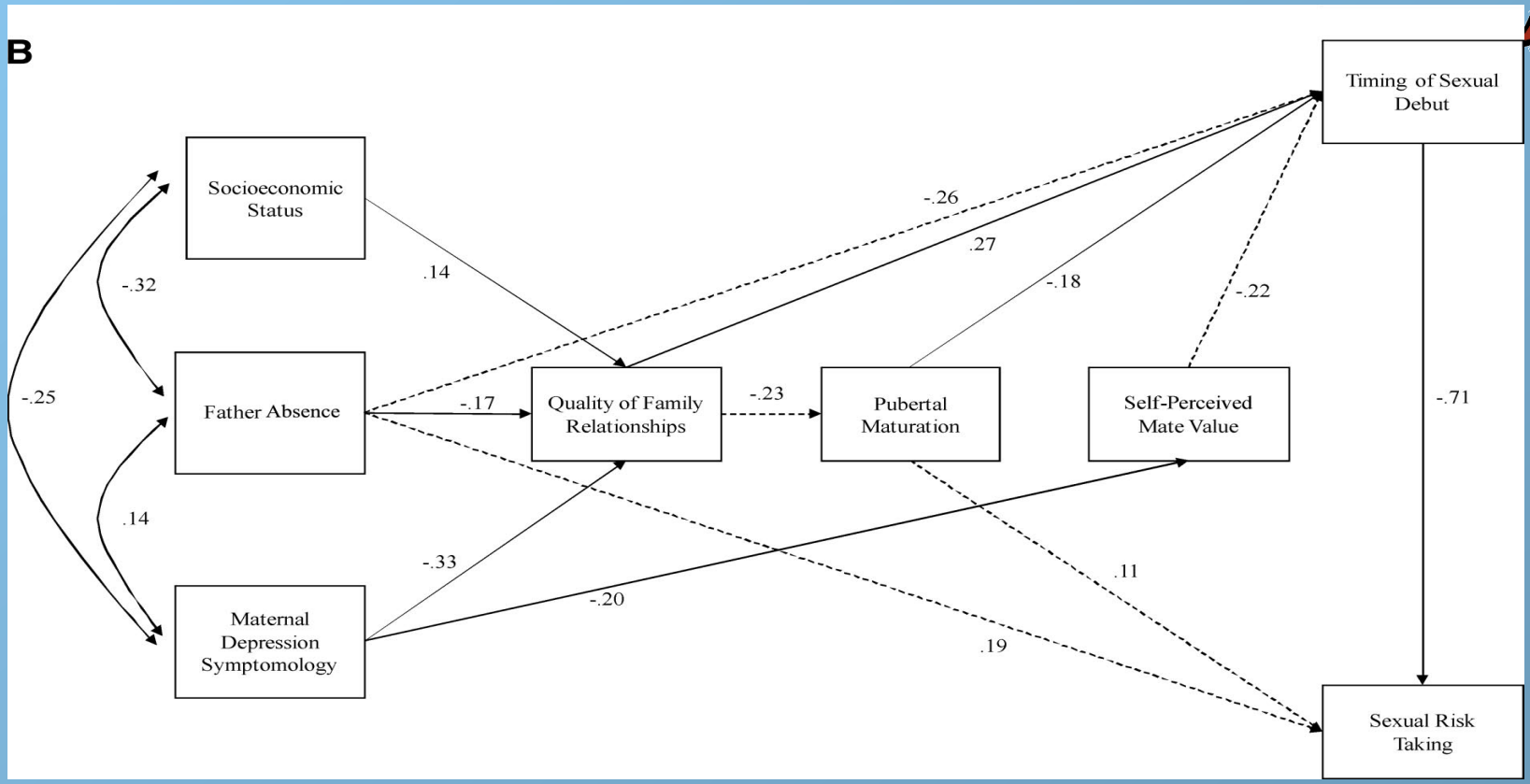
Female Developmental Pathways



Note how pubertal maturation plays a mediational role in this empirical model, mediating effect of family factors. (Dashed lines represent predicted sex differences in developmental pathways.)

James, J. et al. (2012). Sex-specific pathways to early puberty, sexual debut and sexual risk taking. Developmental Psychology.

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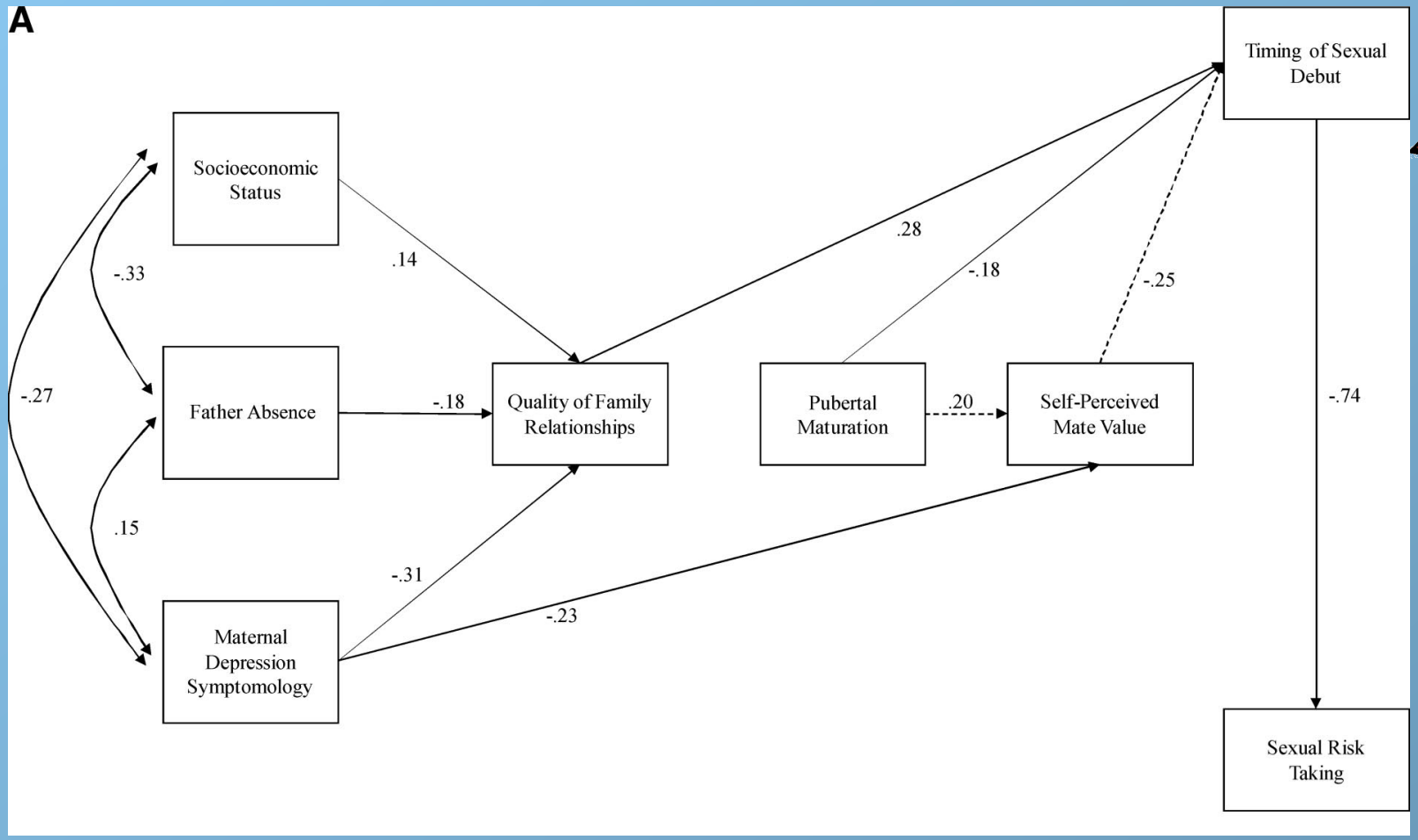
Male Developmental Pathways



Note how puberty does NOT mediate family effects and its effect is mediated by perceived mate value in this empirical model. (Dashed lines represent predicted sex differences in developmental pathways.)

James, J. et al. (2012). Sex-specific pathways to early puberty, sexual debut and sexual risk taking. Developmental Psychology

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BEHAVIOR-GENETIC CHALLENGE: GENETIC MEDIATION "MASQUERADING" AS ENVIRONMENTAL EFFECTS

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To address this issue, Tither and Ellis (2008) evaluated whether years of exposure to father absence and to a dysfunctional father related to age of menarche using a sibling design that compared sisters whose parents separated/divorced so that the older sister would have had less exposure to father absence while being highly genetically related.

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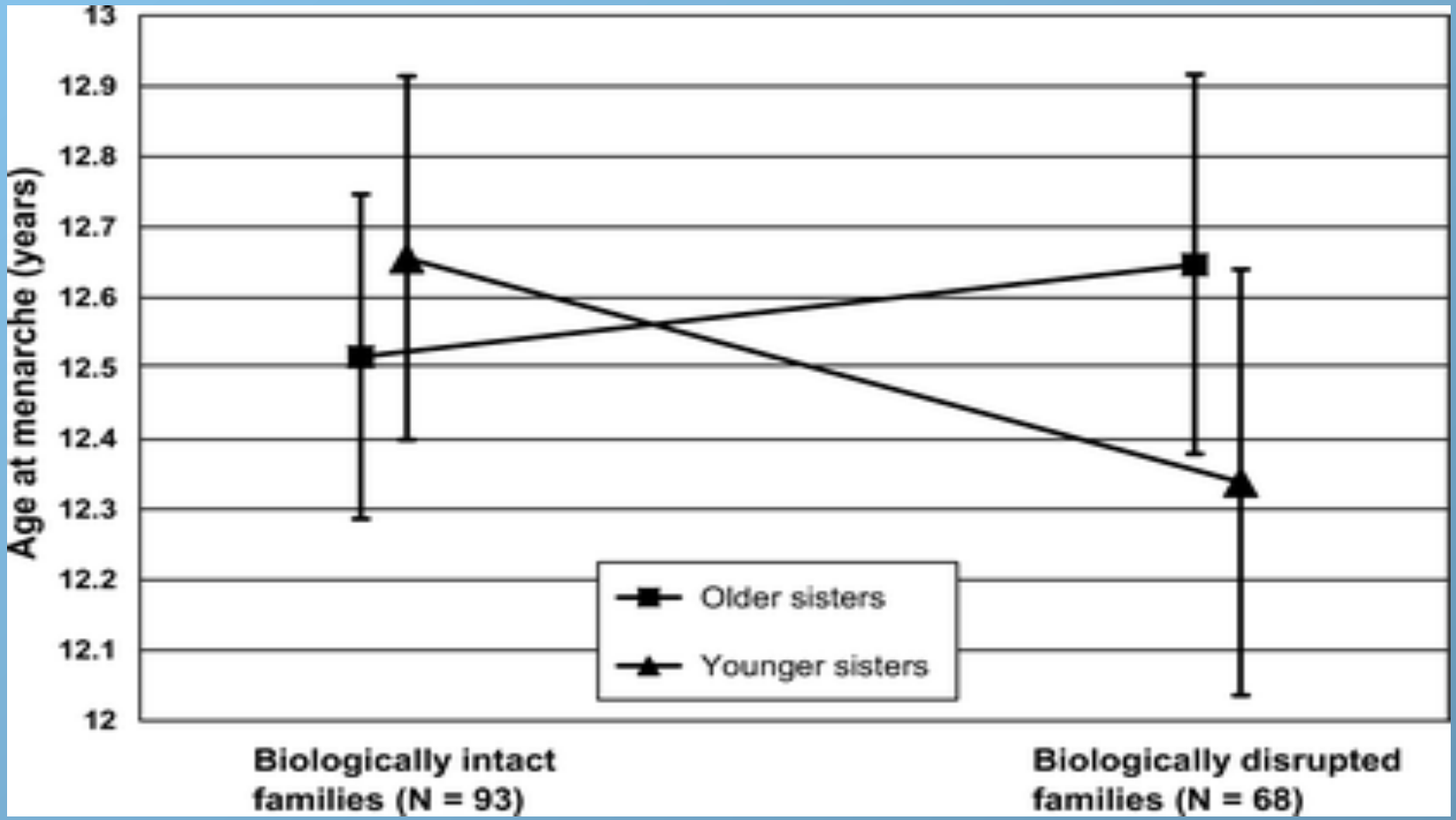
Differences in Sister's Menarcheal Age as a Function of Exposure to Father Absence



Tither, J.M. & Ellis, B.J. (2008). Impact of fathers on daughters' age of menarche: A genetically and environmentally controlled study. *Developmental Psychology, 44, 1409-1420.*

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Moving Beyond the Social Address of Divorce/Father Absence

But is it exposure—or lack thereof—to a father that is critically important or the quality of the relationship fathers have with their daughters?

To address this issue—indirectly—Tither and Ellis (2008) distinguished between father-absent households in which father suffered from psychopathology.

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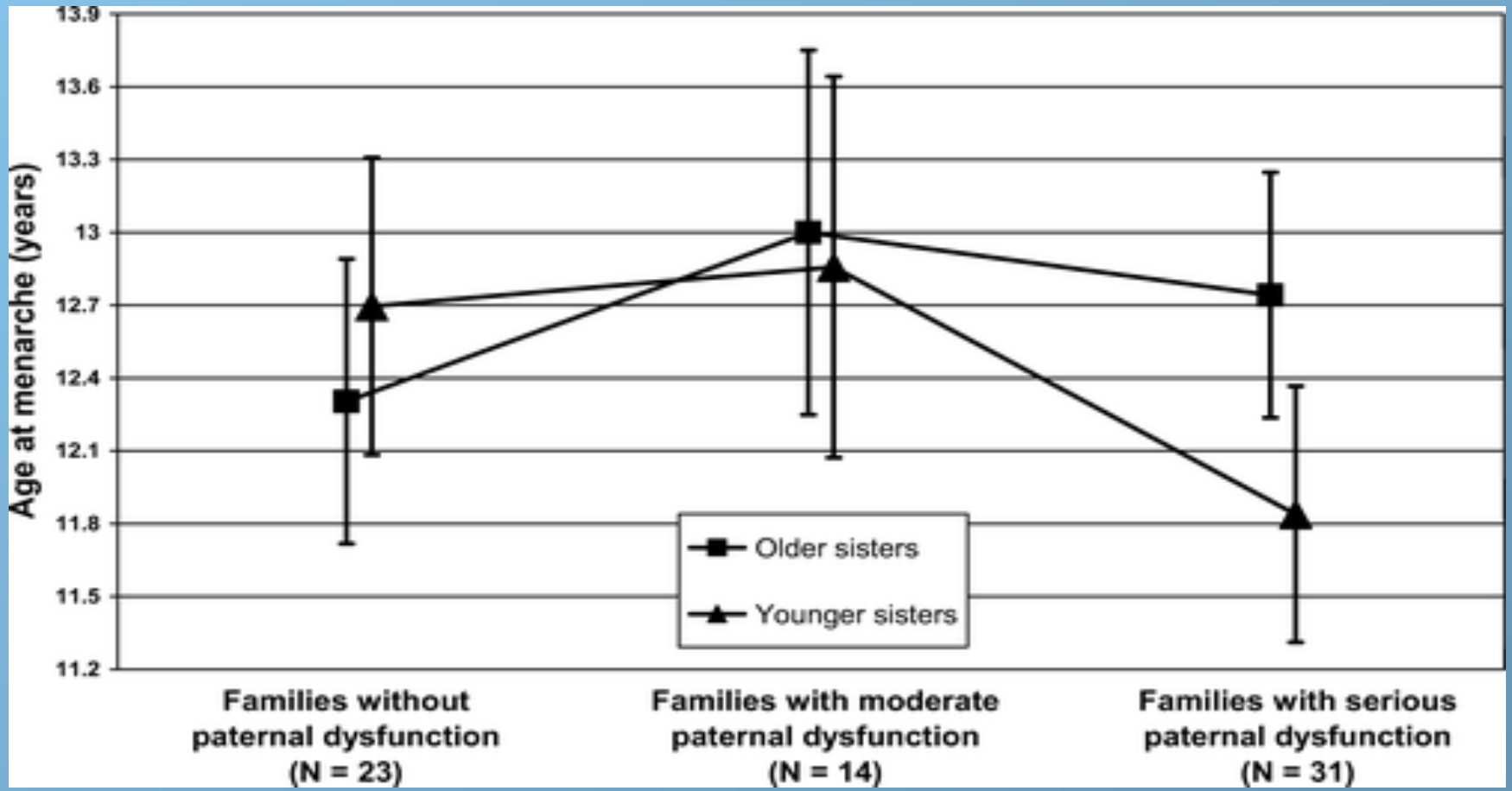
Differences of Sister's Age of Menarche as a Function of Exposure to Father Absence and Father Dysfunction



Tither, J.M. & Ellis, B.J. (2008). Impact of fathers on daughters' age of menarche: A genetically and environmentally controlled study. *Developmental Psychology, 44, 1409-1420.*

War-Related Trauma and Reproductive Traits: A Natural Experiment

Pesonen (2008) tested the life-history prediction that stressful early experiences would regulate reproductive development by taking advantage of a natural experiment. They evaluated whether a **traumatic separation from both parents during childhood** was associated with **reproductive traits later in life**, studying members of the 1934–1944 Helsinki Birth Cohort, including 396 **former war evacuees** from varying socioeconomic backgrounds, who were **sent unaccompanied by their parents to temporary foster families in Sweden and Denmark**, and 503 participants who had no separation experiences.

Former evacuees had earlier menarche, earlier first childbirth (men), more children by late adulthood (women), and shorter interbirth intervals (men), than the non-separated.

A. Pesonen et al., (2008) Reproductive traits following a parent-child separation trauma during childhood: A natural experiment during World War II. *American Journal of Human Biology, 20*, 345-351.

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Effect Sizes Are Small.

Does this matter?

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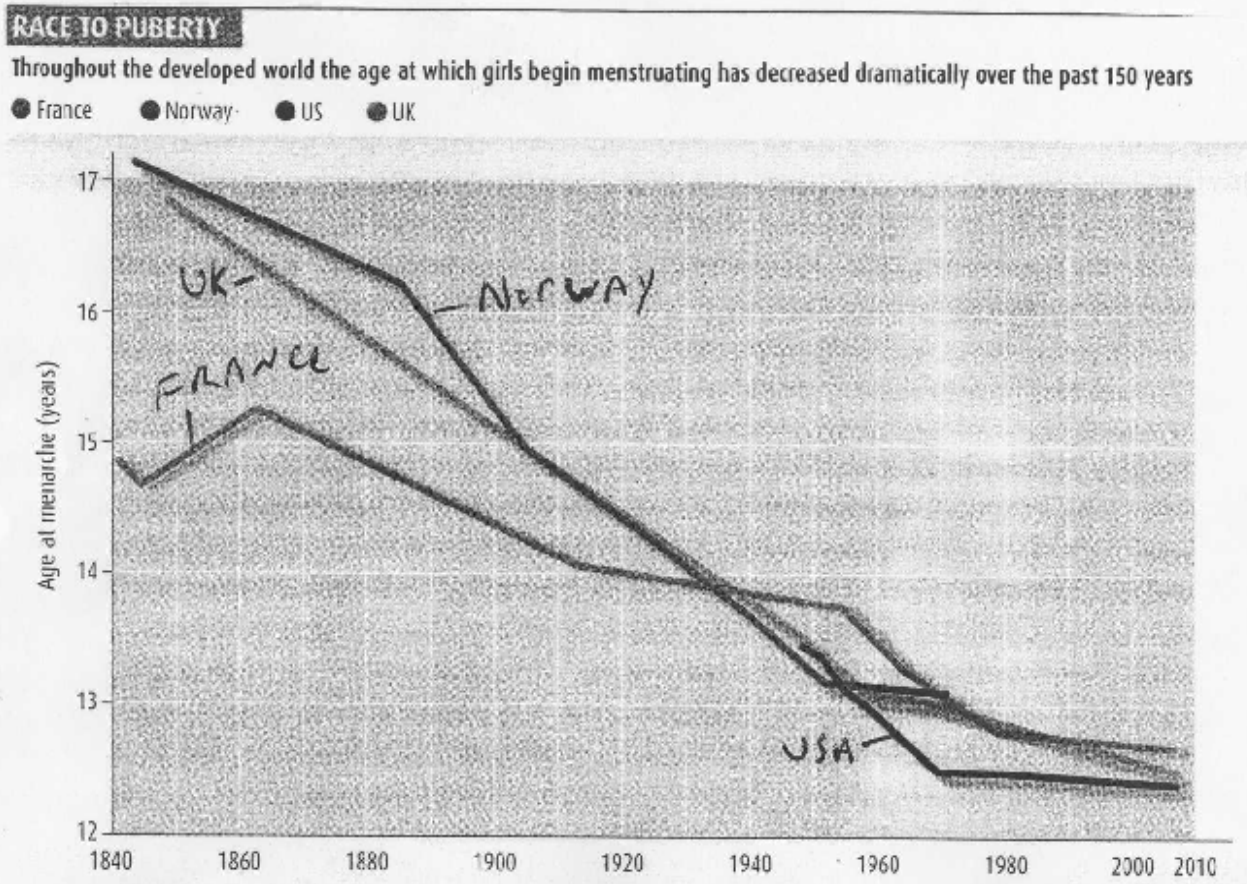
3 POINTS FOR CONSIDERATION:

1.Secular Trend in Pubertal Timing



Source: *New Scientist*, 10TH February 2007, p. 41

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3 POINTS FOR CONSIDERATION:

1. Secular Trend in Pubertal Timing
2. **Functional Consequences of Small Differences in Pubertal Timing**

Functional Consequences of Small Effects

"Although the size of the correlations between family environments and timing of puberty are generally small, these effects may nonetheless have important ramifications...***the time from menarche until 50% of (menstural) cycles are ovulatory is approximately 1 year if menarche occurs before age 12 and 4.5 years if menarcheal age is 13 or older***. Thus, even small effects of family environment on timing of puberty may have substantial effects on timing of onset of reproductive status" (Ellis, 2004, p. 936, emphasis added).

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3 POINTS FOR CONSIDERATION:

1. Secular Trend in Pubertal Timing
2. Functional Consequences of Small Differences in Pubertal Timing
3. **Differential Susceptibility**

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Differential Susceptibility

DARWINIAN CHALLENGE: WHY—not how--WOULD NATURAL SELECTION CRAFT AN ORGANISM WHOSE FUTURE FUNCTIONING IS INFLUENCED BY ITS EARLIER EXPERIENCES?

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POSSIBLE SOLUTION?

CONDITIONAL *AND* ALTERNATIVE REPRODUCTIVE STRATEGIES: Differential Susceptibility to Environmental Influences

Belsky, J. (2000). Conditional and Alternative Reproductive Strategies: Individual Differences in Susceptibility to Rearing Experience. In. J. Rodgers, D. Rowe, & W. Miller (Eds.), Genetic Influences on Human Fertility and Sexuality: Theoretical and Empirical Contributions from Biological and Behavioral Sciences (pp. 127-146). Boston: Kluwer

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Testing Conditional vs. Alternative Reproductive Strategy Hypothesis:

1. Estrogen Receptor-α (*ESR1*) Polymorphism as Moderator

2. Physiological Reactivity as Moderator

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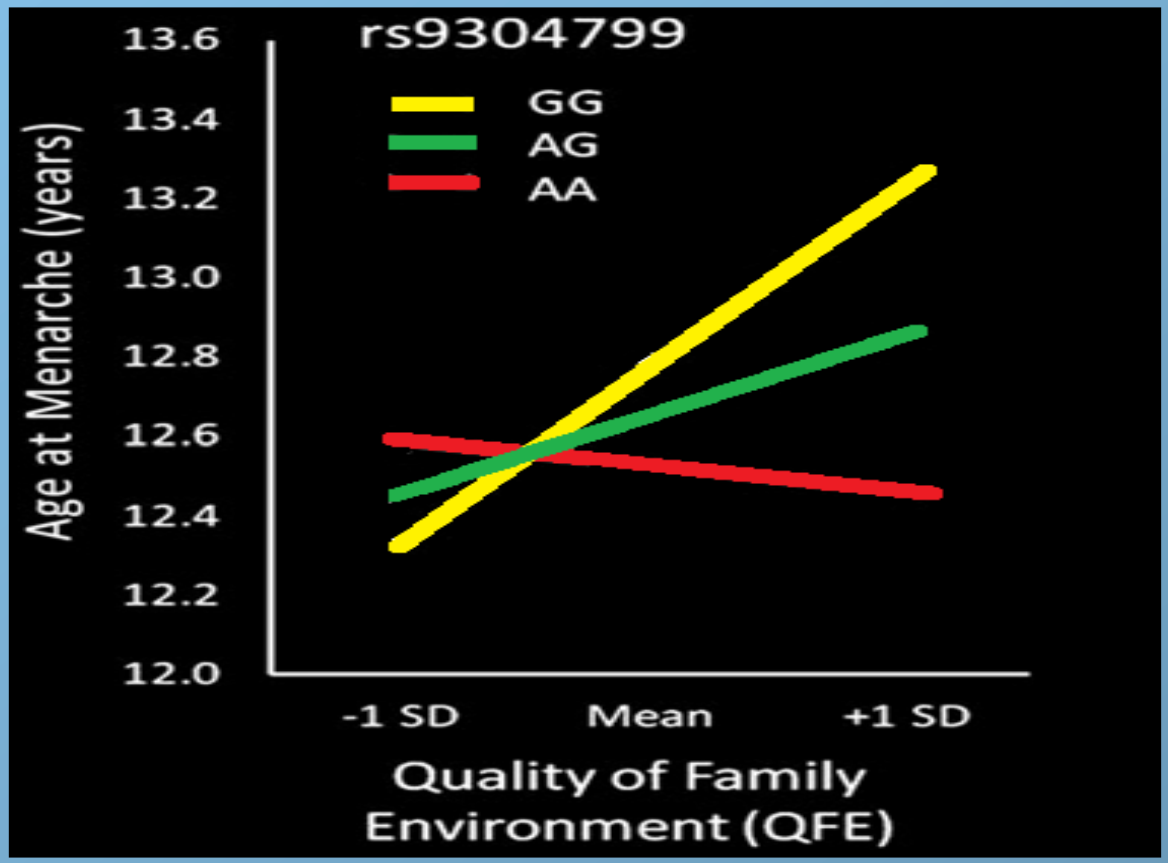
Early Family Environment and Age of Menarche



Manuck, S. et al. (2011). Reported Early Family Environment Covaries with Menarcheal Age as a Function of Polymorphic Variation in Estrogen Receptor-α (ESR1). Development & Psychopathology, 23, 69-83.

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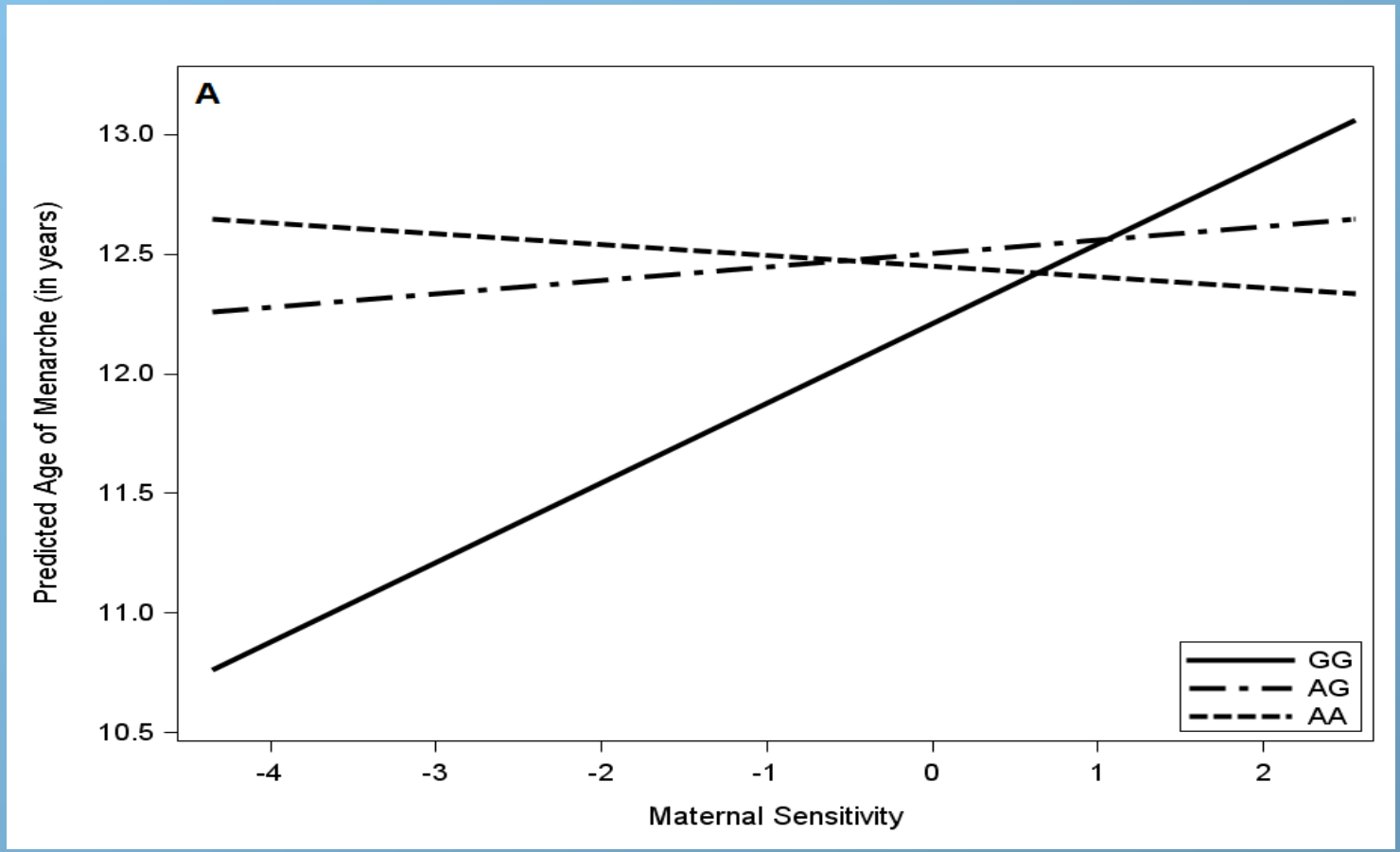
Replication and Extension: Early Maternal Sensitivity and Age of Menarche Moderated by Same Estrogen Receptor-α (ESR1)



Hartman, S., Widaman, K., & Belsky, J. (submitted). Genetic Moderation of Effects of Maternal Sensitivity on Girl's Age of Menarche:Replication and Extension of Manuck et al. (2011)

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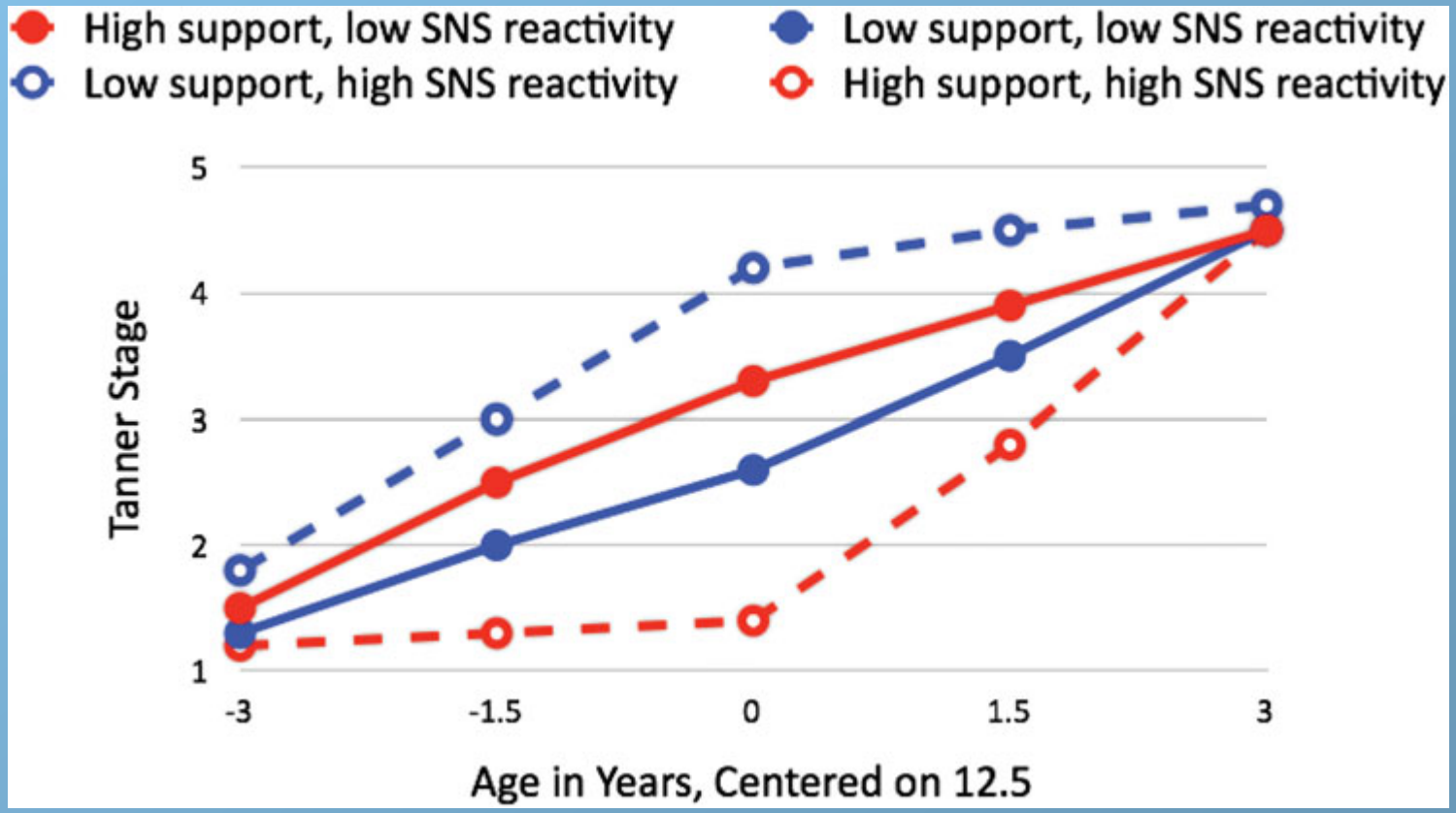
Early Family Environment and Rate of Pubertal Development



Ellis, B. et al. (2011). Quality of early family relationships and the timing and tempo of puberty. Development & Psychopathology, 23, 85-99.

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Future Directions I
Mechanisms of Influence?

By what physiological mechanism(s), beyond adrenarche, might rearing experience, including insecurity-inducing insensitive mothering and maternal harsh control, come to regulate biological development and, thereby, reproductive strategy? Belsky et al. (1991) speculated that a neuroendocrine subsystem intertwined with other endocrine systems could provide a pathway linking experiences in the family with pubertal timing. More recently, Chisholm and associates (2005) theorized that the hypothalamic-pituitary-adrenal (HPA) axis in particular, which is directly involved in stress regulation, may play a critical role in the process.

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Mechanisms of Influence?

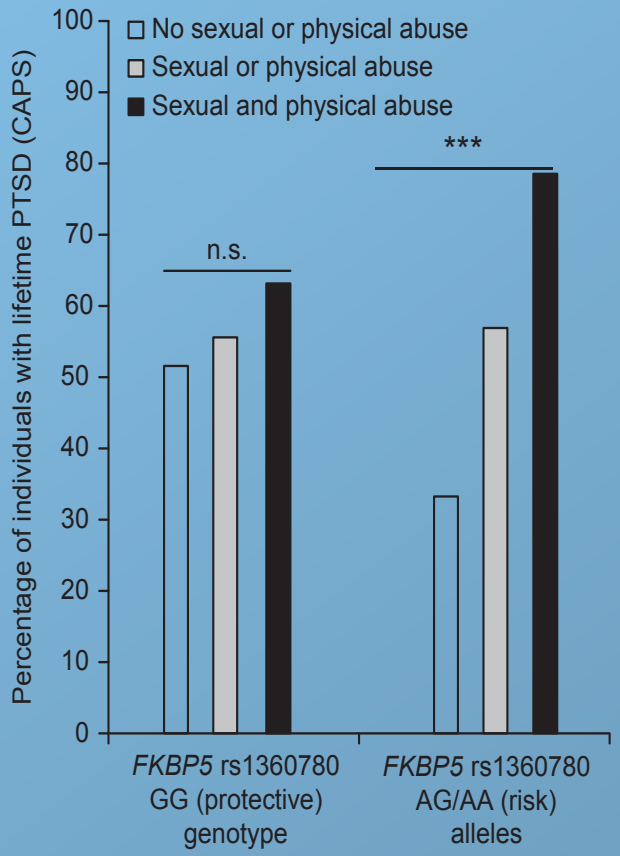
(cont)

Recent elegant experimental research with rats by Cameron and associates (2008; Cameron, Fish & Meaney, 2008) showed not only that maternal licking and grooming of the newborn pup enhances stress regulation, delays the onset of puberty and reduces sexual activity, with the reverse being true of its absence, but that such effects on rat reproductive strategy are mediated by maternal-care effects on gene expression, via methylation.

What remains unclear, of course, is whether these same processes operate in the early regulation of reproductive strategy in humans.

EVIDENCE OF THE ROLE OF EPIGENETICS IN MEDIATING EFFECTS OF CHILD MALTREATMENT ON PTSD

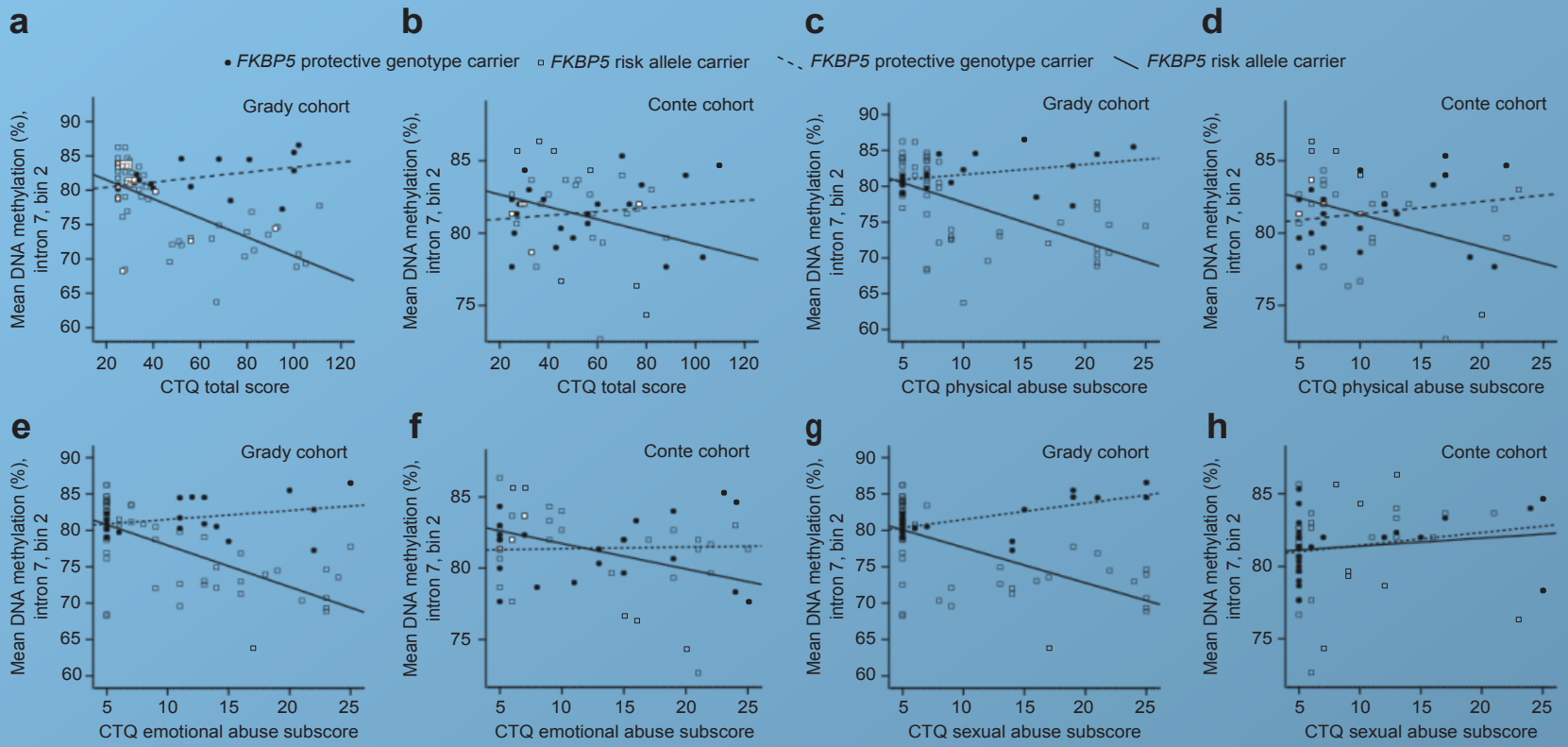
GENETIC MODERATION OF EFFECTS OF CHILD MALTREATMENT ON PTSD



Effect of sex + physical abuse on lifetime PTSD varies by genotype.

Klengel, T. et al. (2013). Allele-specific FKPB5 DNA demethylation mediates gene-childhood trauma interactions. Nature Neuroscience, 16, 33-41.

Genotypic Moderation of Epigenetic Processes: Variation in (De)Methylation Accounts for GXE

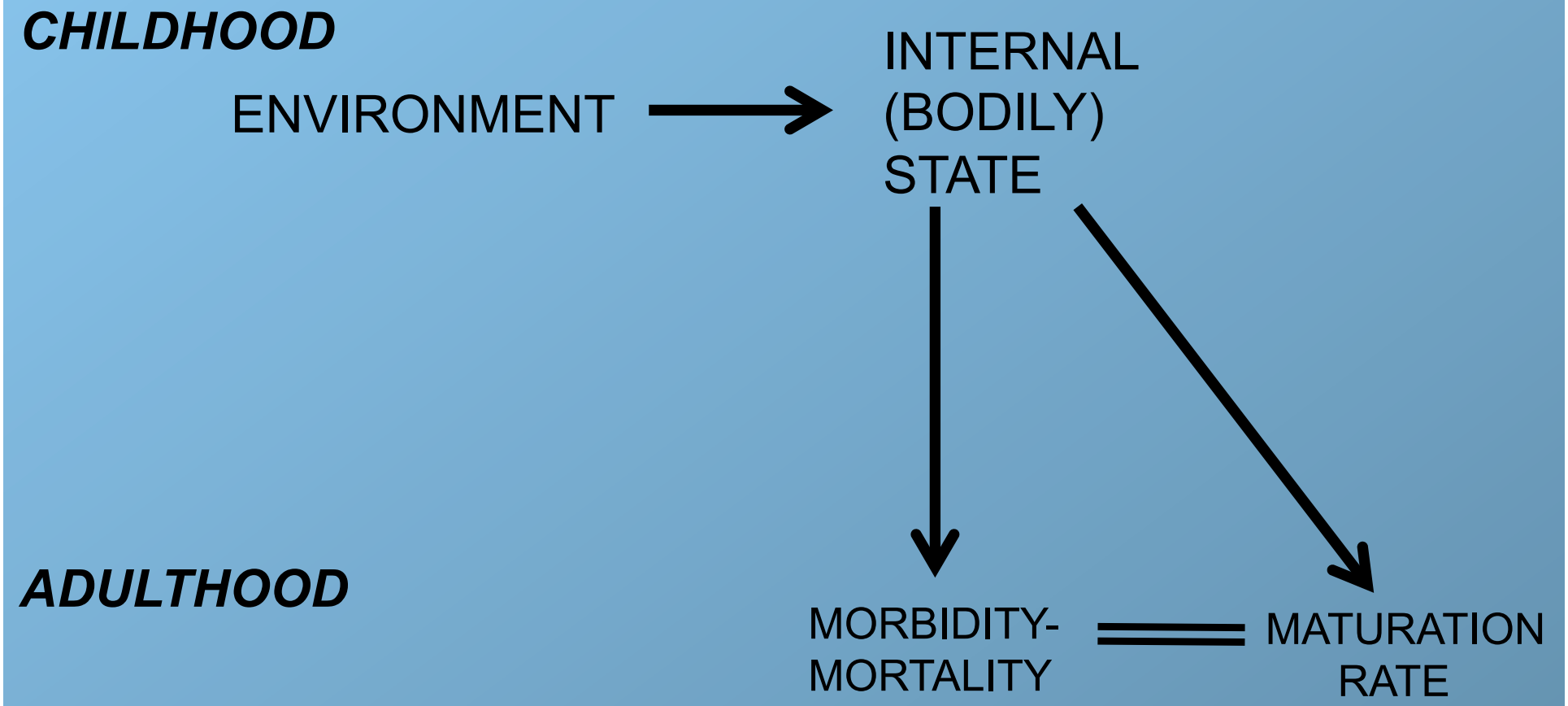


Demethylation Varies by GXE

Klengel, T. et al. (2013). Allele-specific FKPB5 DNA demethylation mediates gene-childhood trauma interactions. Nature Neuroscience, 16, 33-41

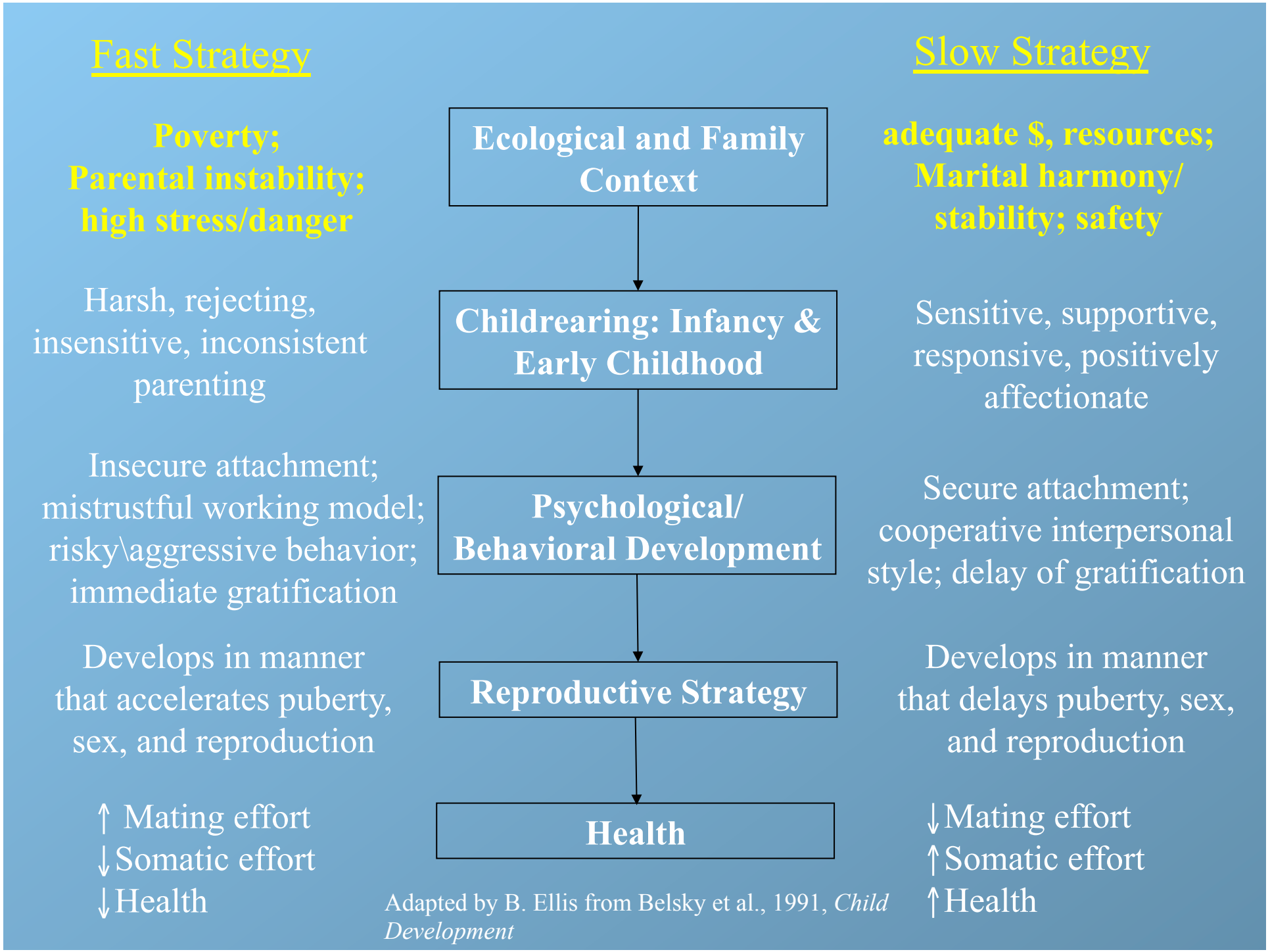
“Alternative” (or Amended?) Model?

INTERNAL PREDICTION MODEL*



* Adapted from: Richard, I., Frankenhuis, W. & Nettle, D. (in press). Why are childhood family factors associated with timing of maturation? A role for internal prediction. Perspectives in Psychological Science.

Toward an Evo-Devo Model of Reproductive Strategy, Health and Longevity


Fast Strategy
Slow Strategy
Poverty; Parental instability; high stress/danger
adequate $, resources; Marital harmony/ stability; safety
Ecological and Family Context
Childrearing: Infancy & Early Childhood
Harsh, rejecting, insensitive, inconsistent parenting
Sensitive, supportive, responsive, positively affectionate
Psychological/ Behavioral Development
Insecure attachment; mistrustful working model; risky\aggressive behavior; immediate gratification
Secure attachment; cooperative interpersonal style; delay of gratification
Reproductive Strategy
Develops in manner that accelerates puberty, sex, and reproduction
Develops in manner that delays puberty, sex, and reproduction
Health
↑ Mating effort
↓Somatic effort
↓Health
↓Mating effort
↑Somatic effort
↑Health
Adapted by B. Ellis from Belsky et al., 1991, Child Development