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Beyond Mental Health: Child Development In Evolutionary Perspective

Jay Belsky
Emeritus Professor
of
Human Development

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Central Claim:

By viewing human development principally from a mental-health perspective, we misconstrue it by failing to view it in evolutionary perspective.

2

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Most developmental theory, inquiry and practice presumes (too often) that there is something commonly referred to as "optimal development."

Freud: to love and to work

Maslow: self actualization

Erikson: basic trust, autonomy, identity, intimacy, generativity

Attachment theory: security, competence, intimacy

3

In light of this way of viewing so-called optimal development, it is no wonder that we view adversity as "undermining" or "compromising" development—and so use terminology emphasizing dysfunction, dysregulation and disorder.

4

But from an evolutionary perspective, we need to appreciate and distinguish diverse developmental *strategies* that serve the ultimate goal of ALL living things under varying contextual conditions:

PASSING GENES ON TO THE NEXT GENERATION

5

I will illustrate the utility of an evolutionary perspective—for leading to new developmental insights by considering two current topics in developmental science whose origins are sometimes decades old, yet remain underappreciated:

--Accelerating effect of contextual adversity on biological development;

--Differential susceptibility to developmental experiences and environmental exposures.

--As we will see, the second topic will qualify the first in important ways.

6

Accelerating Effect Of Adversity on Biological Development:

--why should adversity accelerate development?

7

The basic evolutionary-developmental logic here is very simple:

--If the fundamental goal of all living things is to pass on their genes to the next generation,
--then if, due to contextual adversity, the risk of becoming developmentally compromised or dying before reproducing, the organism should speed up development so as to reach sexual maturity sooner than would otherwise be the case
--and thus be in positionto reproduce.

8

Developmental Adversity Accelerates Biological Aging

--Pubertal Timing

--Cellular Aging

--Brain Development

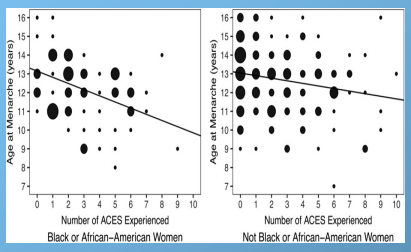
9

Developmental Pathways of Divergent Reproductive Strategies

FAST		SLOW
Marital discord High stress Inadequate $ resources	**A. Family Context**	Spousal harmony Adequate $ resources
Harsh, rejecting, insensitive Inconsistent	**B. Child-rearing** Infancy/Early Childhood	Sensitive, supportive, responsive Positively affectionate
Insecure attachment Mistrustful internal working model Opportunistic interpersonal orientation	**C. Psychological/ Behavioral Development**	Secure attachment Trusting internal working model Reciprocally-rewarding interpersonal orientation
Early maturation/ Puberty	**D. Somatic Development**	**Later maturation/ Puberty**
Earlier sexual activity Short-term, unstable pair bonds Limited parental investment	**E. Reproductive Strategy**	Later sexual activity Long-term, enduring pair bonds Greater parental investment

10

Adverse childhood experiences and reproductive strategies in a contemporary U.S. population



Holdsworth, E.A., & Appleton, A.A. (2019). Adverse childhood experiences and reproductive strategies in a contemporary U.S. population.American Journal of Physical Anthropology.

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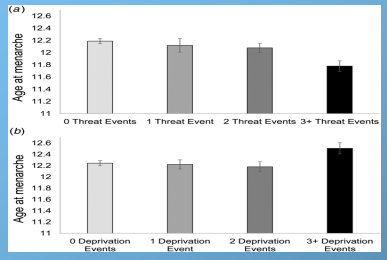
Distinguishing Effects of Threat- and Deprivation-Related Early Experience and Pubertal Timing



Threat: physical abuse, witnessing domestic violence, sexual assault, witnessing or being victim of community violence; emotional abuse.
Deprivation: physical/psychosocial neglect, financial/food insecurity, low parental ed, household poverty

Colich, N.L. (2019). Earlier age of menarche is a transdiagnostic mechanism linking childhood trauma with multiple forms of psychopathology in girls. Psychological Medicine

12

META-ANALYTIC STUDY OF

(43 studies with 46 independent data sets)

ADVERSE CHILDHOOD EXPERIENCES

AND

FEMALE PUBERTAL TIMING

(Age at menarche, Tanner staging scores, Pubertal Development Scale (PDS) and relative perceived timing)

Table 2. Pooled effect size of specific types of ACEs.

Types of Adversity	K	Cohen's d (95% CI)	I^2 (%), p Value
Sexual abuse	12	−0.14 (−0.18, −0.11)	72.4, <0.001
Physical abuse	8	−0.03 (−0.07,0.01)	91.5, <0.001
Neglect	4	0.02 (−0.1,0.14)	72.8, < 0.011
Low SES	25	0.07 (−0.03,0.18)	97.4, <0.001
Father absence	12	−0.40 (−0.63, −0.16)	98.2, <0.001
Family dysfunction	11	−0.08 (−0.11,−0.04)	66.9, < 0.001

(Data in parentheses are 95% Cis, ES = effect size (Cohen's d), SES = socioeconomic status.)

Zhang, L., Zhang, D., & Sun, Y. (2019). Adverse childhood experiences and early pubertal timing among girls: A meta-analysis. International Journal of Environmental Research and Public Health, 16, 2887.

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DO EFFECTS ON PUBERTAL DEVELOPMENT EXTEND TO SEXUAL/REPRODUCTIVE BEHAVIOR?

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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

Jay Belsky
Birkbeck University of London

Laurence D. Steinberg
Temple University

Renate M. Houts
Duke University

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

the NICHD Early Child Care Research Network

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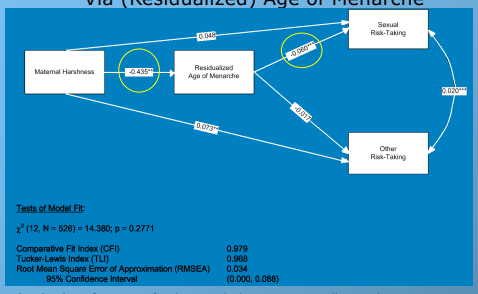
Indirect Effects of Maternal Harsh Control (54 mos.) on Sexual and Other Risk Taking* (15 yrs.) Via (Residualized) Age of Menarche



Sexual Risk Taking: frequency of oral sex, vaginal sex, pregnancy, diagnosed STD.
Other Risk Taking: frequency of use of alcohol, tobacco or other drugs, behaved in ways that threatened 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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WHAT ABOUT INFANT ATTACHMENT SECURITY

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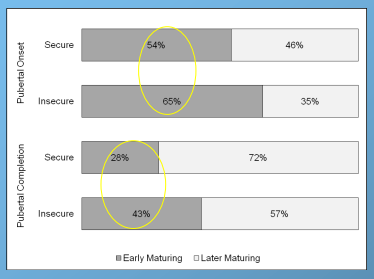
(Early onset: pubertal onset <10½ years; early completion: <13½ years.)



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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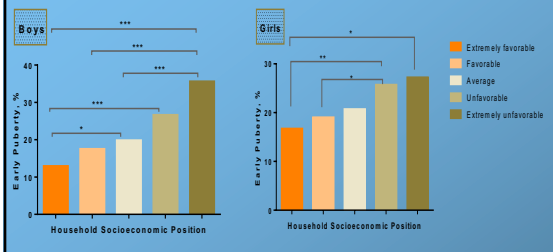
WHAT ABOUT BOYS?

Household SES (from 0-11 Yrs)

And Early Pubertal Development



Sun, Y. (2017). Childhood social disadvantage and pubertal timing: A national birth cohort from Australia. Pediatrics, 139, e20164099.

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Developmental Adversity Accelerates Biological Aging:
--Pubertal Timing
--Cellular Aging
-Telomeres
-Epigenome
--Brain Development

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Telomeres

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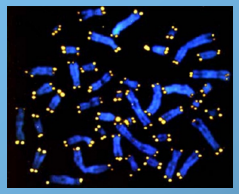
Telomeres

Ends of linear chromosomes
Shorten Every Time Cell Duplicates
And So Decrease with Age



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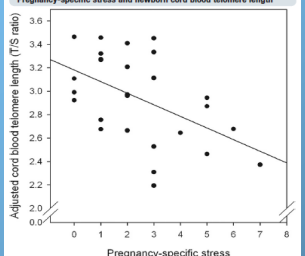
Maternal psychosocial stress during pregnancy is associated with newborn leukocyte telomere length

Sonja Entringer, PhD; Elissa S. Epel, PhD; Jue Lin, PhD; Claudia Buss, PhD; Babak Shahbaba, PhD; Elizabeth H. Blackburn, PhD; Hyagriv N. Simhan, MD; Pathik D. Wadhwa, MD, PhD

Entringer et al, 2013, *Am J Obstet Gynecol*

FIGURE
Pregnancy-specific stress and newborn cord blood telomere length



Scatterplot of association between maternal pregnancy-specific stress and newborn (cord blood) telomere length ($R^2 = 0.25$). T/S ratio is adjusted for covariates (newborn gestational age at birth, weight, sex, and exposure to antepartum obstetric complications).

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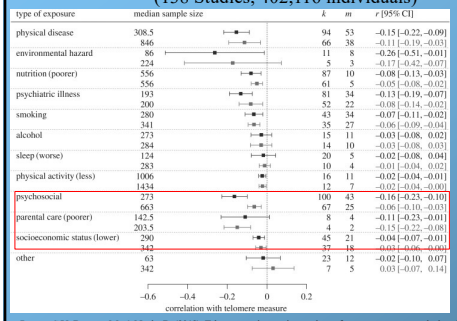
Meta-Analytic Associations Between Type of Adversity And Telomere Length (138 Studies, 402,116 individuals)



Overall, exposure to adversity associated with shorter telomeres (r =-.15, CI: -.18 to -.11)

Pepper, G.V., Bateson, M., & Nettle, D. (2018). Telomeres as integrative markers of exposure to stress and adversity: A systematic review and meta-analysis. Royal Society Open Science, 5: 180744.

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EPIGENOME: As we age, the epiginome changes

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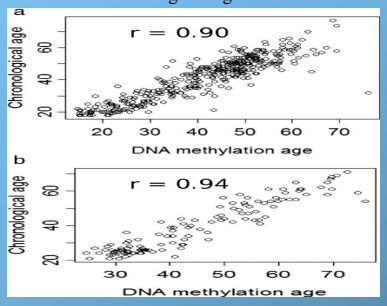
Correlation Between DNA Methylation Age
and
Chronological Age



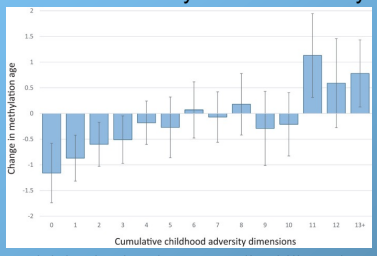
Cohort 1

Cohort 2

Zanas, A.S. et al. (2015). Lietimes tress accelerates epigenetic aging in an urban, African American cohort. Genome Biology, 16, 266-277.

25

Early adversities accelerate epigenetic aging into adulthood, from age 15 to 23, Great Smokey Mountains Study



(threat, material deprivation, loss, unpredictability, other adversities)

Copeland, W.E., et al., (2022). Early adversities accelerate epigenetic aging into adulthood: a 10-year, within-subject analysis. Journal of Child Psychology and Psychiatry, DOI: (10.1111/jcpp.13575)

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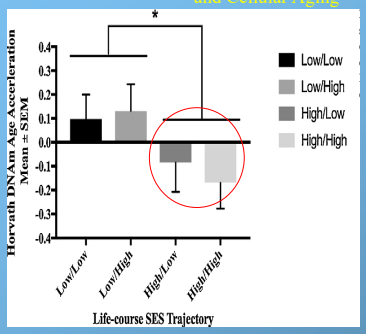
Early- and Later-Life Socioeconomic Disadvantage and Cellular Aging



Note: Early-life disadvantage (i.e., low SES) accelerates cellular aging, not disadvantage later in life.

Austin, M.K., Chen, E., Ross, K., McEwen, L., & Miller, G. (2018). Early-life socioeconomic disadvantage, not current, predicts accelerated epigenetic aging of monocytes. Psychoneuroendocrinology 97, 131-134.

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Developmental Adversity Accelerates Biological Aging:
--Pubertal Timing
--Cellular Aging
-Telomeres
-Epigenome
--Brain Development

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CONNECTING
THE BRAIN BRAKE AND ACCELERATOR?

Development and Psychopathology 29 (2017), 505–518
Insensitive parenting may accelerate the development of the amygdala–medial prefrontal cortex circuit
SANDRA THIJSSEN, RYAN L. MUETZEL, MARIAN J. BAKERMANS-KRANENBURG,VINCENT W. V. JADDOE, HENNING TIEMEIER, FRANK C. VERHULST, TONYAWHITE, AND MARINUS H. VAN IJZENDOORN

Abstract: stronger amygdala–mPFC connectivity in children with less sensitive mothers….Amygdala-mPFC resting-state functional connectivity has been shown to increase from age 10.5 years onward, implying that the positive association between age and amygdala–mPFC connectivity in 6- to 10-year-old children of less sensitive parents represents accelerated development of the amygdala–mPFC circuit.

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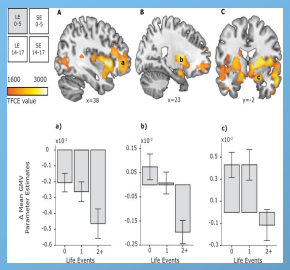
Early-life Stress (Before Age 5)
Accelerates Typical Maturational Decrease in
Gray Matter Volume in Adolescents



The more adverse life events, the smaller the GMV

Prefrontal Cortex Insula Amygdala

Tyborowska, A., et al. (2018). Early-life and pubertal stress differential modulate grey matter development in human adolescents. Scientific Reports, 8, 9201.

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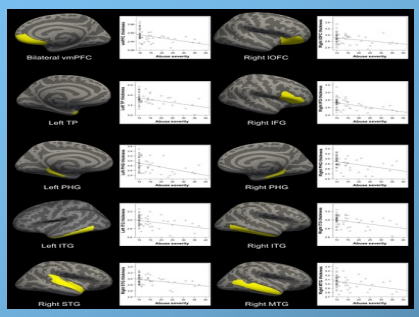
Greater Child Abuse Severity Accelerates Normal Age-Related Thinning in Brain Regions Involved in Emotional Processing



Gold, A.L., et al. (2016). Childhood abuse and reduced cortical thickness in brain regions involved in emotional processing. Journal of Child Psychology and Psychiatry, 57, 1

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Differential Susceptibility to Environmental Influences:

Why should children vary in their susceptibility to environmental influences?

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Again, the basic evolutionary-developmental logic here is very simple:

--Because the future is INHERENTLY UNCERTAIN
--there must have been times and places in human evolutionary history when being shaped by early developmental experiences proved counter-productive, undermining rather than enhancing the chance of passing on genes to future generations;
--thus, to "hedge bets" about an uncertain future, evolution should have led to the bearing of children who vary in their developmental plasticity, that is, their susceptibility to developmental experiences and environmental exposures.

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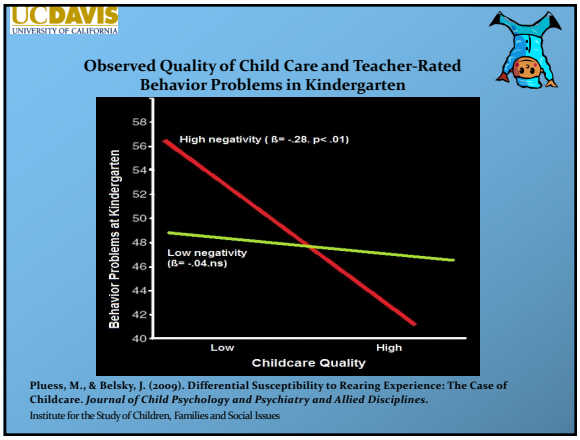
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Observed Quality of Child Care and Teacher-Rated Behavior Problems in Kindergarten
High negativity (ß= -.28. p< .01)
Low negativity (ß= -.04.ns)
Behavior Problems at Kindergarten
58
56
54
52
50
48
46
44
42
40
Low
High
Childcare Quality
Pluess, M., & Belsky, J. (2009). Differential Susceptibility to Rearing Experience: The Case of Childcare. Journal of Child Psychology and Psychiatry and Allied Disciplines.
Institute for the Study of Children, Families and Social Issues

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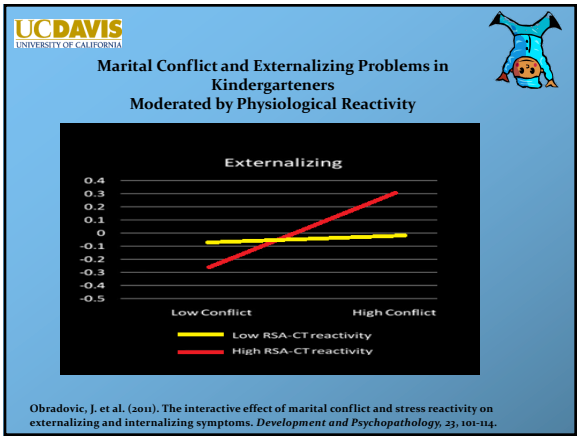
UCDAVIS
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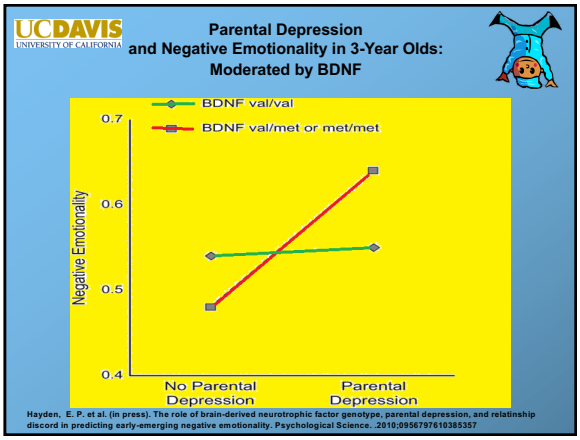
Marital Conflict and Externalizing Problems in Kindergarteners
Moderated by Physiological Reactivity
Externalizing
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
Low Conflict
High Conflict
Low RSA-CT reactivity
High RSA-CT reactivity
Obradovic, J. et al. (2011). The interactive effect of marital conflict and stress reactivity on externalizing and internalizing symptoms. Development and Psychopathology, 23, 101-114.

35


UCDAVIS
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Parental Depression and Negative Emotionality in 3-Year Olds:
Moderated by BDNF
BDNF val/val
BDNF val/met or met/met
Negative Emotionality
0.7
0.6
0.5
0.4
No Parental Depression
Parental Depression
Hayden, E. P. et al. (in press). The role of brain-derived neurotrophic factor genotype, parental depression, and relationship discord in predicting early-emerging negative emotionality. Psychological Science. .2010;0956797610385357

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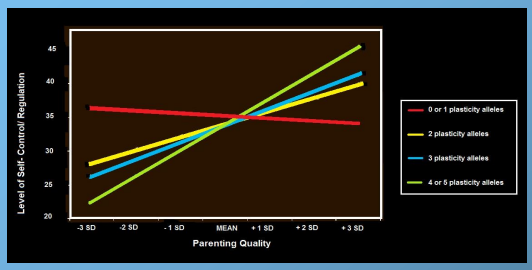
BEYOND SINGLE GENES: POLYGENIC SCORES



Belsky, J., & Beaver, M. (2011). Cumulative-Genetic Plasticity, Parenting and Adolescent Self-Control/Regulation. *Journal of Child Psychology & Psychiatry*.

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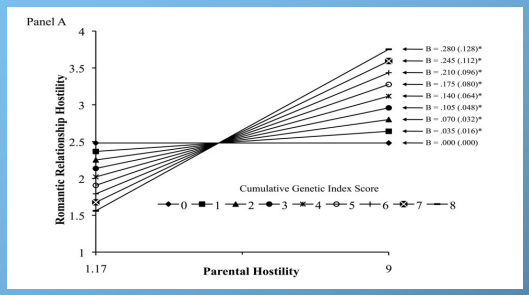
Parenting in Adolescence and Hostile Romantic Relations in Young Adulthood Moderated by Cumulative Genetic Plasticity (5HTT, ANKK/DRD2, DRD4, DAT, COMT)



Masarik, A.S. et al. (2014). For better and for worse: Genes and parenting interact to predict future behavior in romantic relationships. Journal of Family Psychology, 28, 357-367..

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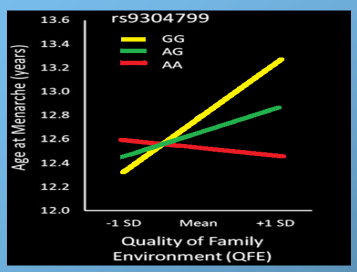
What About Environmental Effects on Age of Menarche?



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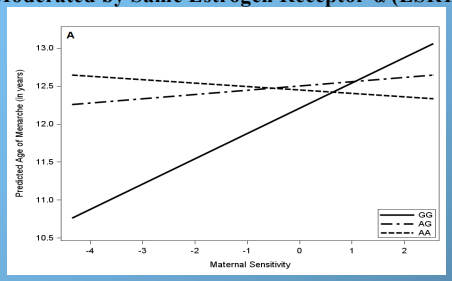
Replication and Extension: Early Maternal Sensitivity and Age of Menarche Moderated by Same Estrogen Receptor-α (ESR1)



Hartman, S., Widaman, K., & Belsky, J. (2012). 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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Toward an Evo-Devo Model of Reproductive Strategy, Health and Longevity

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

Adapted by B. Ellis from Belsky et al., 1991, *Child Development*

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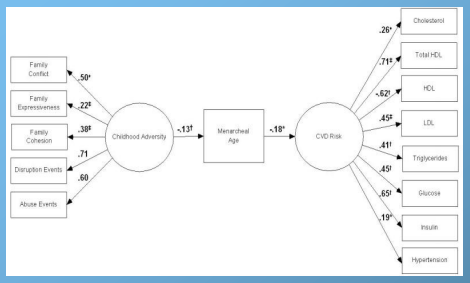
Interrelation of Childhood Adversity, Menarcheal Age and Cardiovascular Risk:
Cross-Sectional Evidence



Bleil, M.E. et al. (2013). Childhood adversity and pubertal timing: Understanding the origins of adulthood cardiovascular risk. Biological Psychology, 93, 213-219.

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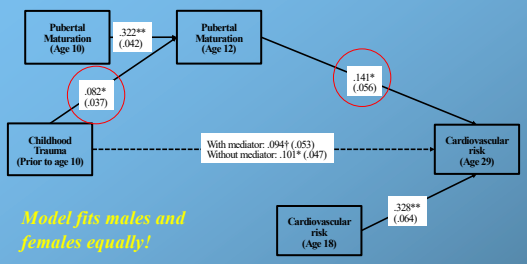
Childhood Trauma, Accelerated Pubertal Maturation and Deteriorating Cardiovascular Health:
Longitudinal Analysis



Model fits males and females equally!

Lei, M. K., Beach, S. R. H., & Simons, R. L. (2018) Childhood trauma, pubertal timing, and cardiovascular risk in adulthood. *Health Psychology, 37*, 613-617.

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