

Biobehavioral development of puberty-smoking associations: The role of genetics, smoking during pregnancy, and harsh discipline

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Introduction

Puberty → behavior problems & substance use

Ullsperger & Nikolas, 2017

Puberty and externalizing behaviors both genetically influenced

Beunen et al., 2000; Palmert & Hirschhorn, 2003; Corley et al., 2015

Dick et al., 2016; Do et al., 2015; Maes et al., 2017

- Are puberty-related genes involved in a developmental pathway?
- Genetic confounding of association?

Introduction

A substantial proportion of women still smoke during pregnancy

- Decline from 15% (2006) to 11% (2016) in UK

<http://content.digital.nhs.uk/catalogue/PUB20781/stat-smok-eng-2016-rep.pdf>

- - Some areas still above 25%

- Decline from 13% (2000) to 12% (2010) in US

- - Some areas still above 25%, Some areas increased (LA, ME, MI, WV)

Tong et al, 2013

SDP → behavior problems

Bidwell et al., 2017; D'Onofrio et al., 2012; Estabrook et al., 2015

Knopik, Marceau, Bidwell et al., 2016; Marceau et al., 2017

SDP → early timing of puberty

Yermachenko & Dvornik, 2015; Gayle et al., 2017

Introduction

Also more proximal influences on smoking

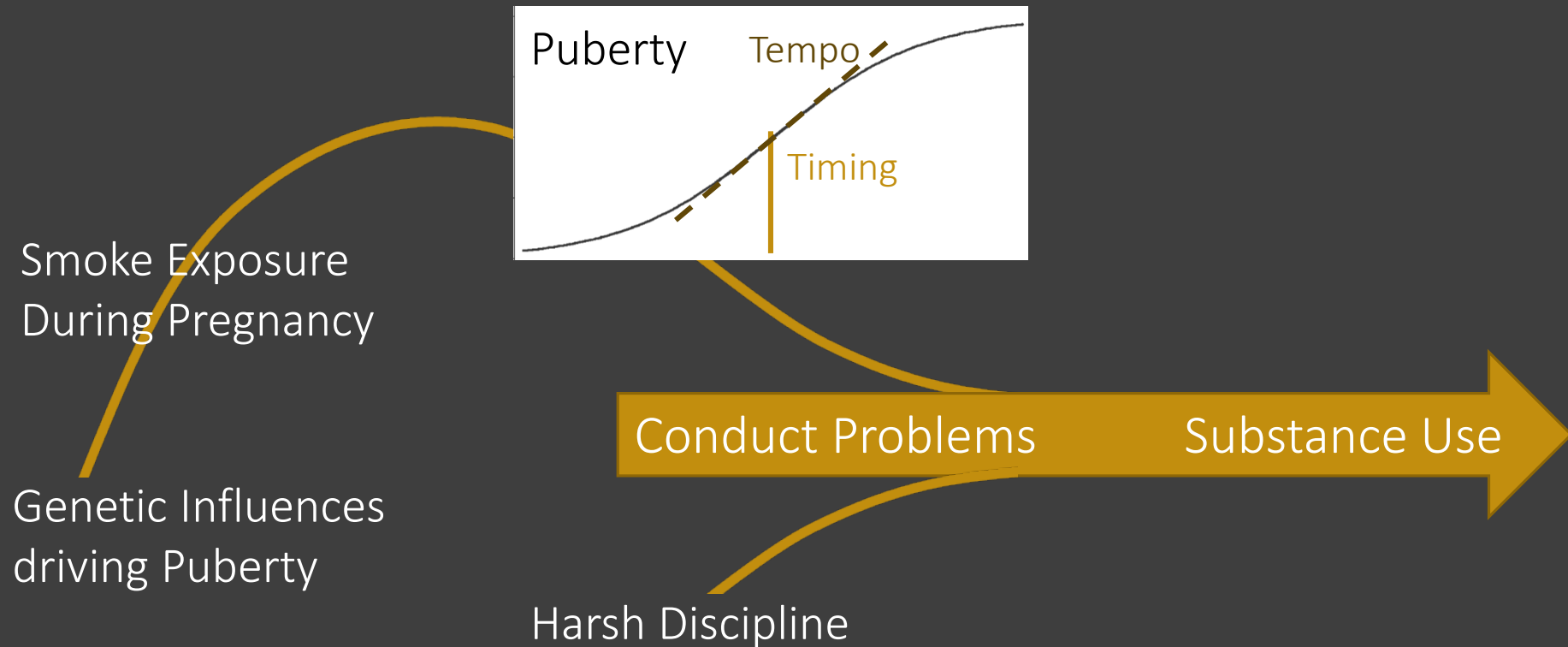
- harsh parenting Neppl et al., 2016

- earlier behavior problems Colder et al., 2013

Also linked to puberty

Marceau et al., 2014; Ullsperger & Nikolas, 2017

Conceptual Model



Study Aim

Assess a developmental pathway to adolescent smoking that includes puberty as a biological mechanism

ALSPAC

Avon Longitudinal Study of Parents and Children

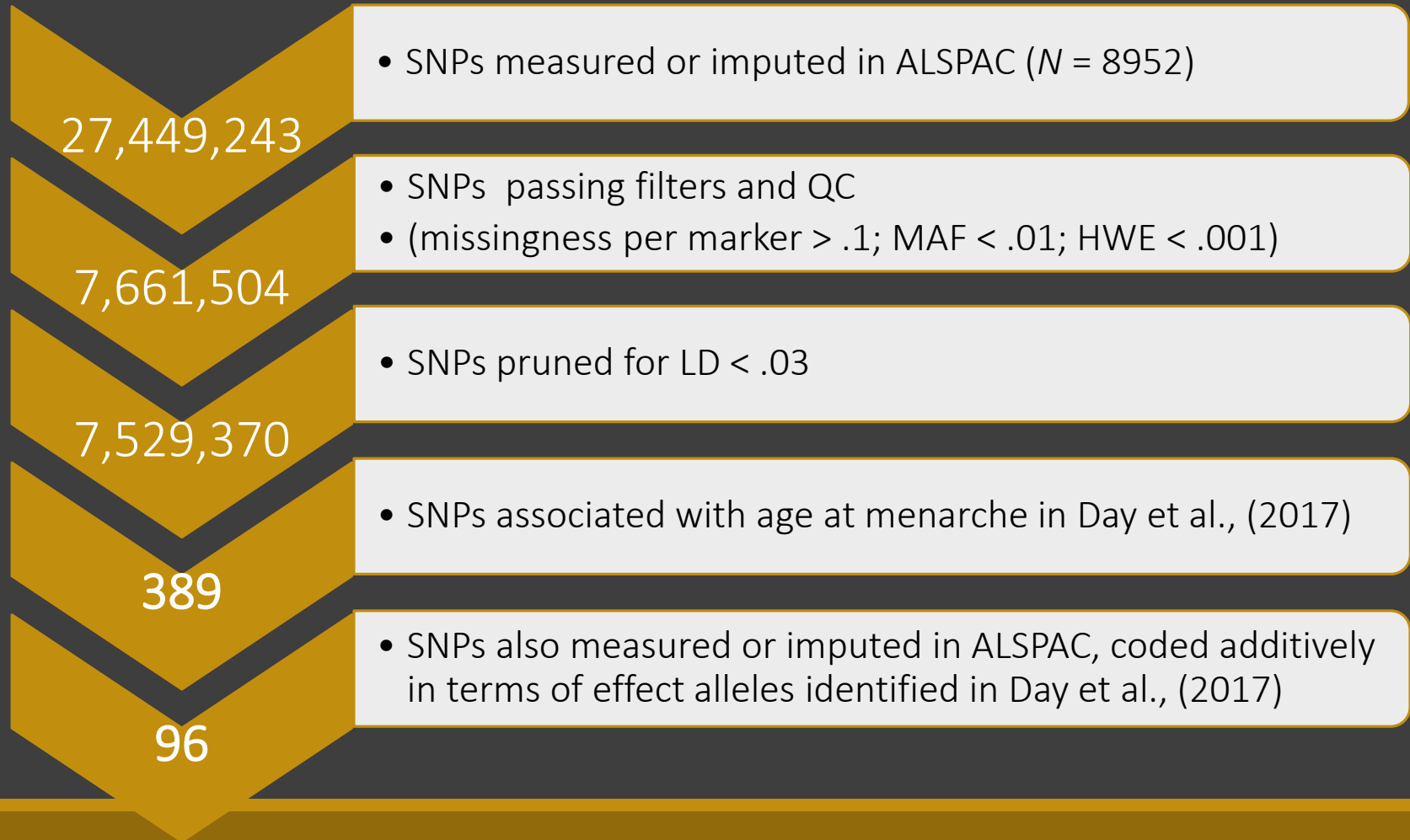
Boyd et al., 2013

14,701 pregnant women

- Live births, alive at 1 year ($N = 14,541$)
- Valid data on relevant variables
- 1 child per family if multiple birth ($N = 406$)

Analytic N: 8,801 with genetic data

Genetic Data



Polygenic Score: Age at menarche-increasing

Derived from findings from Day et al., (2017)

	β from Day et al., 2017	Person 1 # effect alleles	Person 1 SNP score	Person 2 # effect alleles	Person 2 SNP score
SNP1	.5	0	0	1	.5
SNP2	.1	.	=0	1	.1
SNP3	-.5	2	1.5	0	0
Polygenic score			1.5		0.6
PGS _ missing			.		0.6

Polygenic Score: Age at menarche-increasing

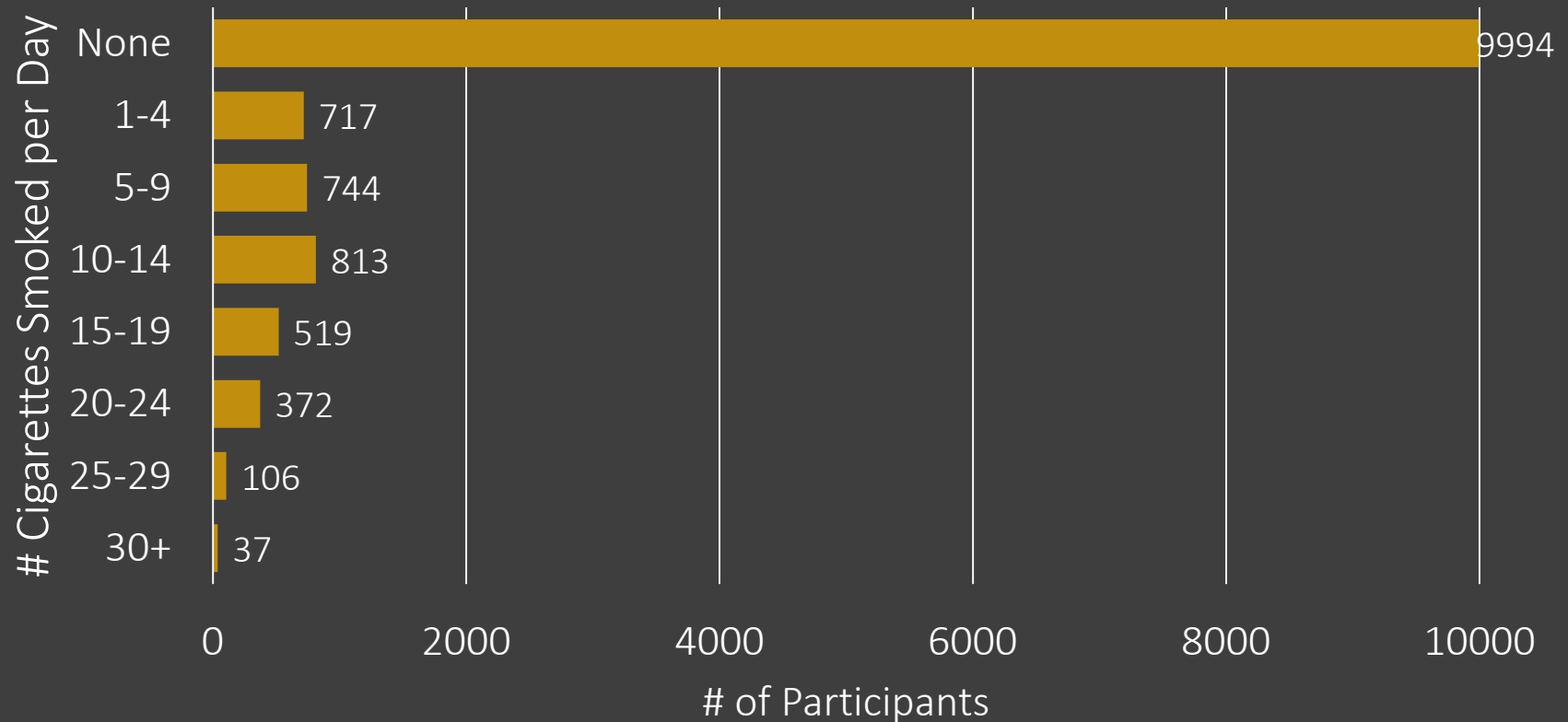
Derived from findings from Day et al., (2017)

- ALSPAC included in Day et al., (2017)
 - Potential problem of non-independence of discovery sample
- Day et al., (2017) included DeCODE replication

Sensitivity Analyses

- Used all beta-weights from DeCODE
- Used beta-weights that were significant in DeCODE

SDP: 1st trimester



Pubertal Maturation

9 Assessments of Nurse Reported Tanner Stages (ages 8-17) (Marshall & Tanner, 1969, 1970; Tanner, 1962)

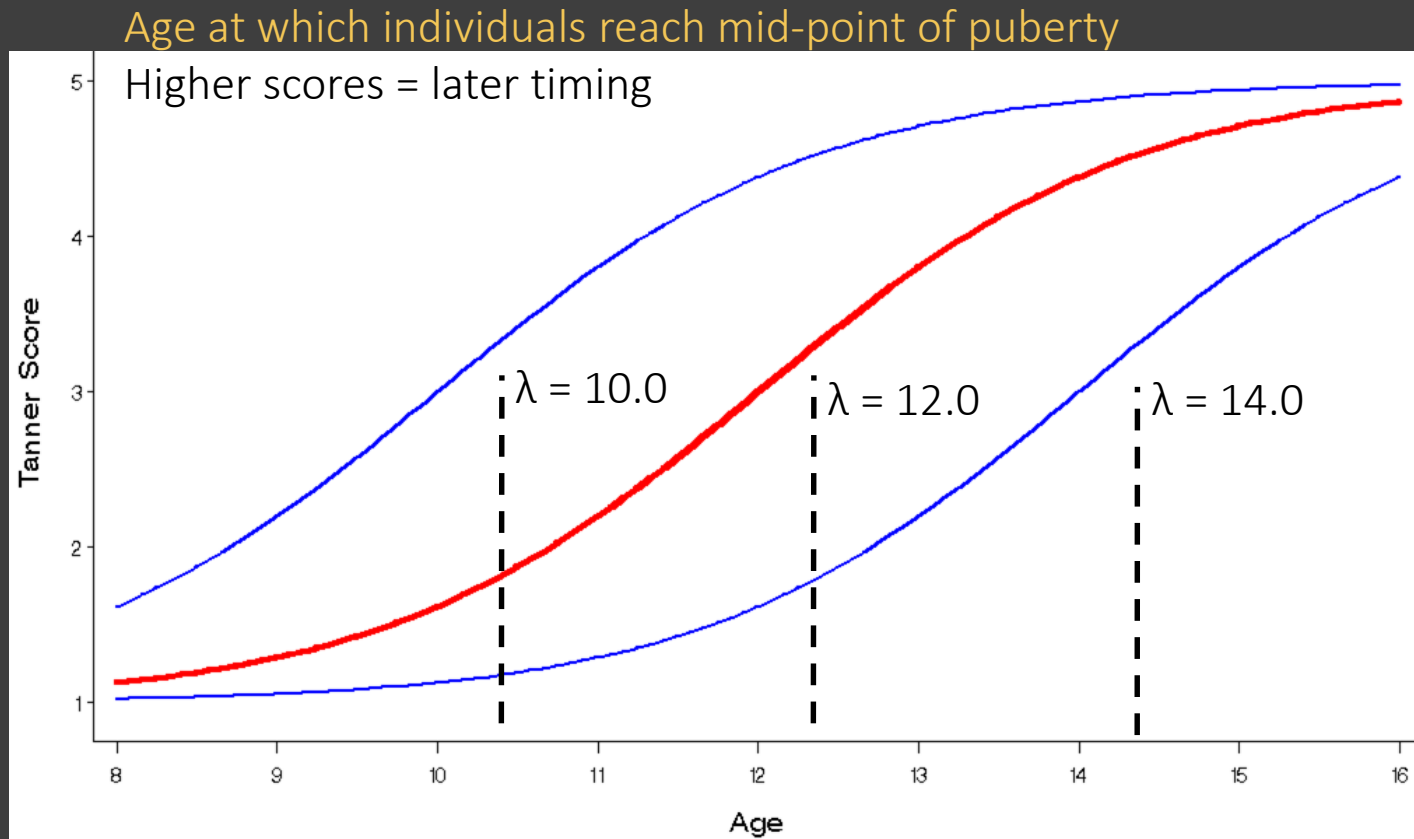
Boys' pubic hair development

Boys' genital development

Girls' pubic hair development

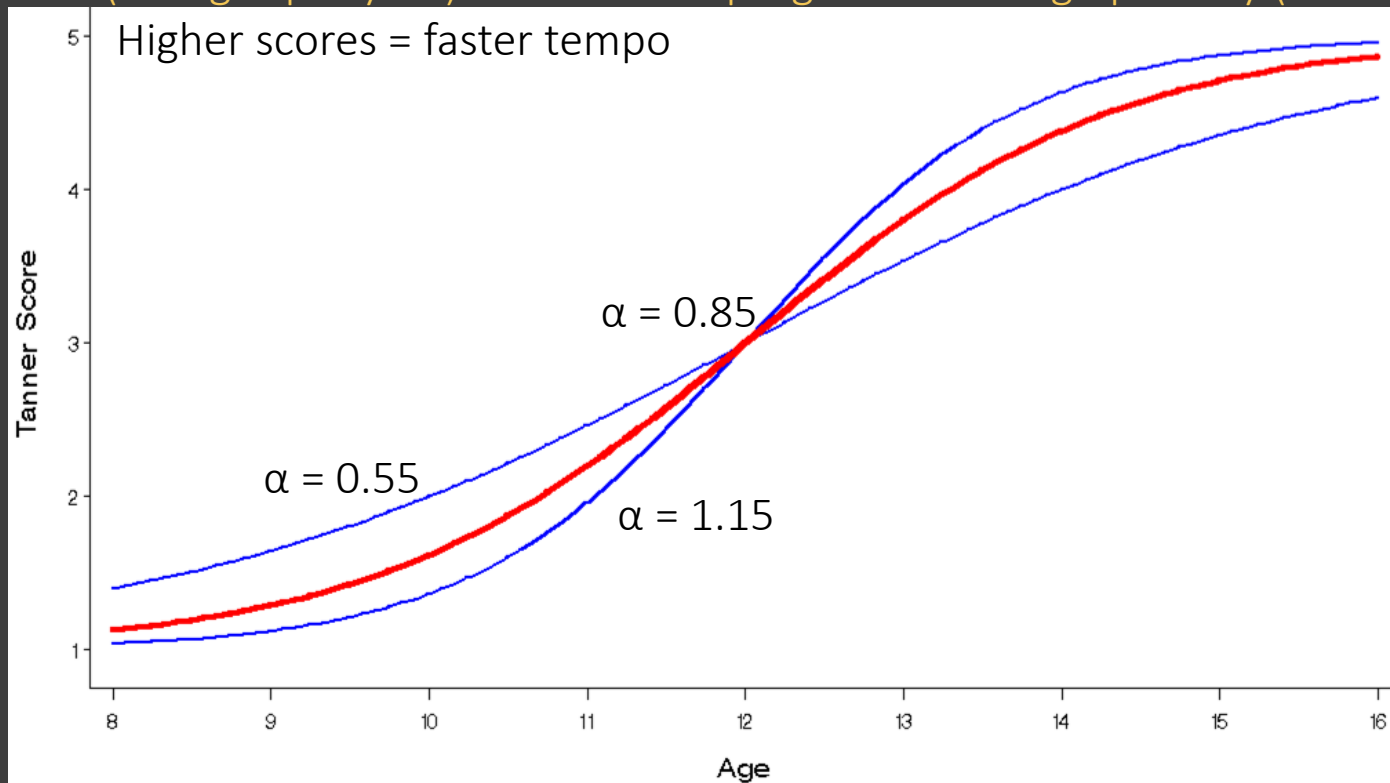
Girls' breast development

Logistic Growth Curve: Pubertal Timing



Logistic Growth Curve: Pubertal Tempo

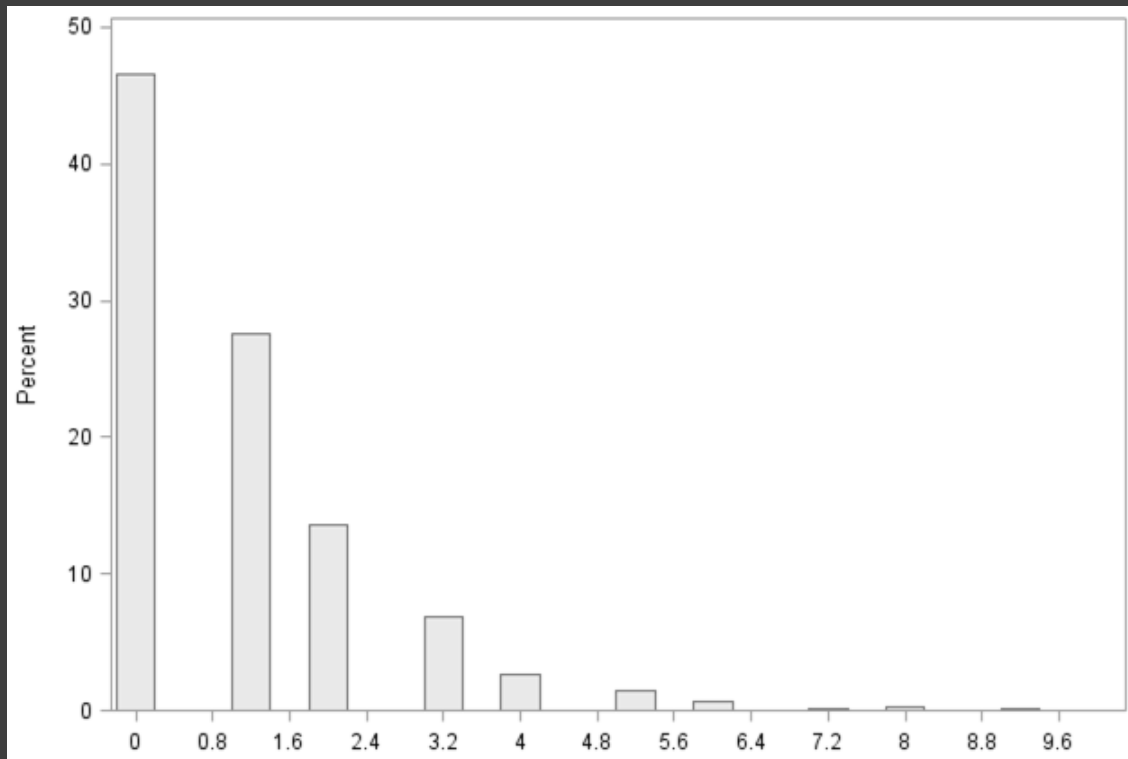
How fast (# stages per year) an individual progresses through puberty (at midpoint)



Conduct Problems (age 17)

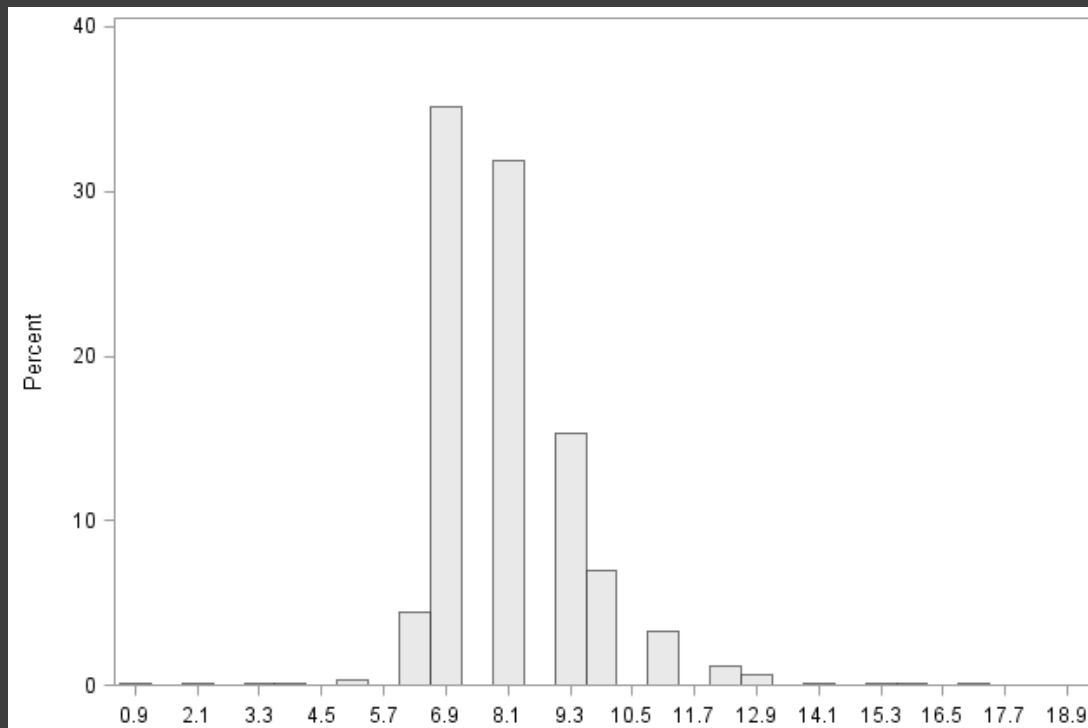
Strengths and Difficulties Questionnaire

Goodman, 1997

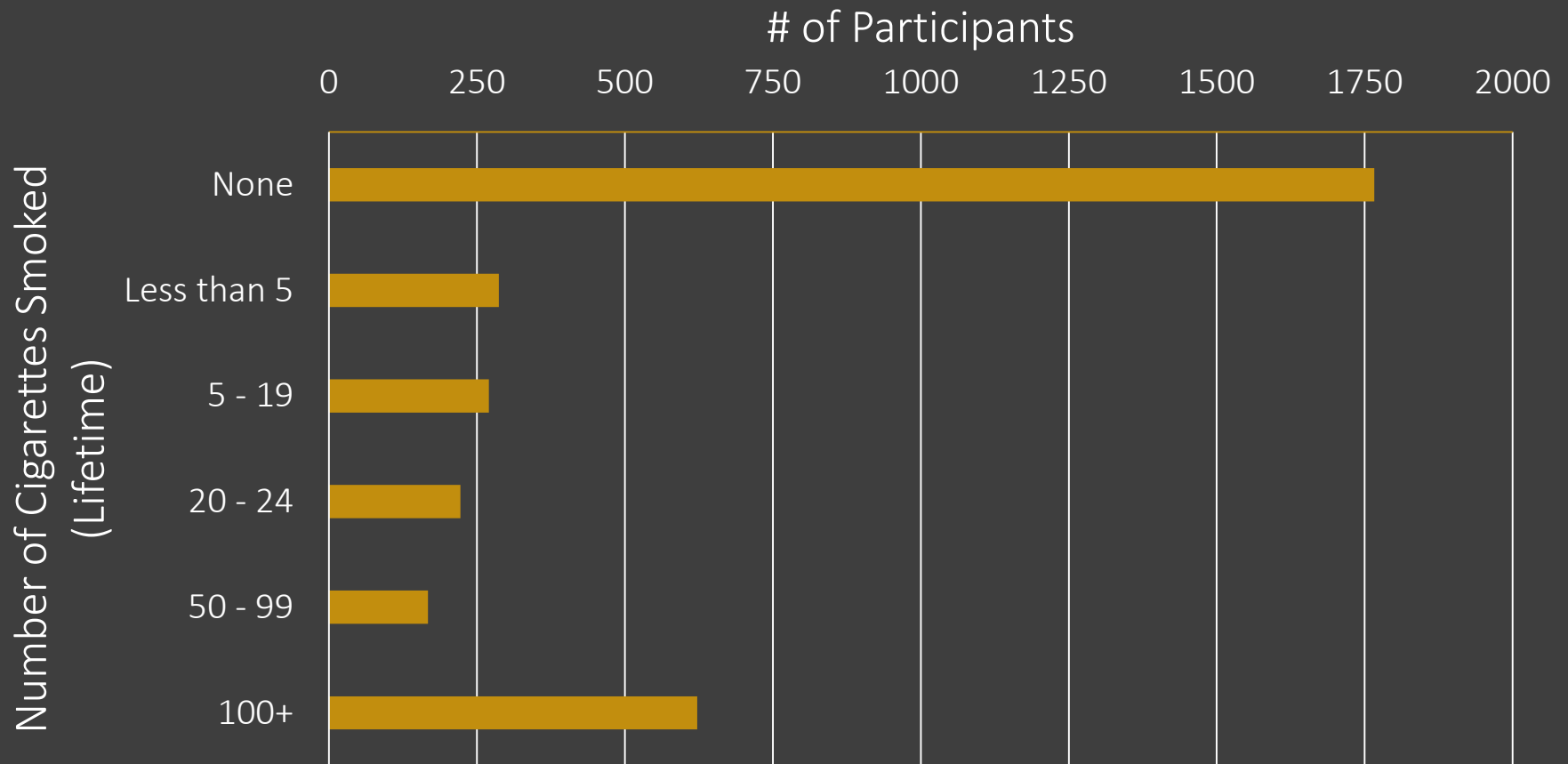


Harsh Discipline (age 17)

7 items, tells off, grounds, hits/slaps, locks out of house, $\alpha = .50$



Quantity Smoked (age 20)



Analytic Strategy

Structural Equation Models in R(lavaan)

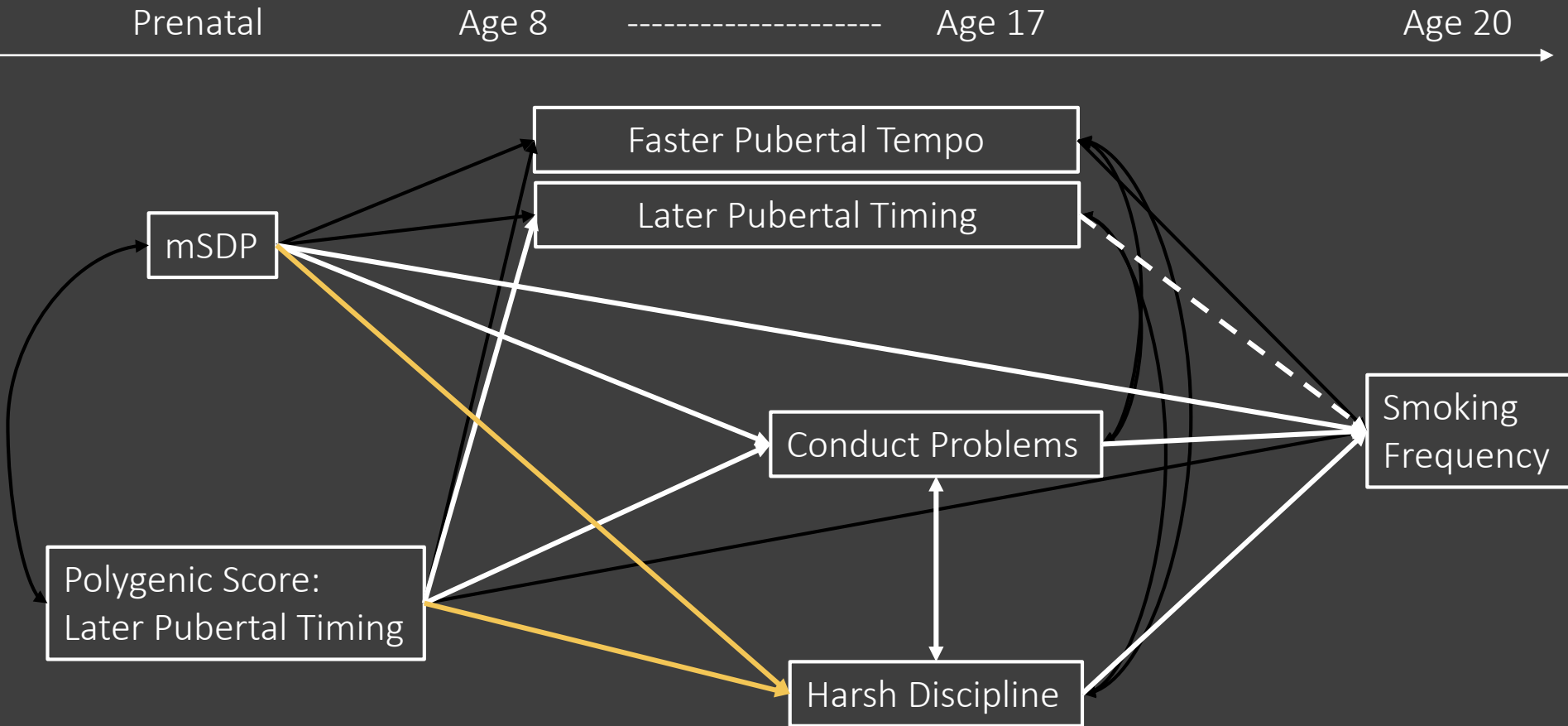
Developmental Pathways

Indirect effects from PGS and SDP to smoking frequency examined.

Solid lines = positive association
Hashed lines = negative association

Significant in all analyses
Significant in original, not in sensitivity analyses
Not significant

Results: boys' pubic hair



Results including missing values for PGS presented.
Only effect of PGS on timing holds when using complete PGS.

Indirect Effects

Boys and Girls

Smoking During Pregnancy (SDP)

→ conduct problems

→ smoking frequency

Girls

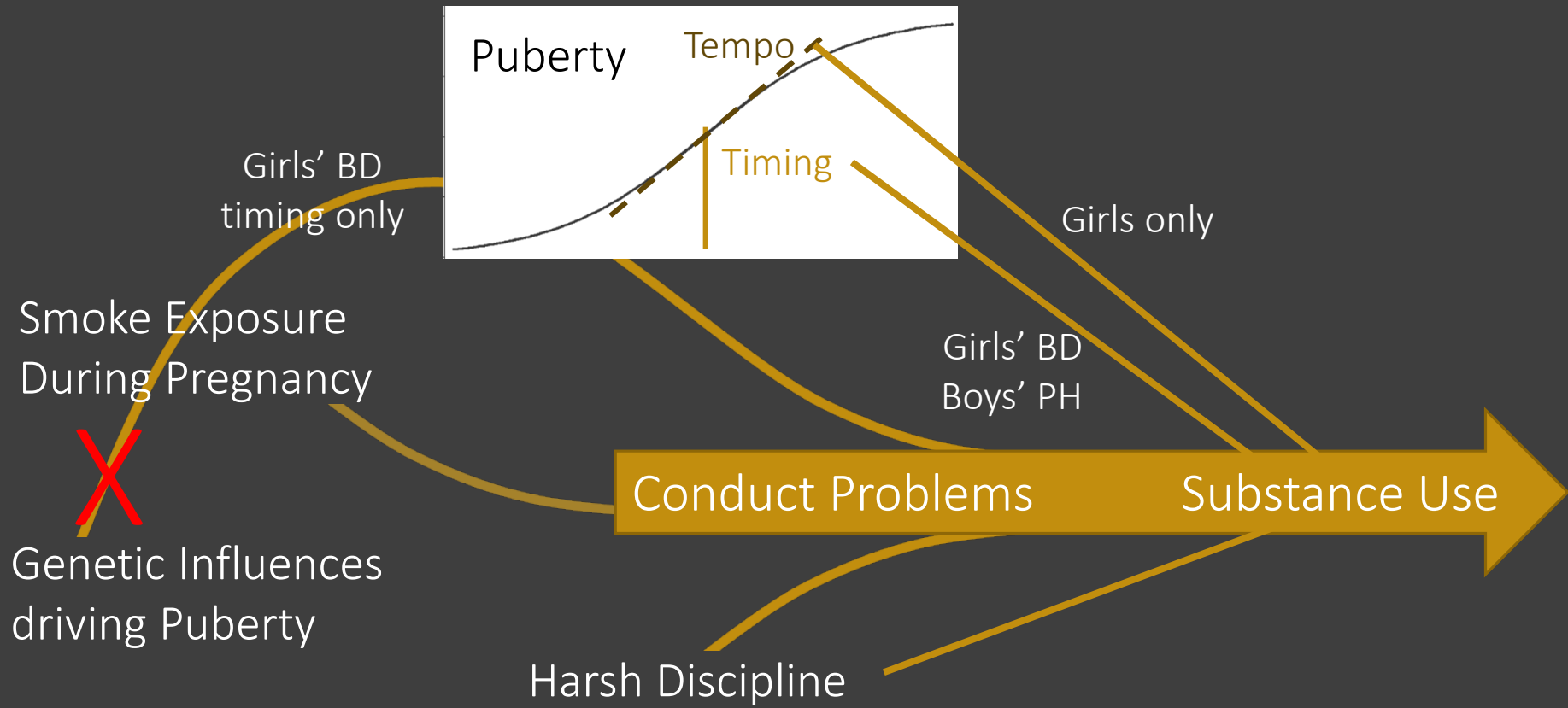
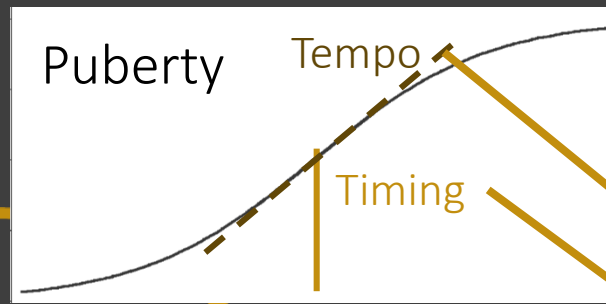
SDP → Timing (BD) → smoking frequency

PGS → timing (BD) → smoking frequency

PGS → harsh discipline → smoking frequency

PGS → tempo (PH) → smoking frequency

Conclusions/Implications



Future Directions

Initial evidence that PGS predicts puberty

- Not replicated in DeCODE
 - - Some findings from Day et al., (2017) may be ALSPAC-specific
 - - Decisions around PGS construction have meaningful effects

PGS based on larger puberty gene list based on multiple studies and theory/animal models

- Independent of ALSPAC

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(Timing and Tempo of Puberty)

Jenae Neiderhiser

(G-E interplay, parenting)

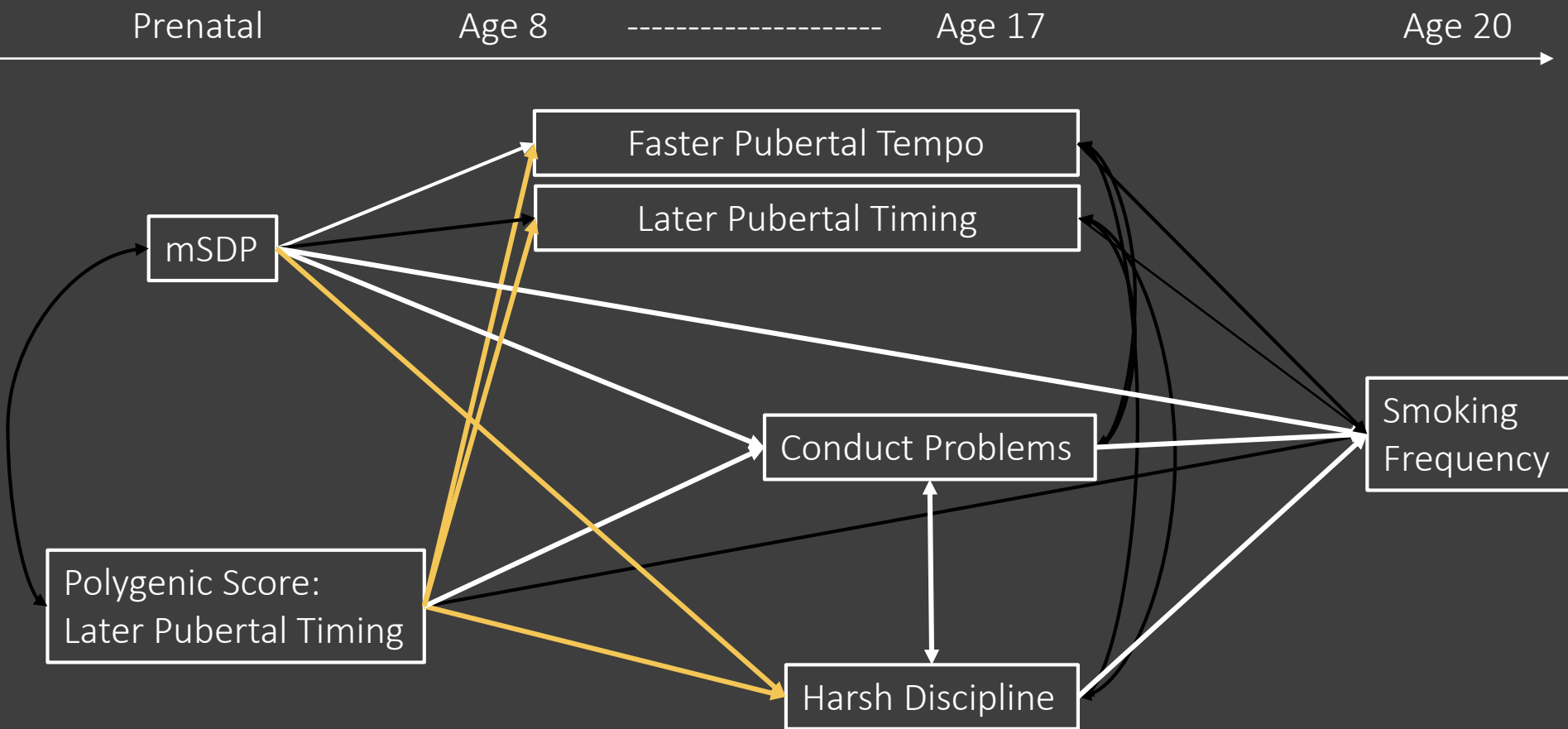
Extra Slides

Results from other models

Solid lines = positive association
Hashed lines = negative association

Significant in all analyses
Significant in original, not in sensitivity analyses
Not significant

Results: boys' genital dev.

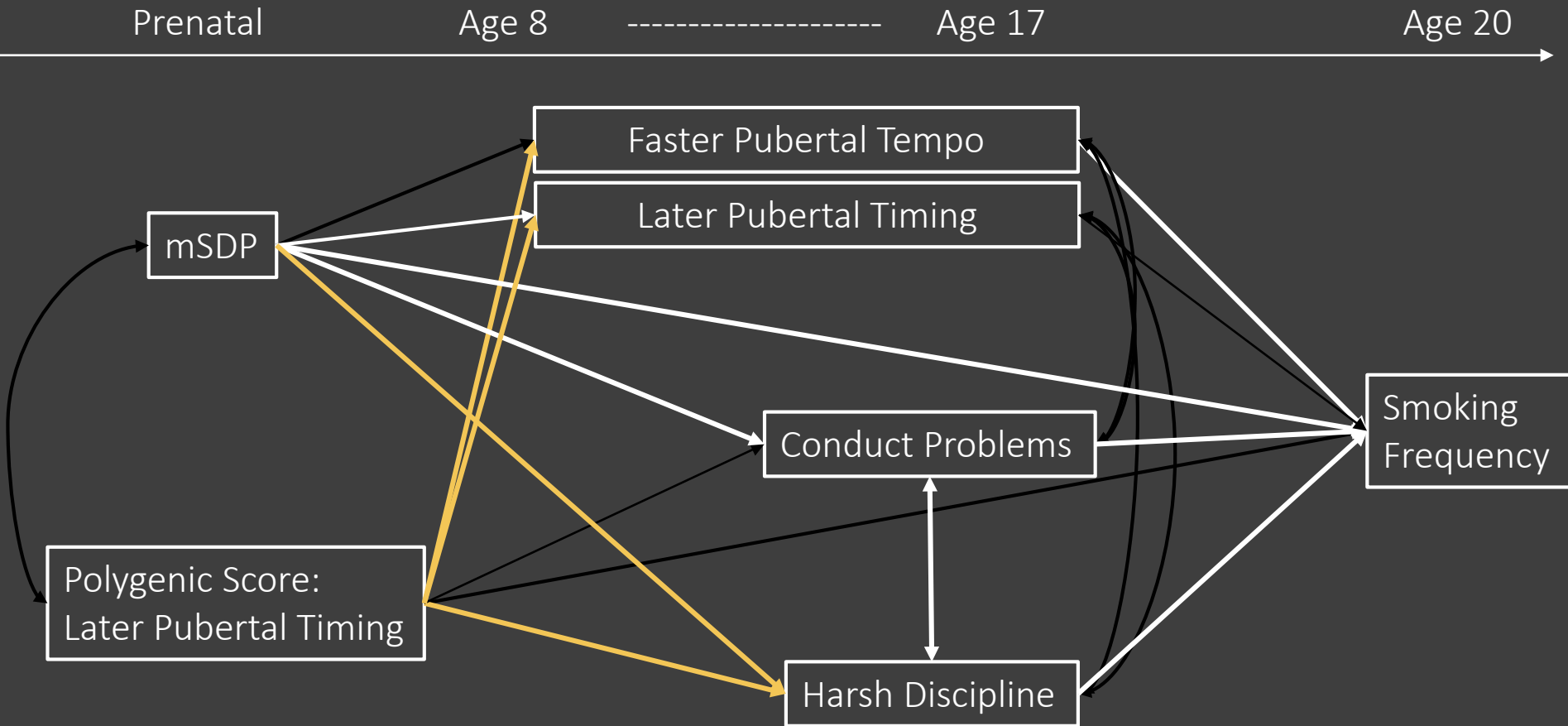


Results including missing values for PGS presented.
Only effect of PGS on timing holds when using complete PGS.

Solid lines = positive association
Hashed lines = negative association

Significant in all analyses
Significant in original, not in sensitivity analyses
Not significant

Results: girls' pubic hair

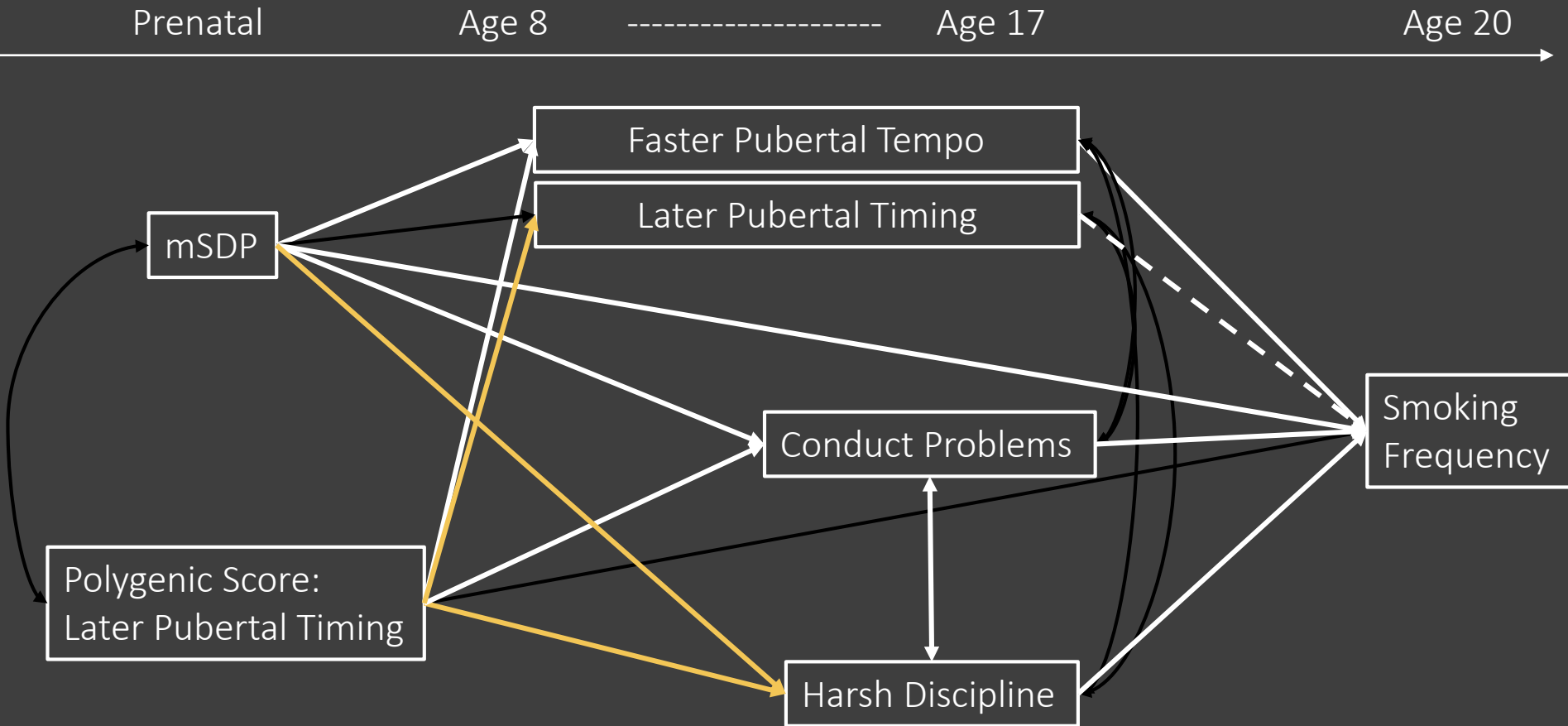


Results including missing values for PGS presented.
Only effect of PGS on timing holds when using complete PGS.

Solid lines = positive association
Hashed lines = negative association

Significant in all analyses
Significant in original, not in sensitivity analyses
Not significant

Results: girls' breast dev.



Results including missing values for PGS presented. Pattern identical if using completed PGS.