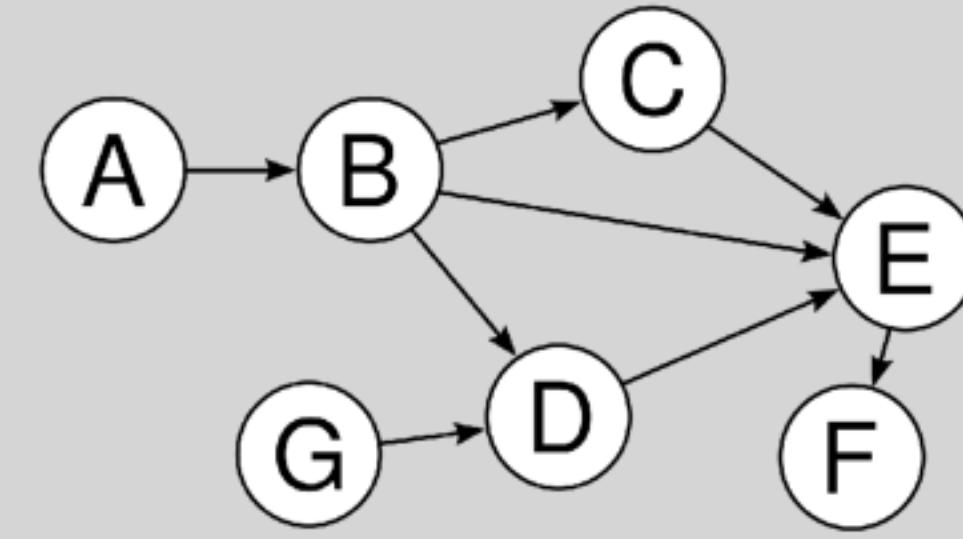
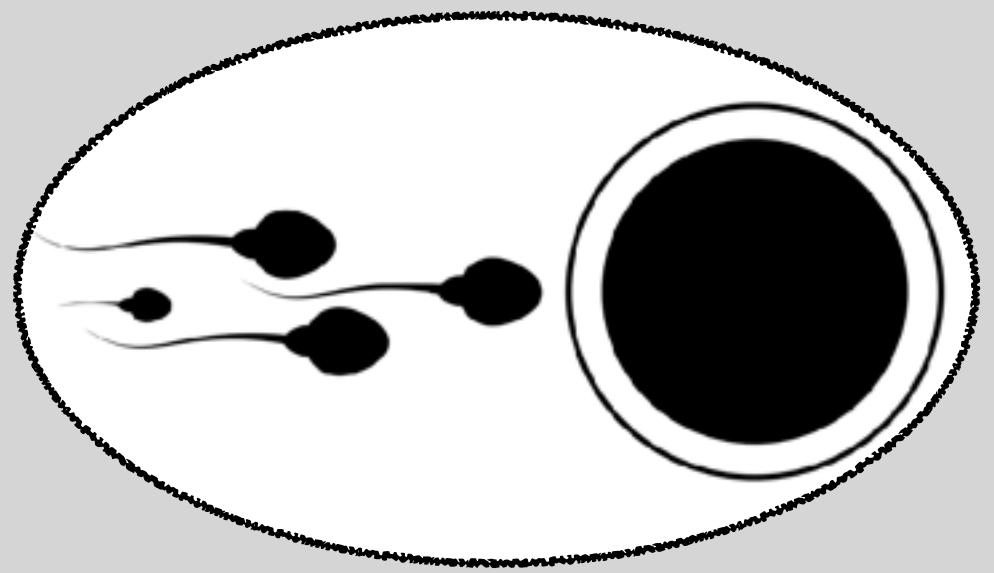


A microsimulation model of fertility shows  
that preferences cannot explain why highly  
educated women remain childless more often

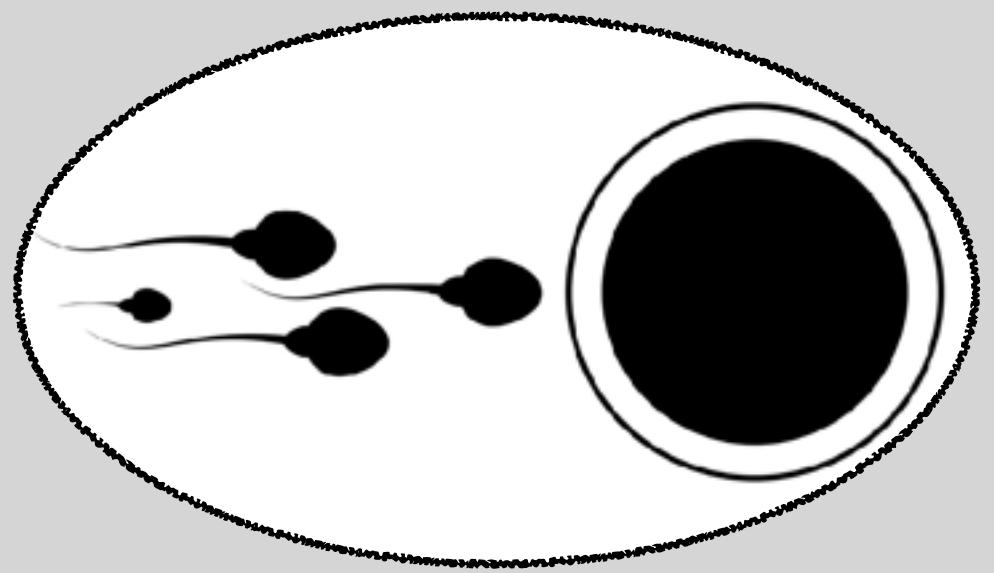


{ ABC }

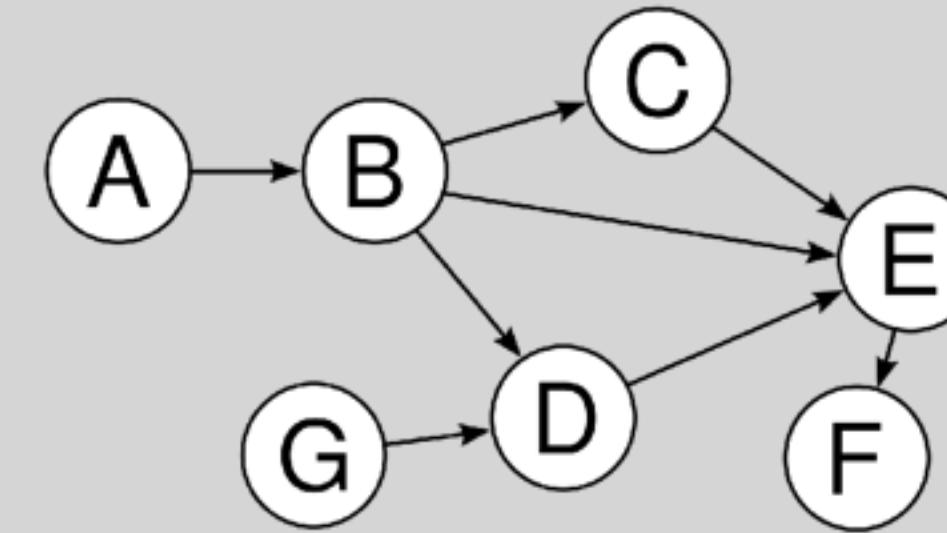
# Take-Home Messages

microsimulation  
can advance  
sociological research

microsimulation can:



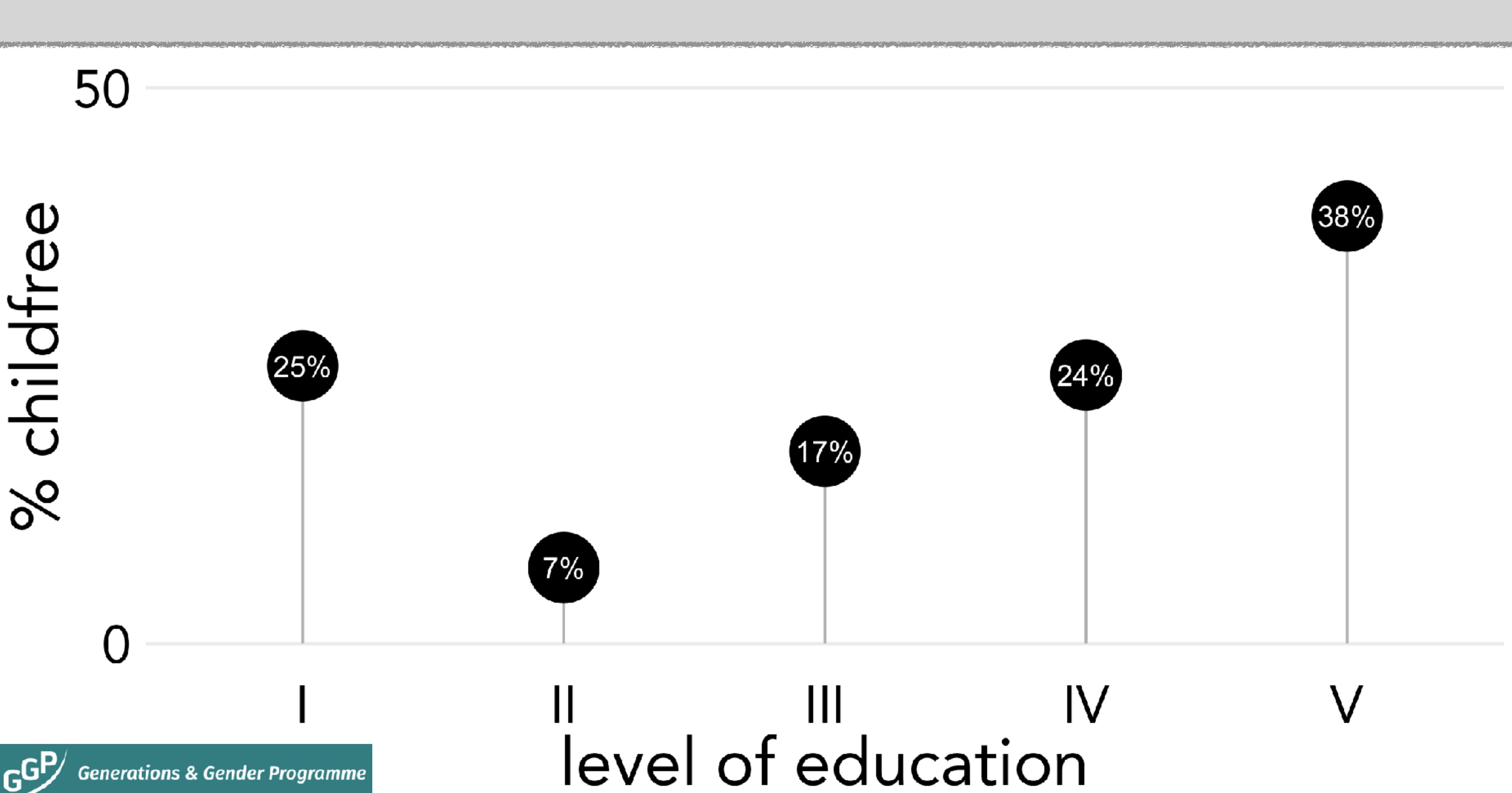
include  
biological  
information

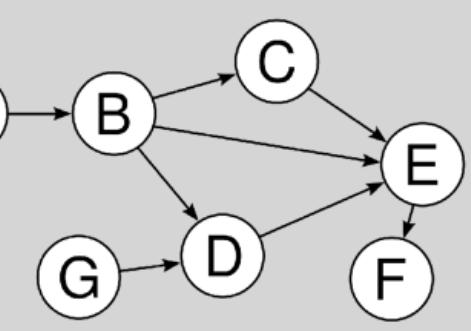
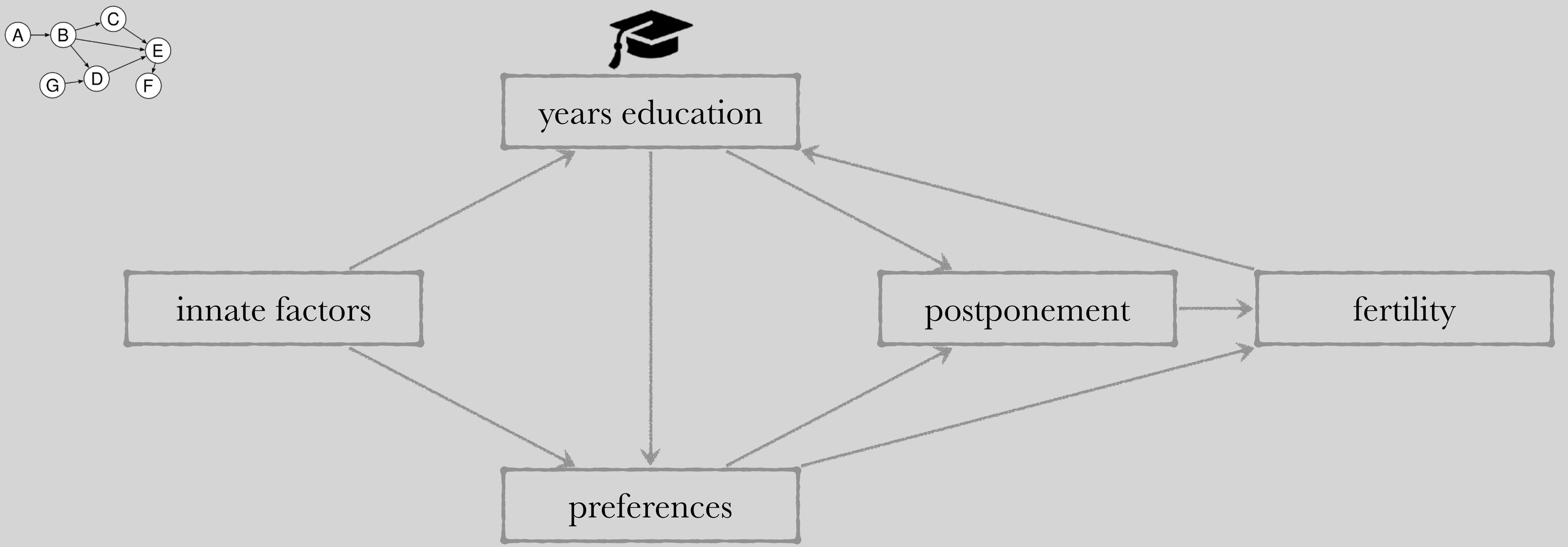


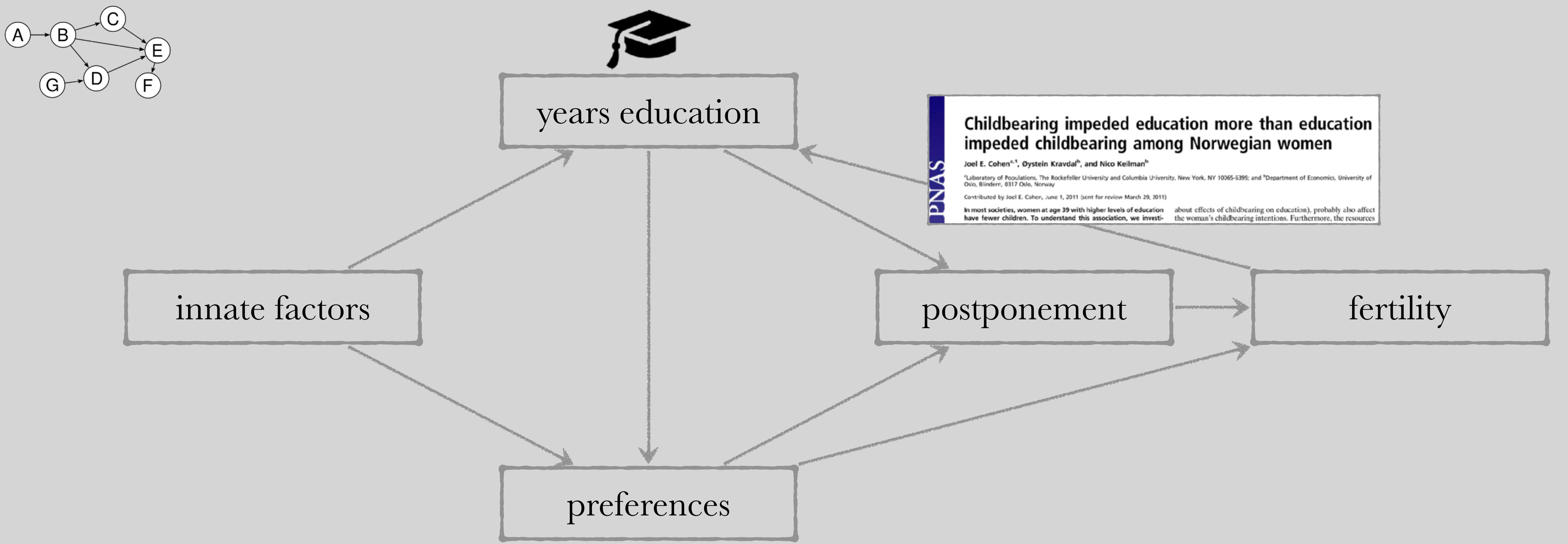
test (causal)  
mechanisms

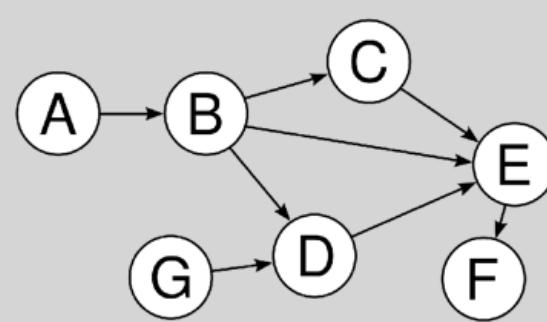
{ ABC }

estimate unknown  
parameters









years education

**Childbearing impeded education more than education impeded childbearing among Norwegian women**

Joel E. Cohen<sup>a,\*</sup>, Øystein Kravdal<sup>b</sup>, and Nico Keilman<sup>b</sup>

<sup>a</sup>Laboratory of Populations, The Rockefeller University and Columbia University, New York, NY 10065-5399; and <sup>b</sup>Department of Economics, University of Oslo, Blindern, 0317 Oslo, Norway

Contributed by Joel E. Cohen, June 1, 2011 (sent for review March 29, 2011)

In most societies, women at age 39 with higher levels of education have fewer children. To understand this association, we investigate how education and childbearing interact. We find that education has a positive effect on fertility, but that childbearing has a negative effect on education. This implies that childbearing impeded education more than education impeded childbearing among Norwegian women. The results suggest that the effects of education on fertility and childbearing on education are mediated by other factors, such as the woman's childbearing intentions. Furthermore, the resources available to the woman during her childbearing years probably also affect the woman's childbearing intentions. Furthermore, the resources

European Journal of Population (2019) 35:563–586  
<https://doi.org/10.1007/s10680-018-9492-2>

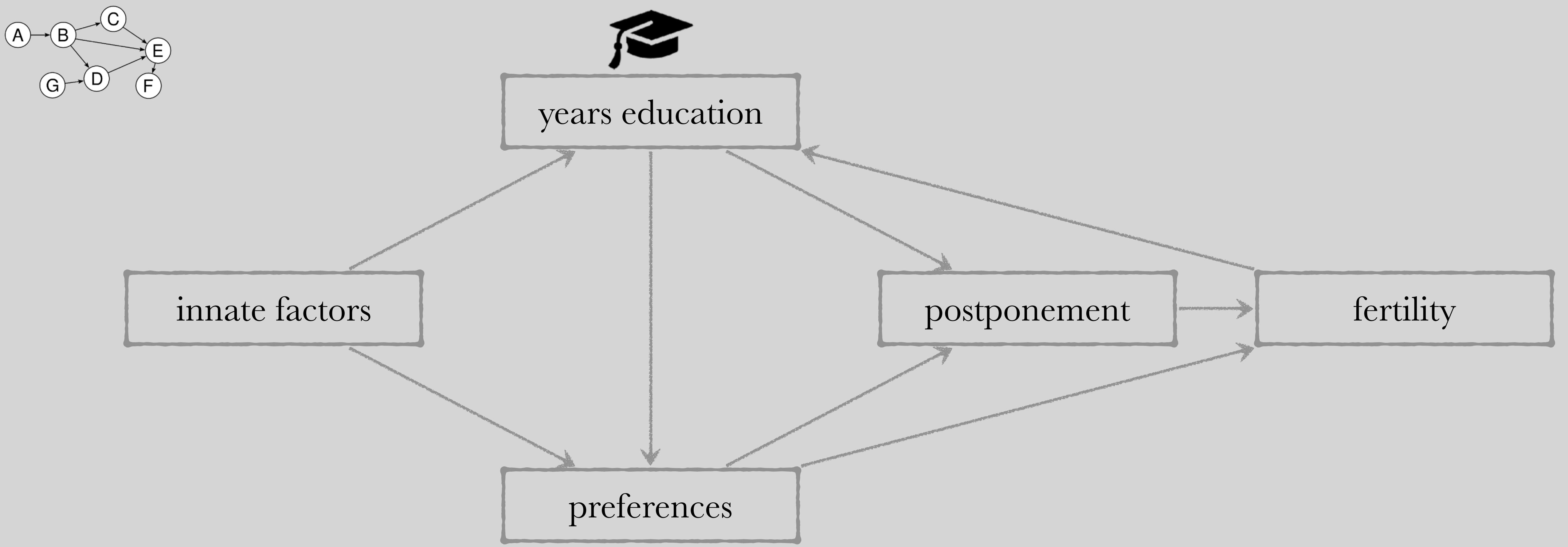


## Education, Gender, and Cohort Fertility in the Nordic Countries

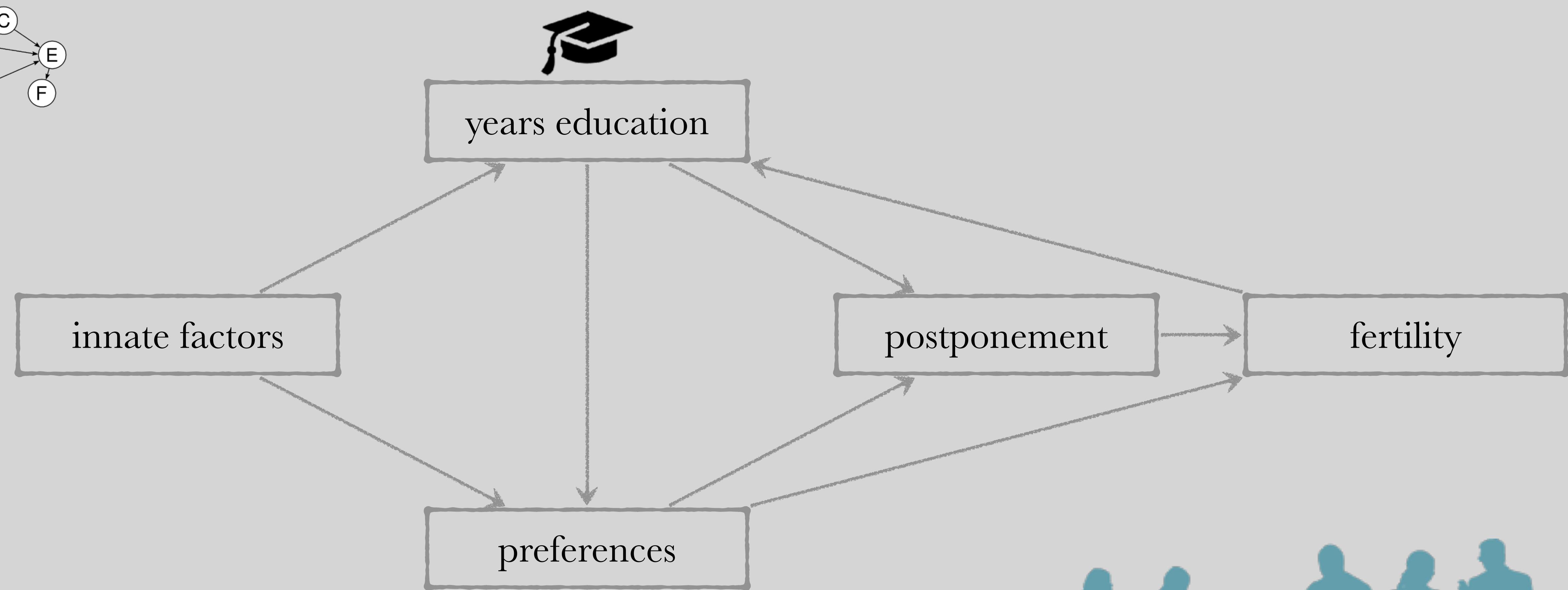
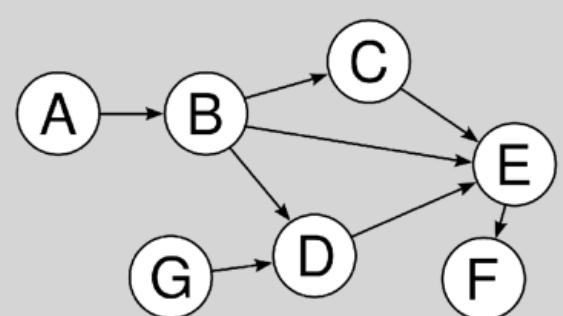
Marika Jalovaara<sup>1</sup> · Gerda Neyer<sup>2</sup> · Gunnar Andersson<sup>2</sup> · Johan Dahlberg<sup>2</sup> ·  
 Lars Dommermuth<sup>3</sup> · Peter Fallesen<sup>2,4</sup> · Trude Lappégaard<sup>5</sup>

“

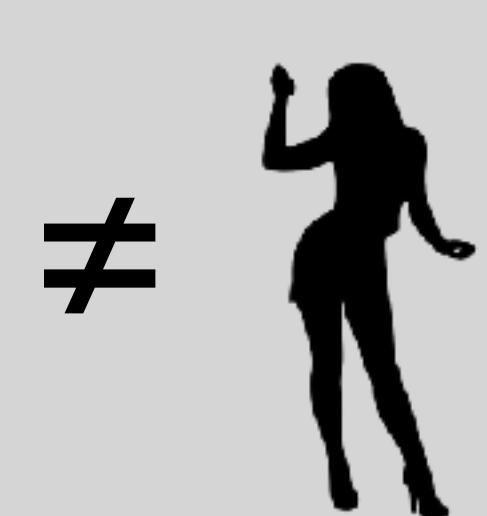
In Denmark, Norway and Sweden, childlessness is now highest among the least educated women



What Kind of Data  
Would We need to  
Address This Model?



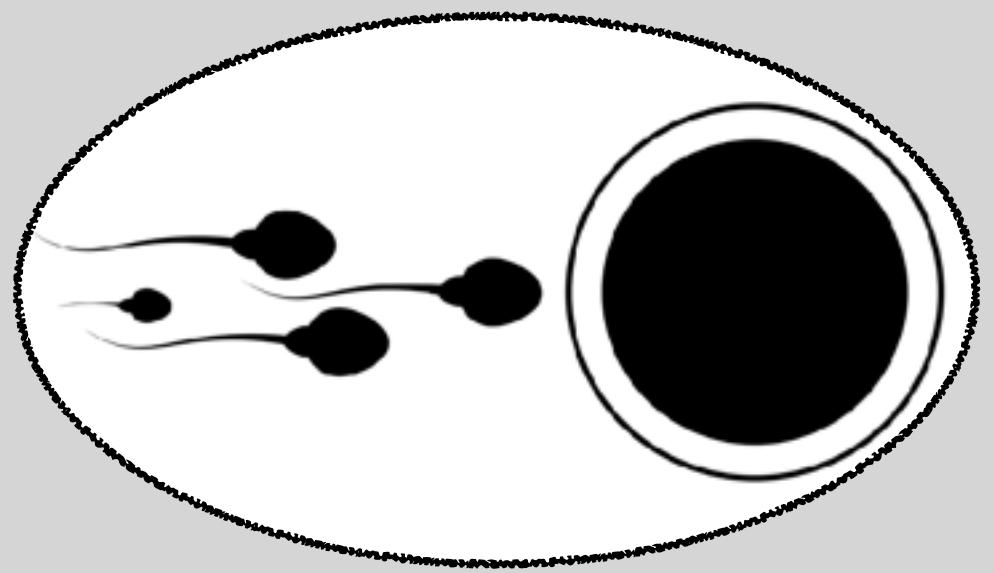
What Kind of Data  
Would We need to  
Address This Model?



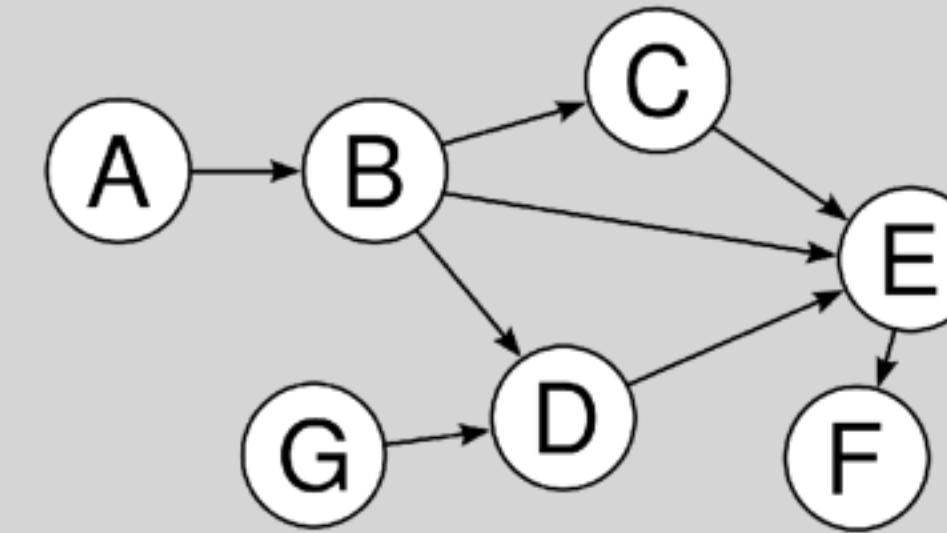
# Take-Home Messages

microsimulation  
can advance  
sociological research

microsimulation can:



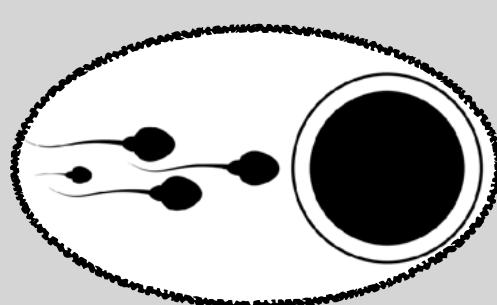
include  
biological  
information



test (causal)  
mechanisms

{ ABC }

estimate unknown  
parameters

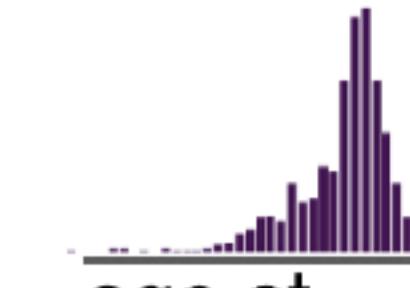


## MODEL INPUT

biological parameters



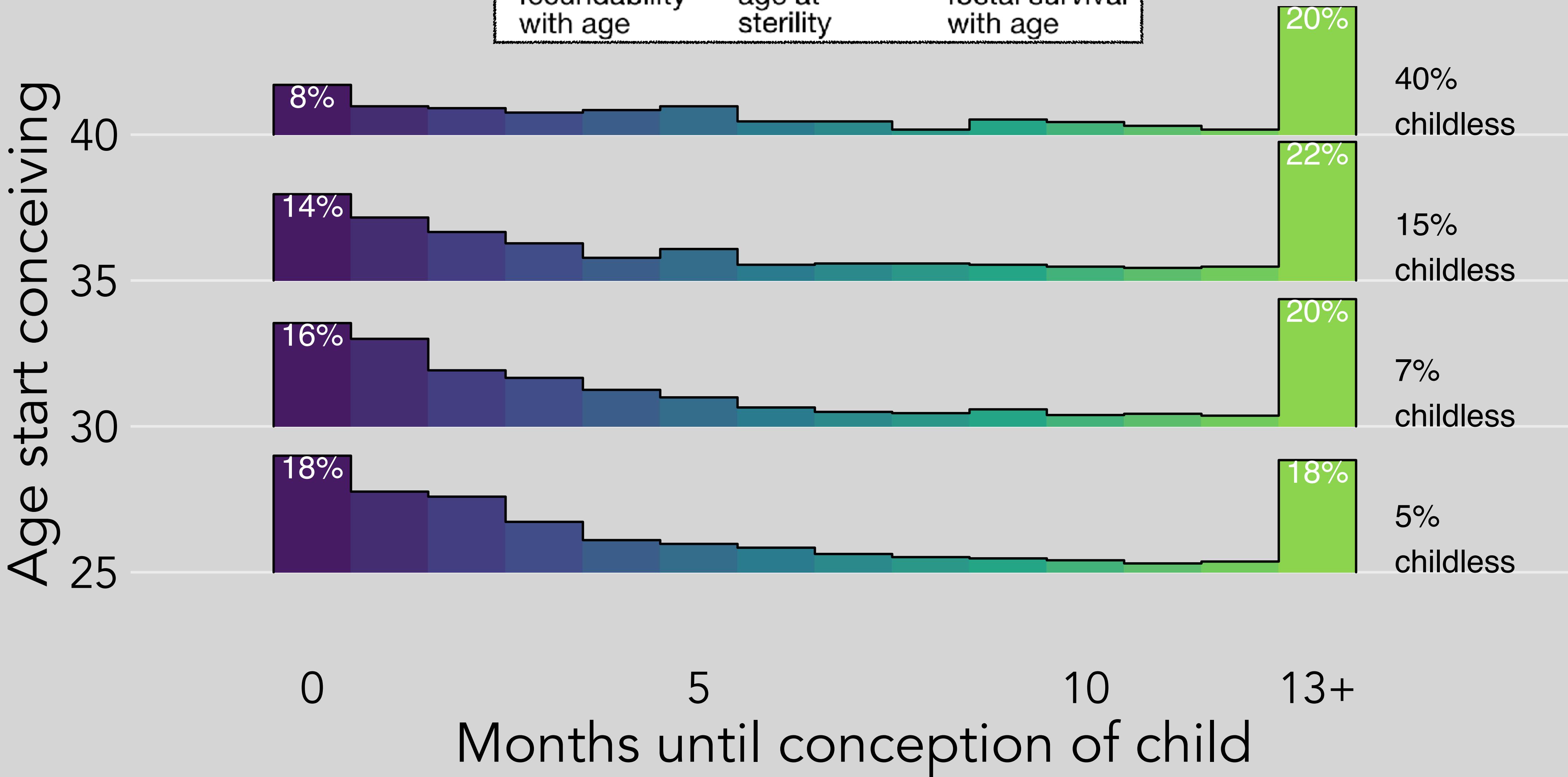
fecundability  
with age

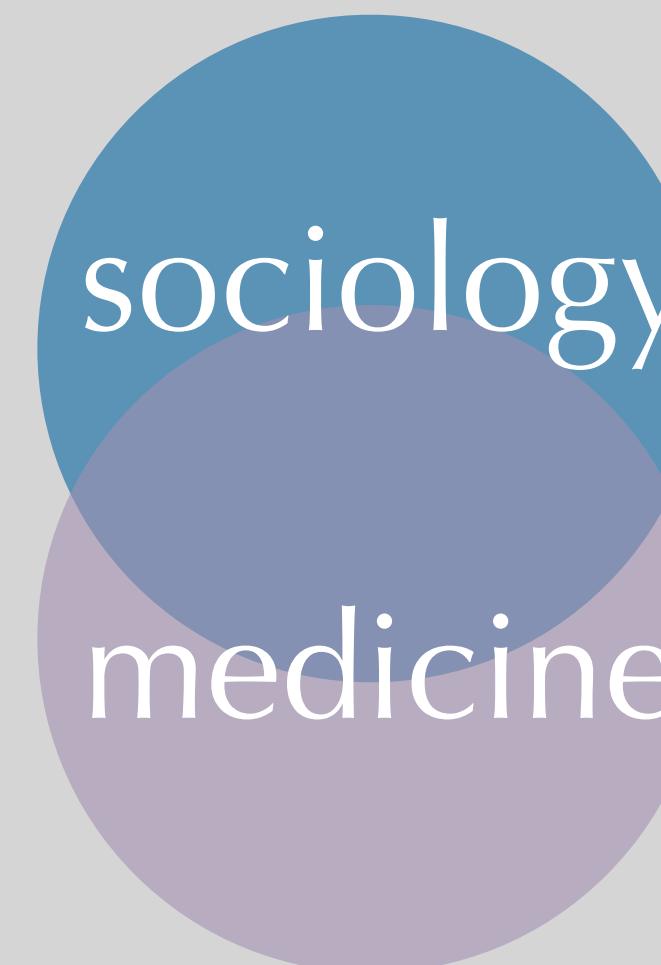
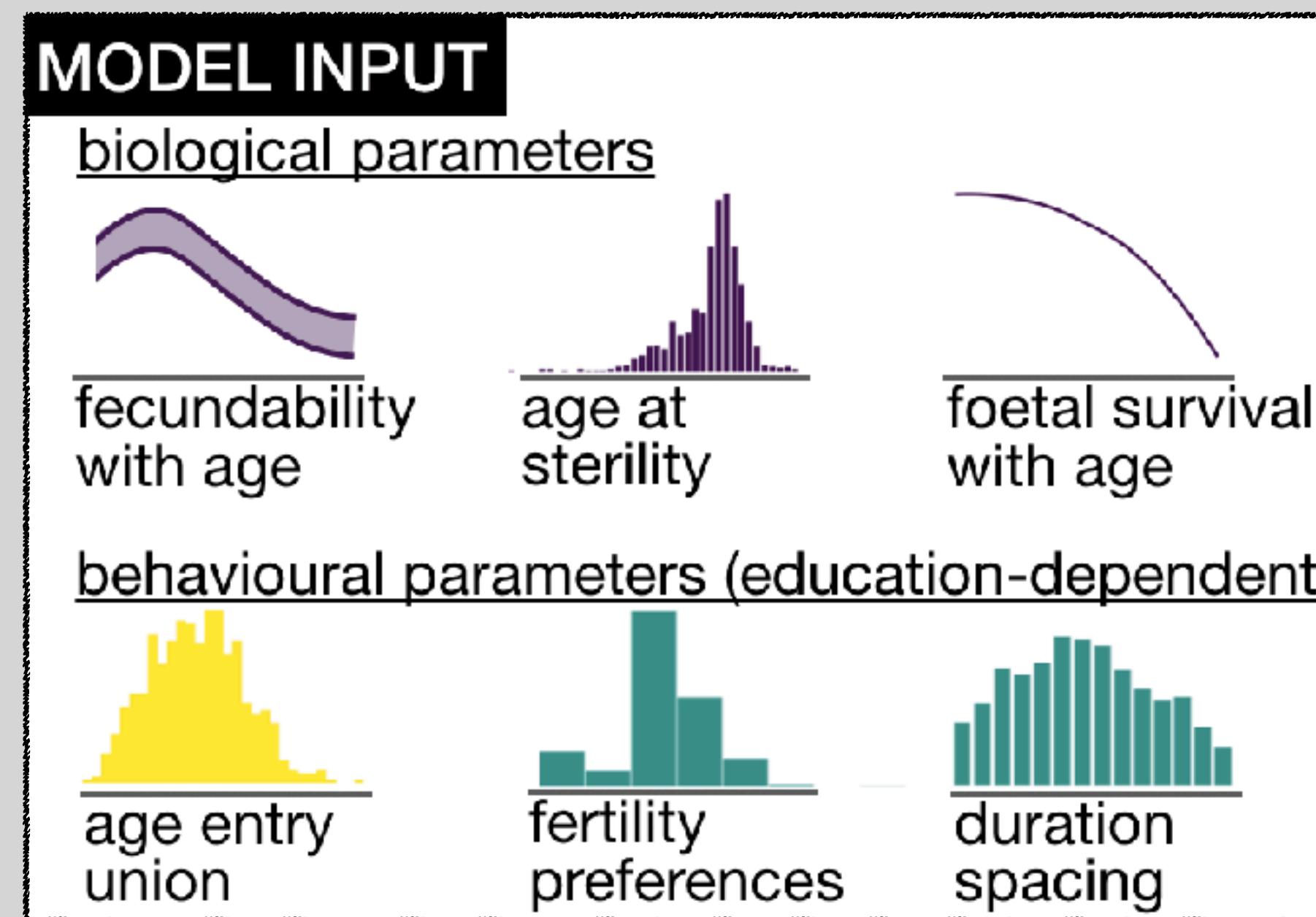
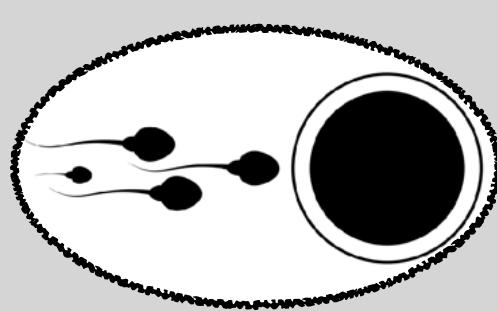


age at  
sterility



foetal survival  
with age



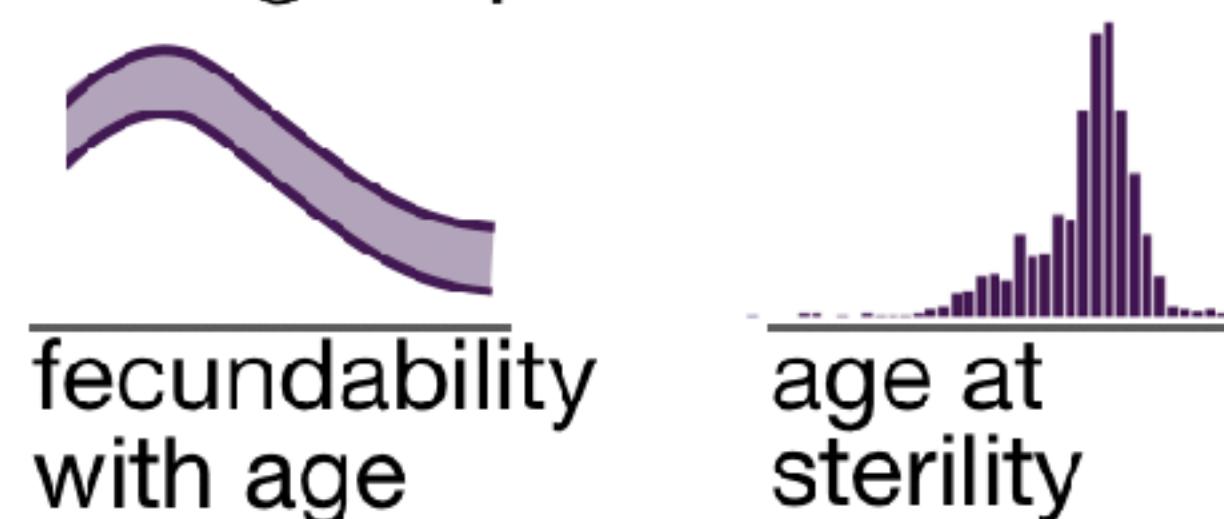


determines whether and when people would like to conceive

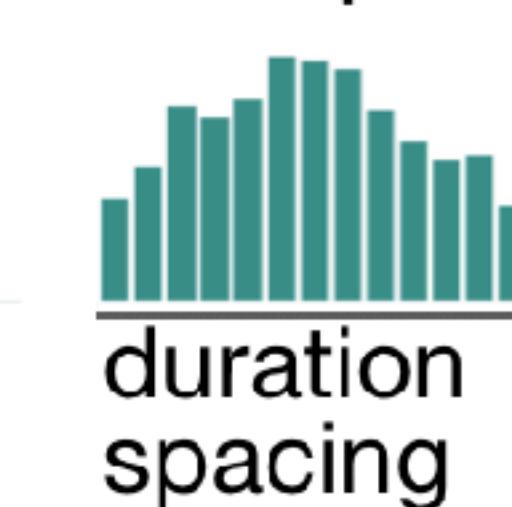
determines whether and when people conceive

## MODEL INPUT

### biological parameters

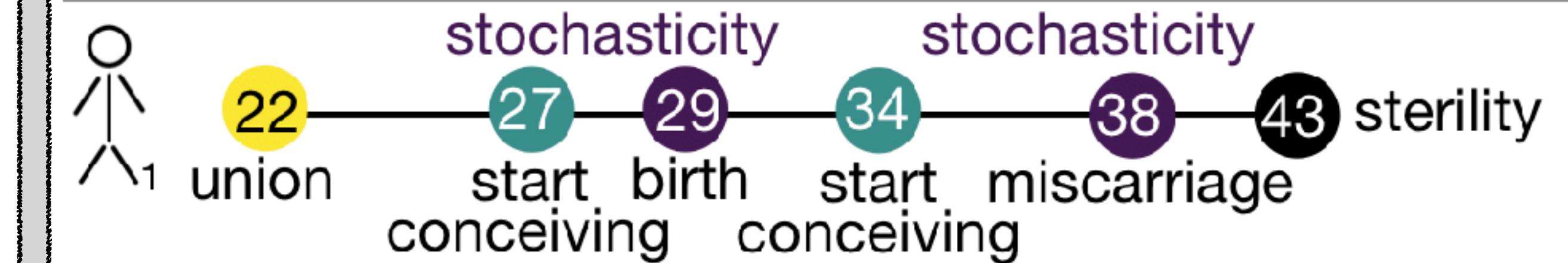


### behavioural parameters (education-dependent)

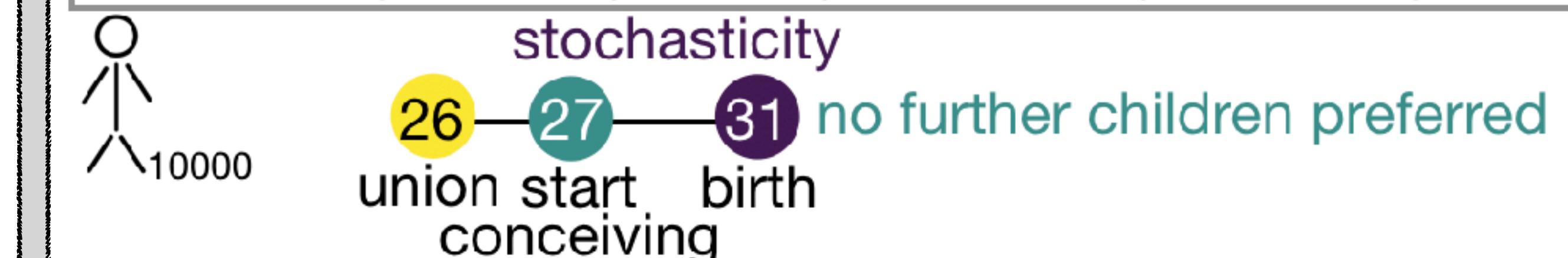


## MODEL RUN

**Randomly determined traits individual 1**  
in union =22 | spac. =5 | pref. =2 | fecund. =0.3 | steril. =43 | edu. =high



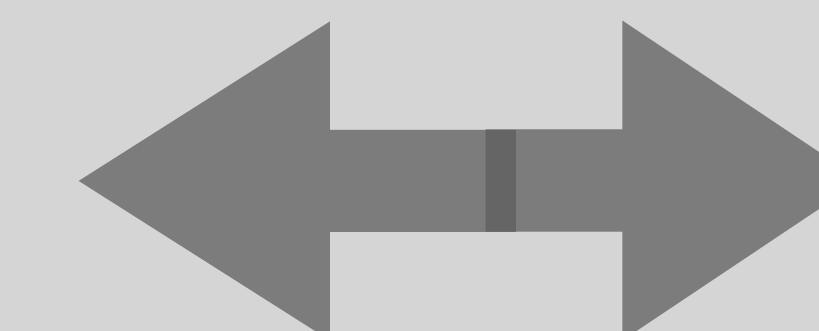
**Randomly determined traits individual 10000**  
in union =26 | spac. =1 | pref. =1 | fecund. =0.1 | steril. =45 | edu. =low



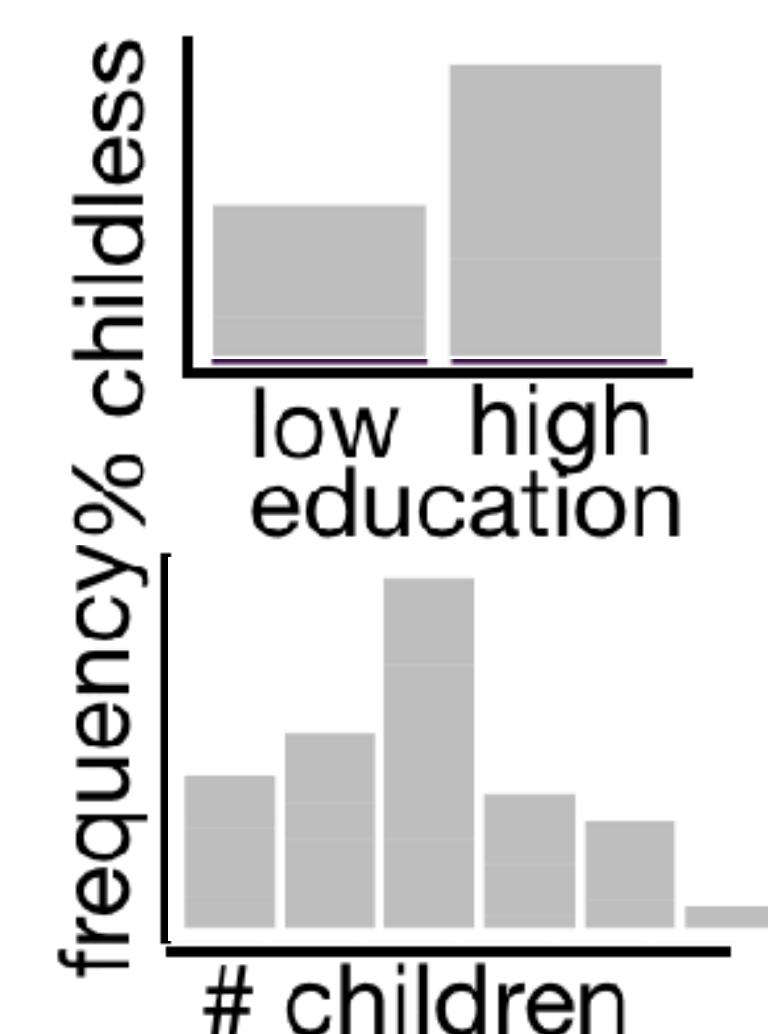
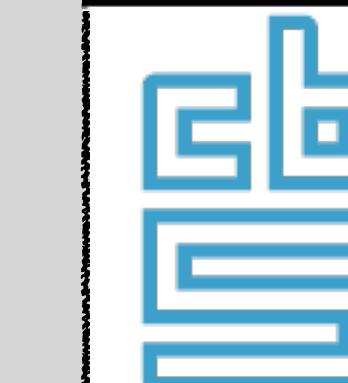
## MODEL OUTPUT

due to:

- partner status
- preferences
- stochasticity



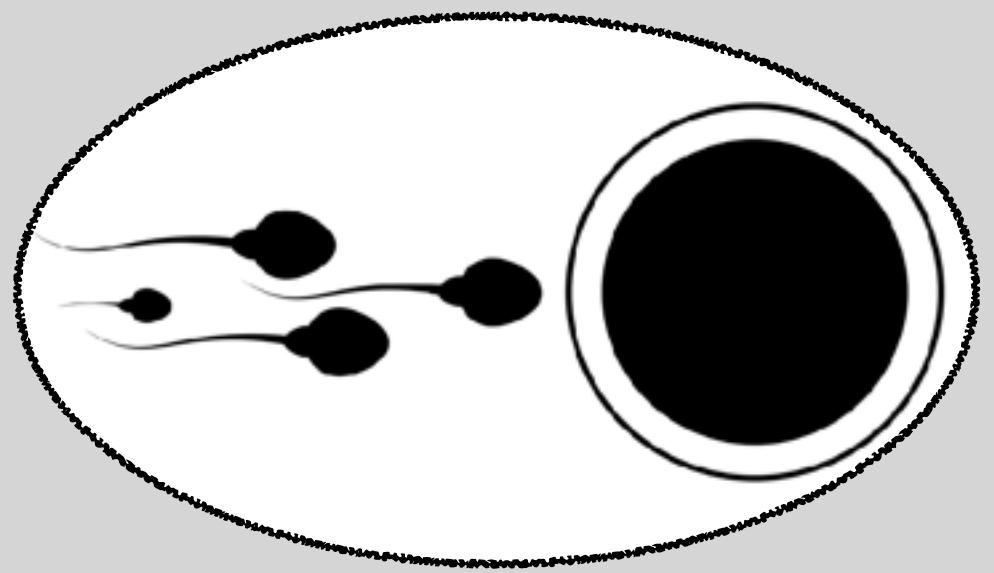
## 'TRUTH'



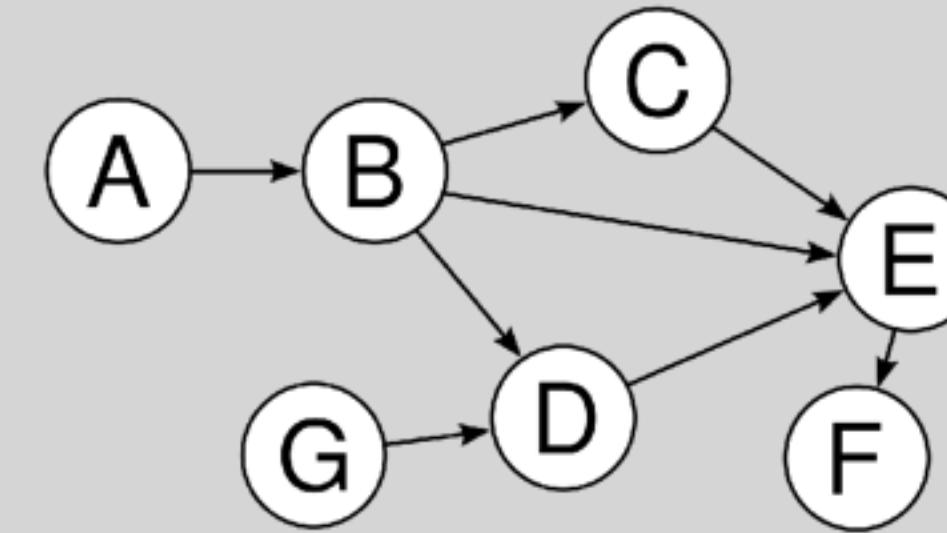
# Take-Home Messages

microsimulation  
can advance  
sociological research

microsimulation can:



include  
biological  
information

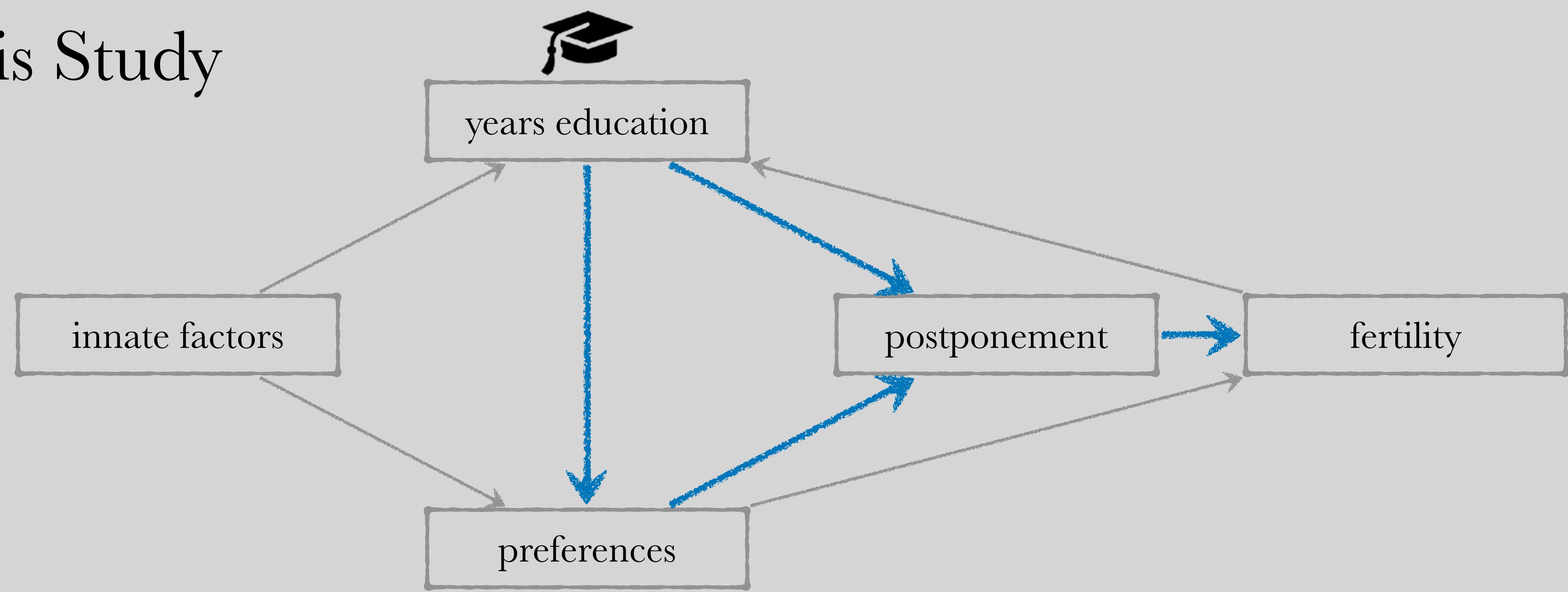


test (causal)  
mechanisms

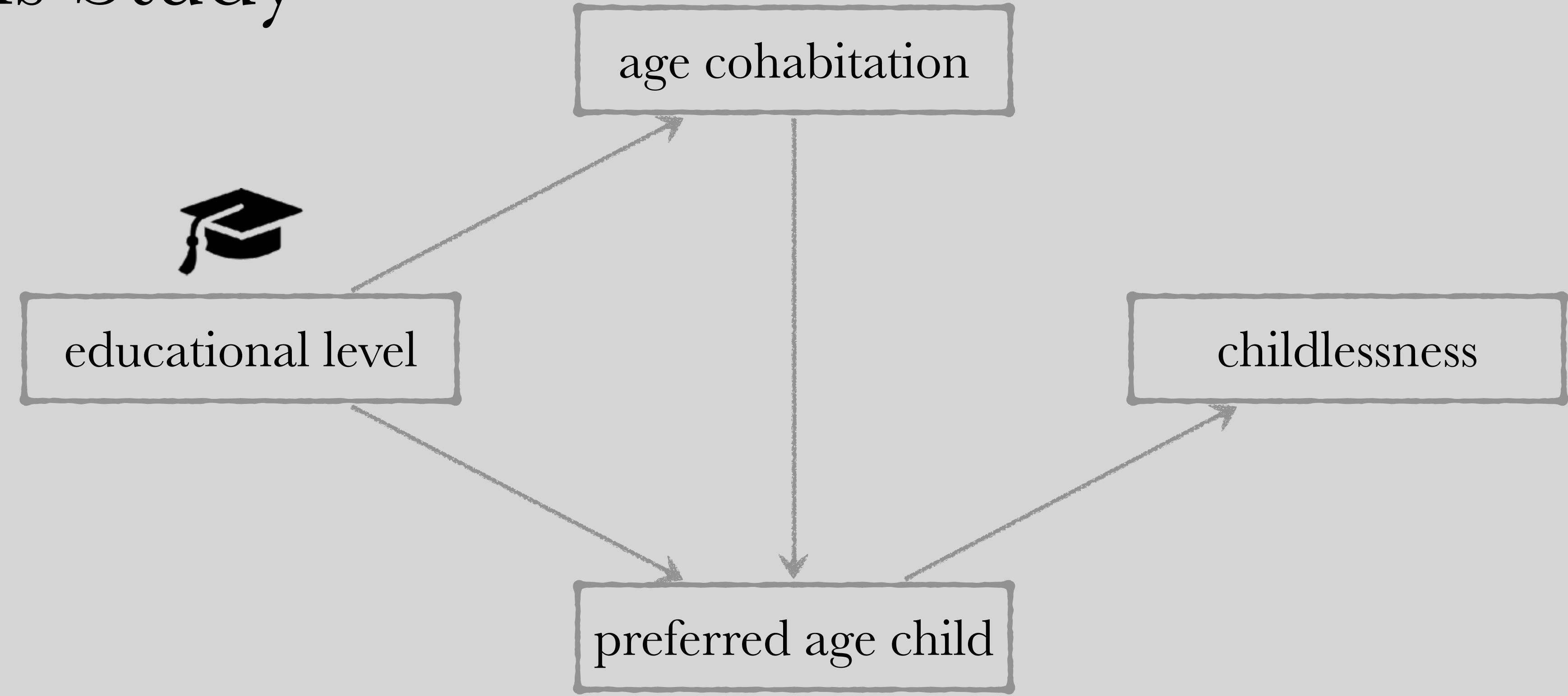
{ ABC }

estimate unknown  
parameters

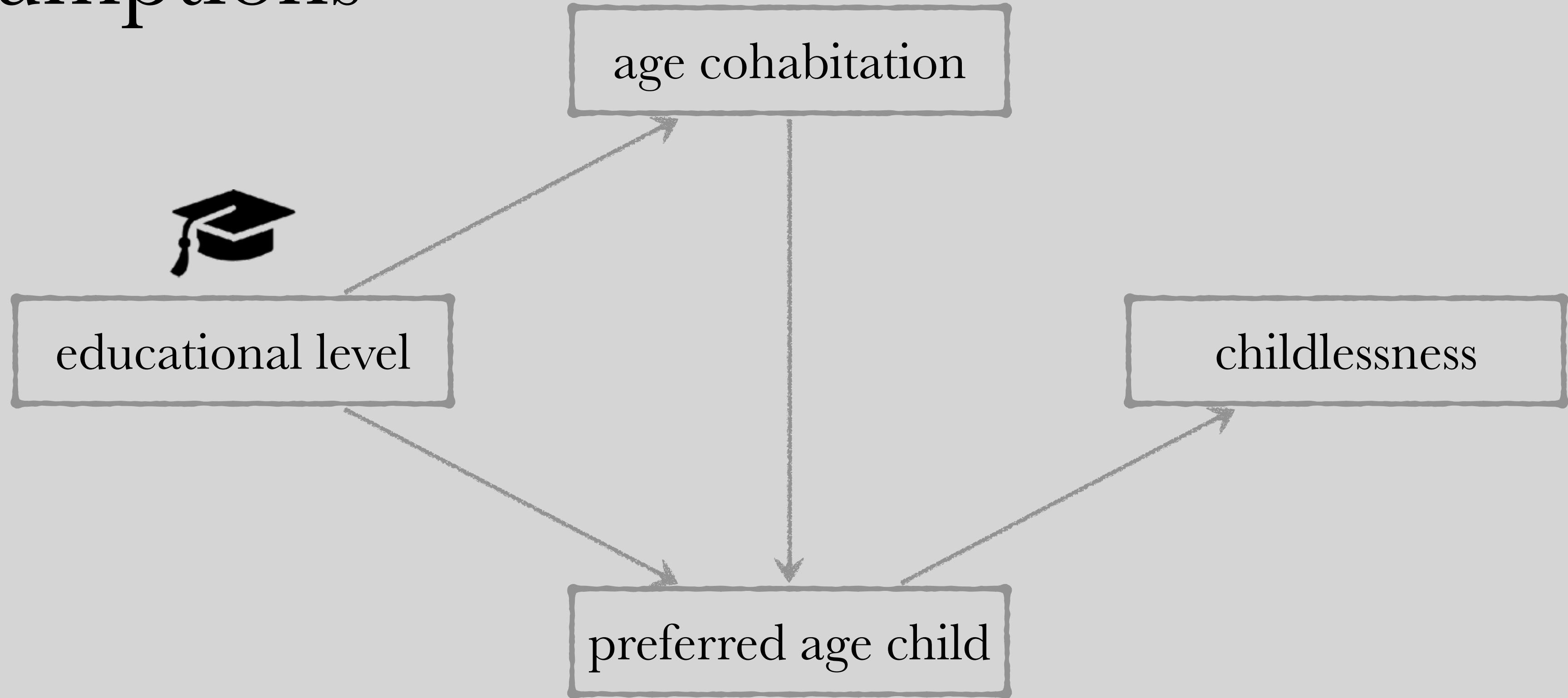
# This Study



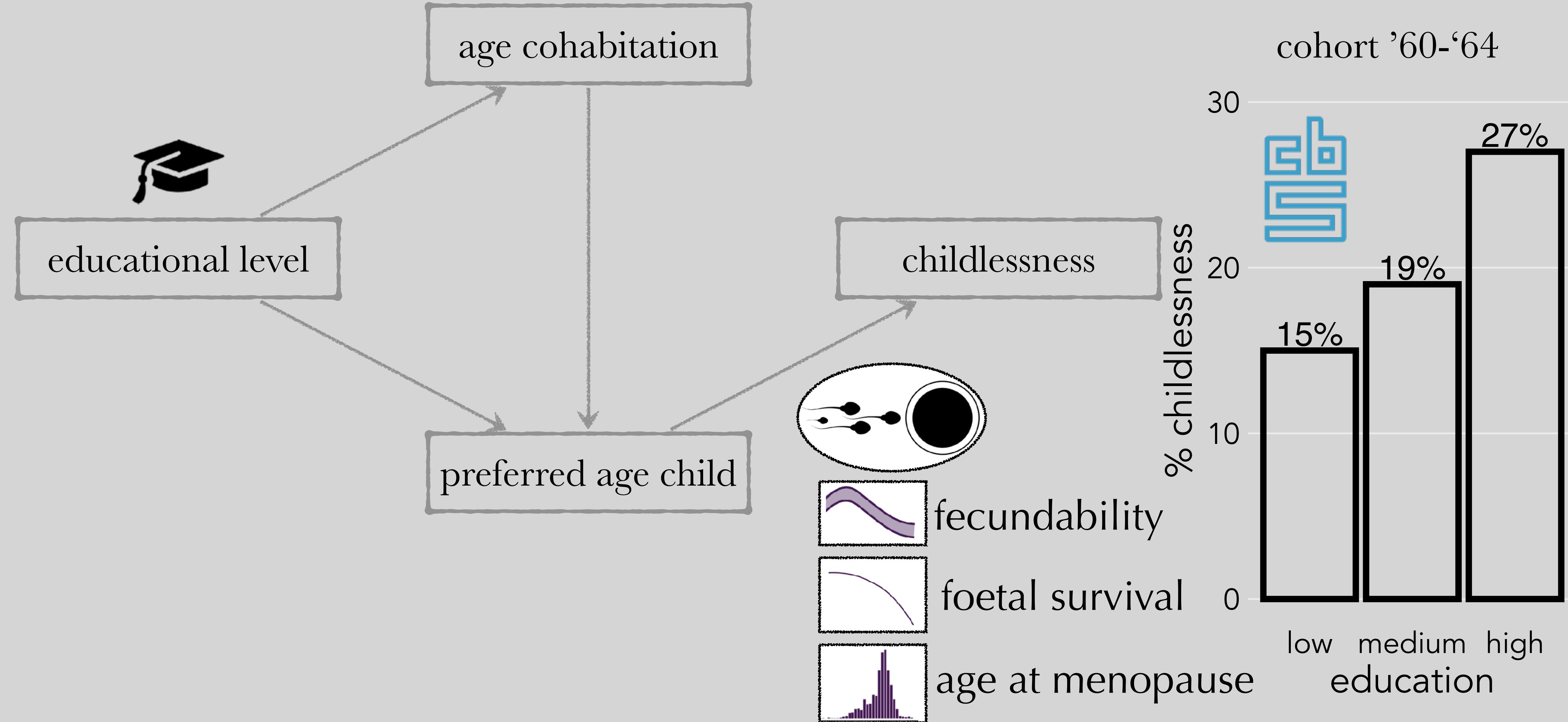
# This Study

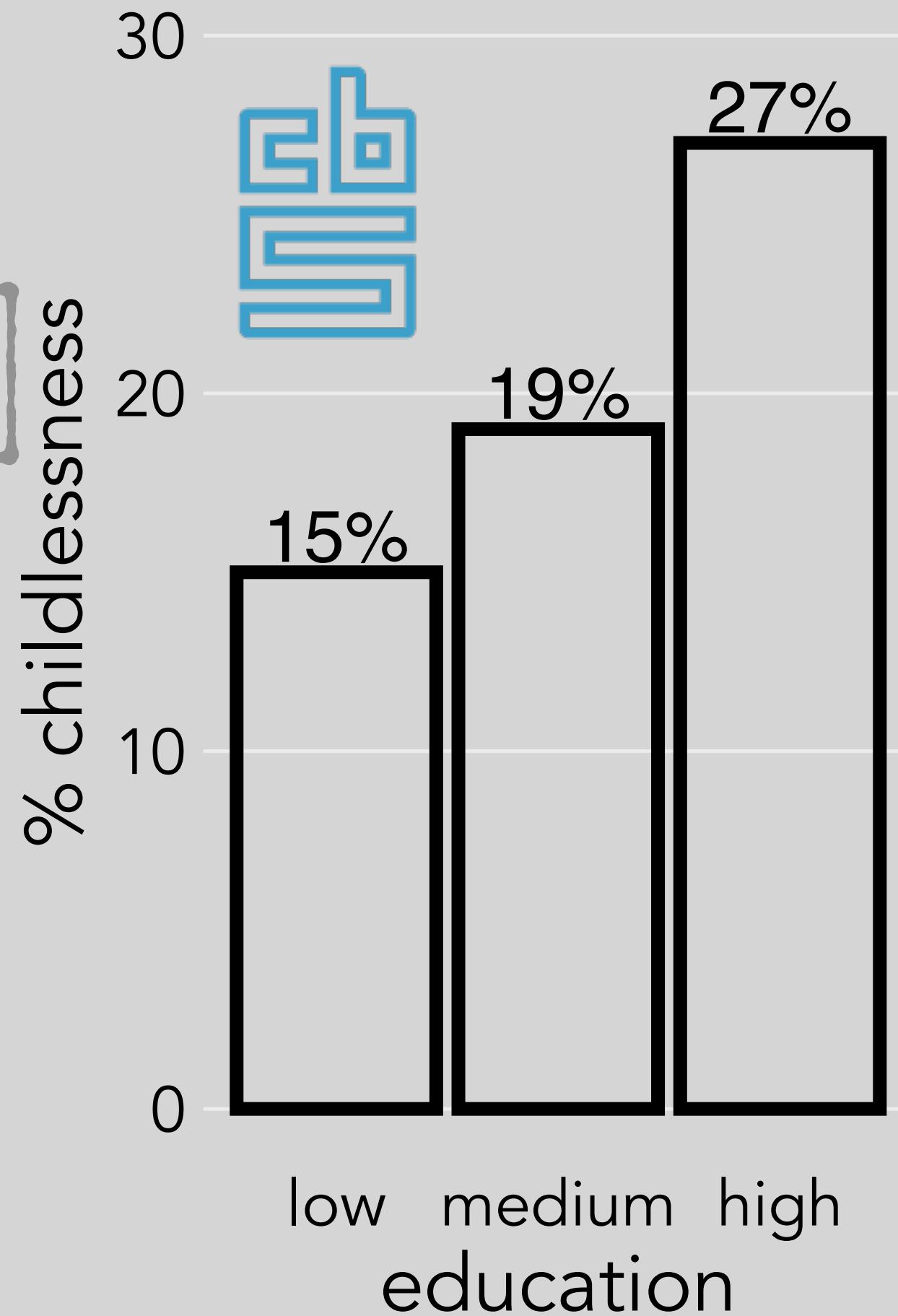
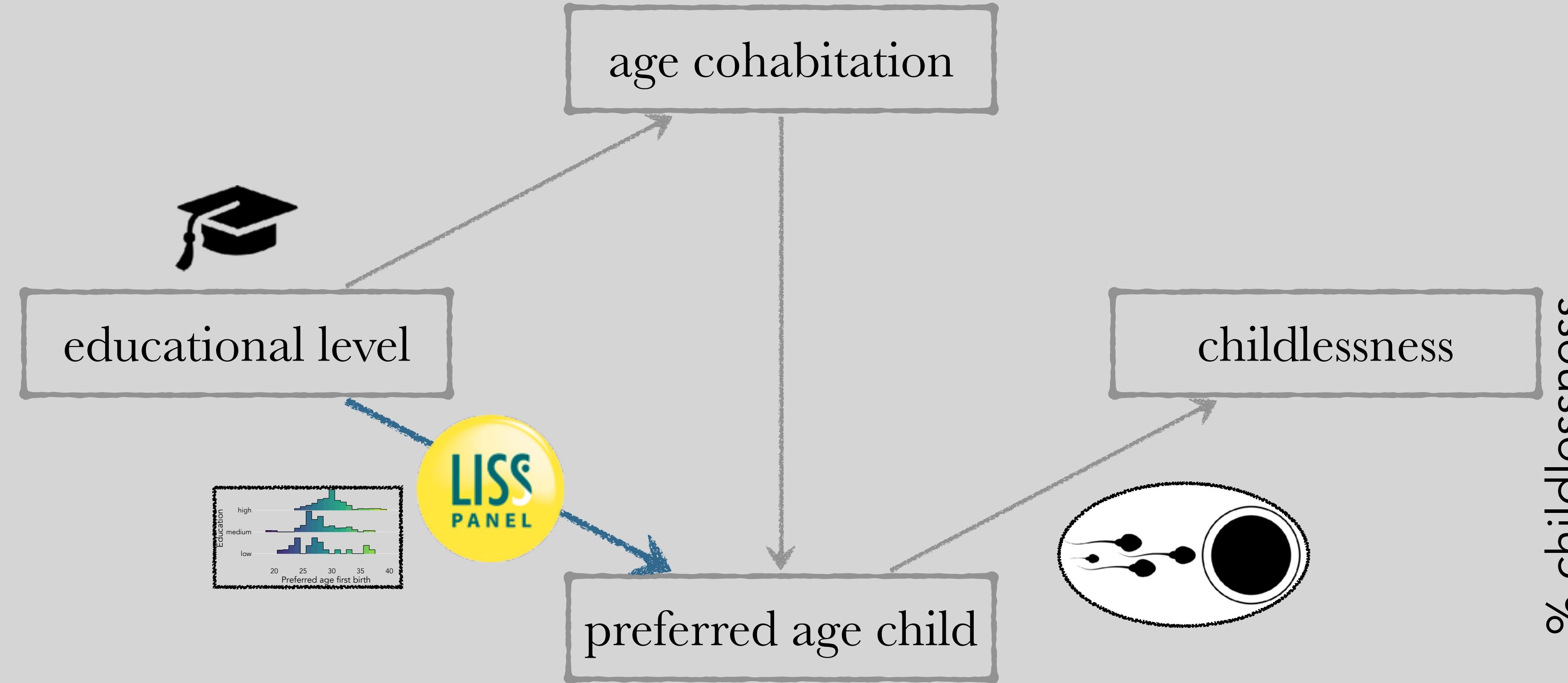


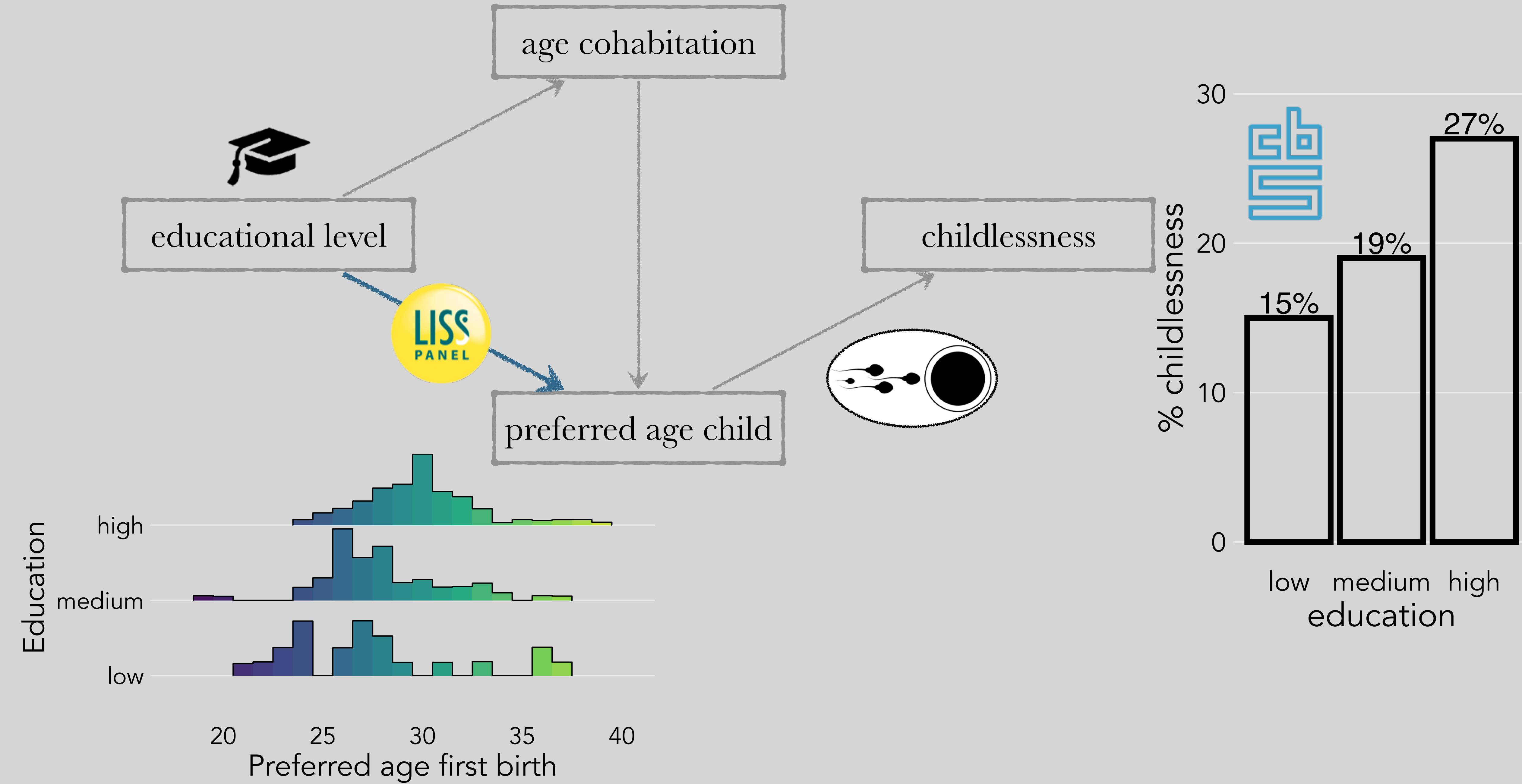
# Assumptions

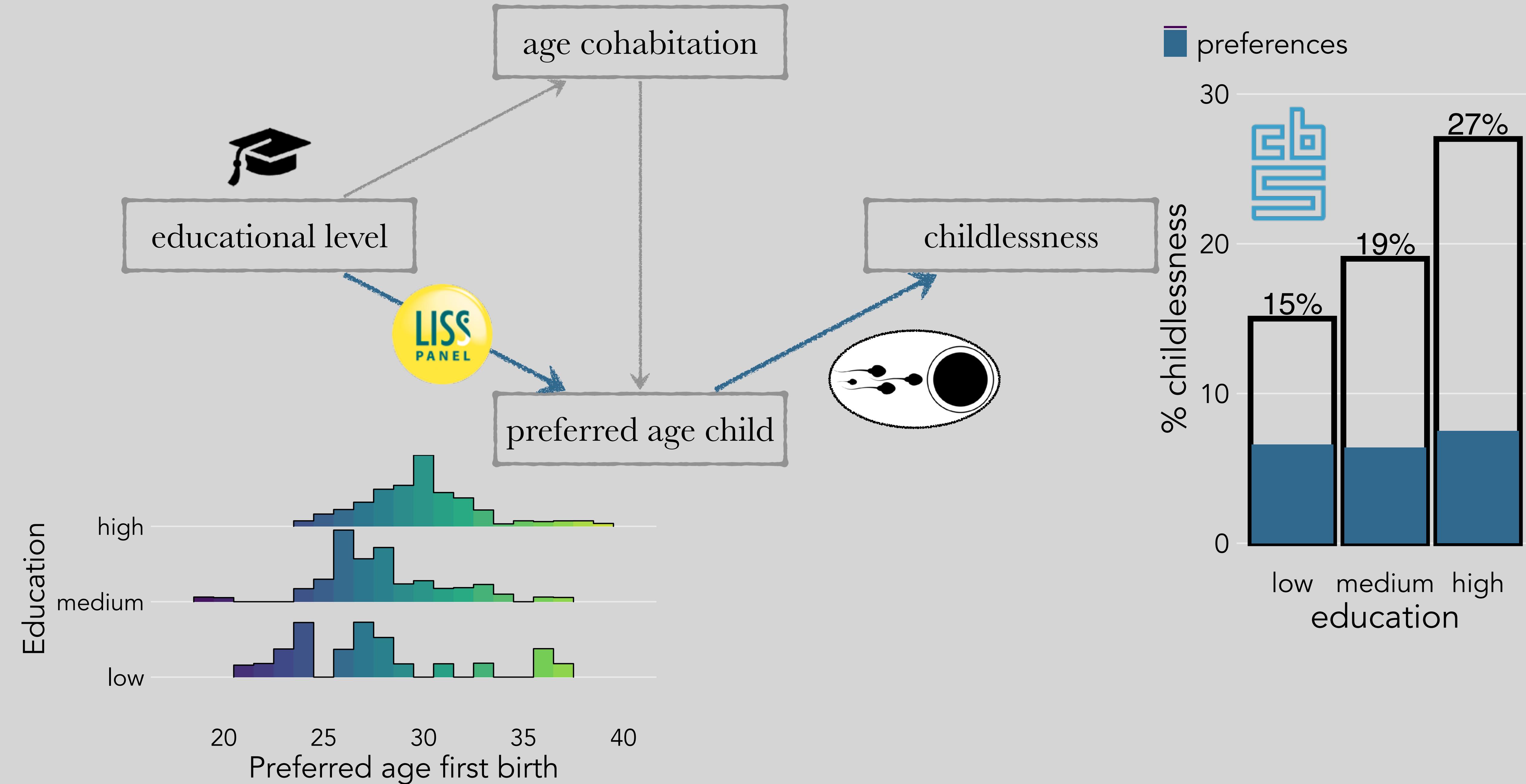


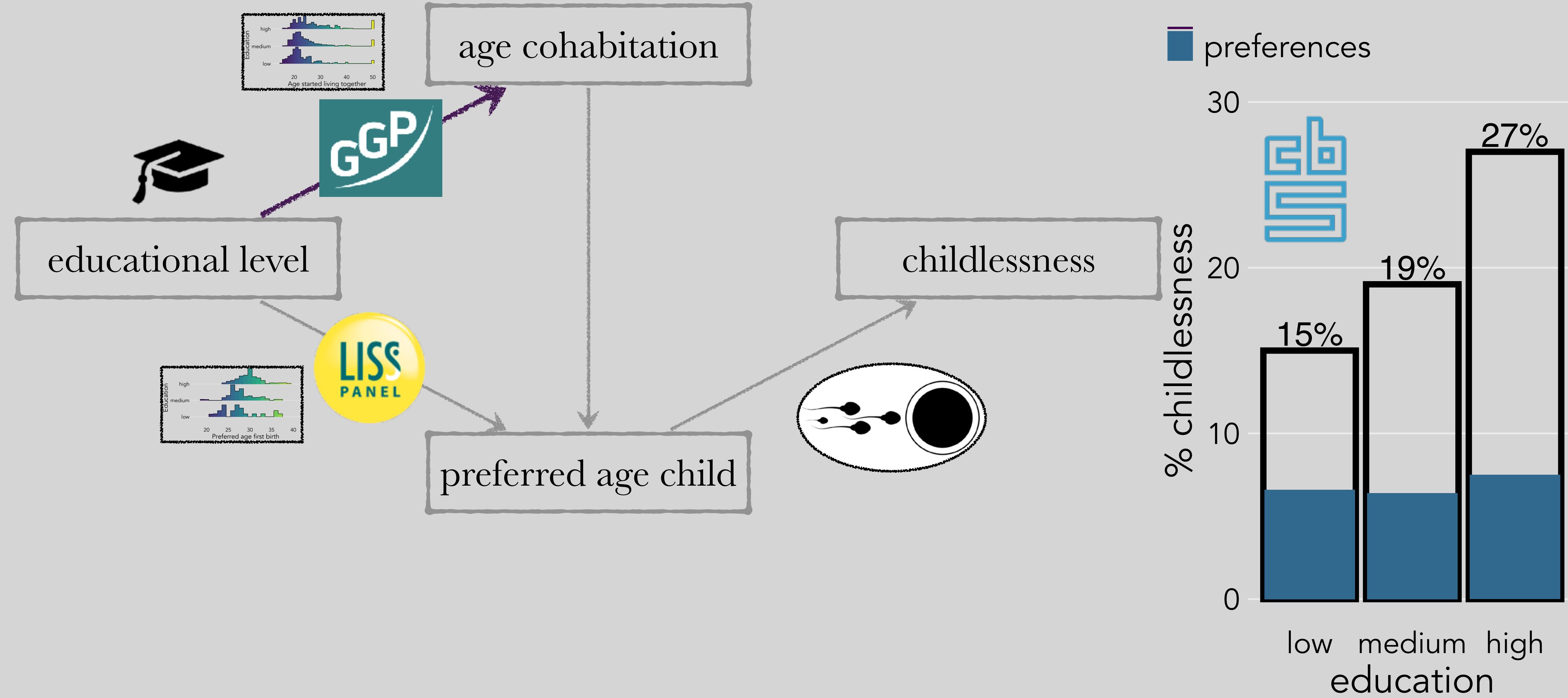
1. Cohabitation is necessary for births
2. No break-ups
3. All births are preferred
4. Preferences do not determine cohabitation
5. Preferences do not determine education
6. *Education is not related to 'biology'*
7. *Preferences are measured well*

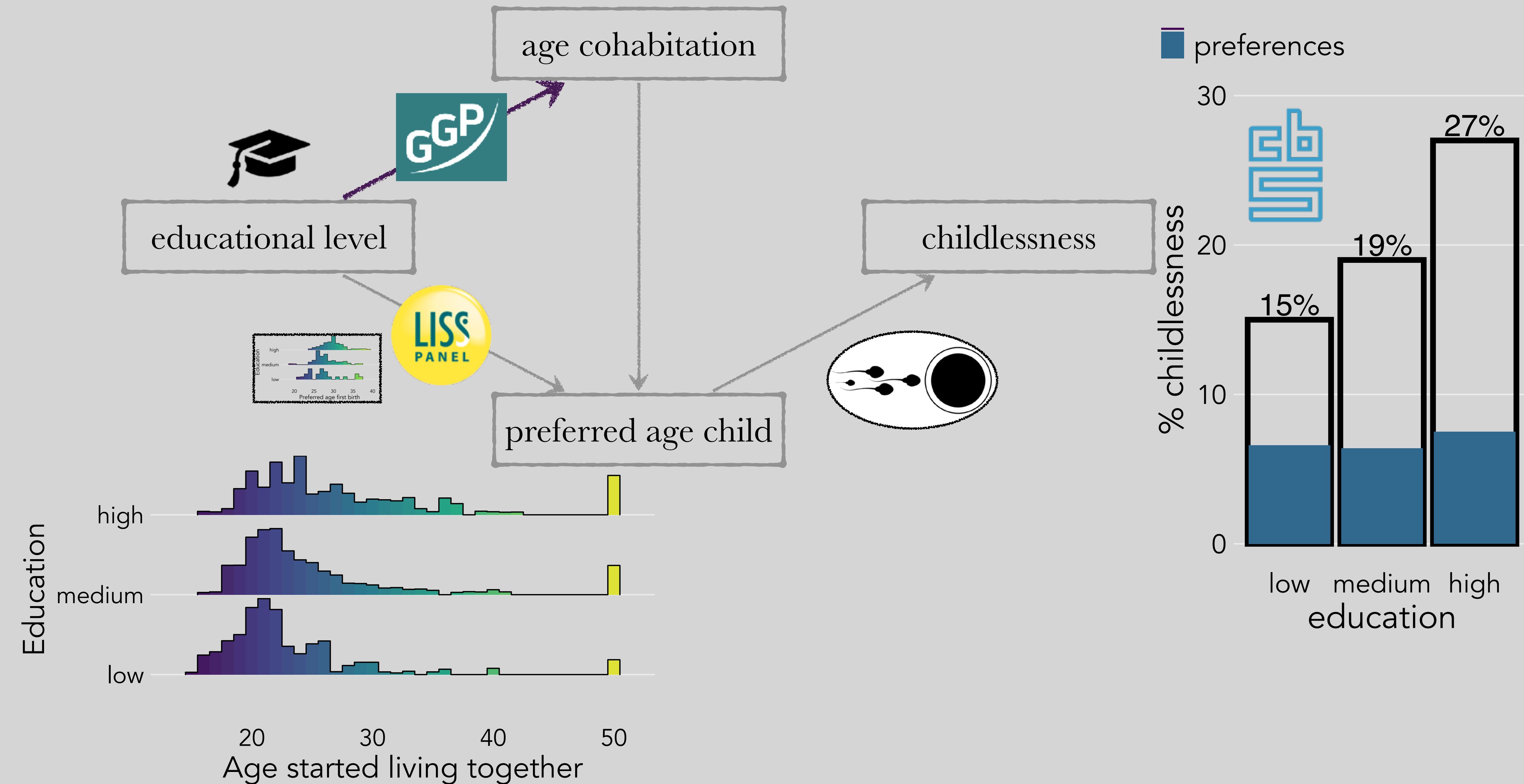


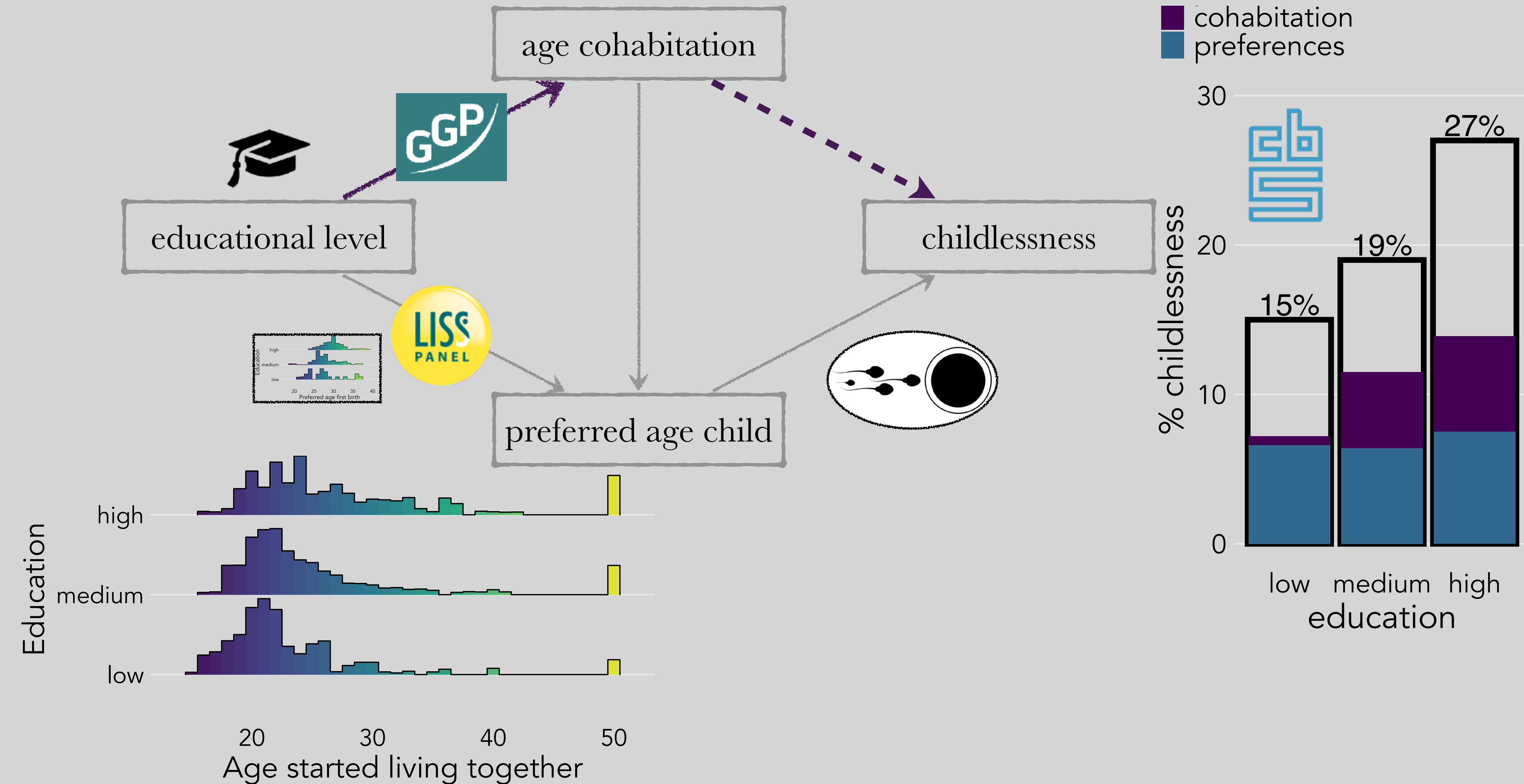


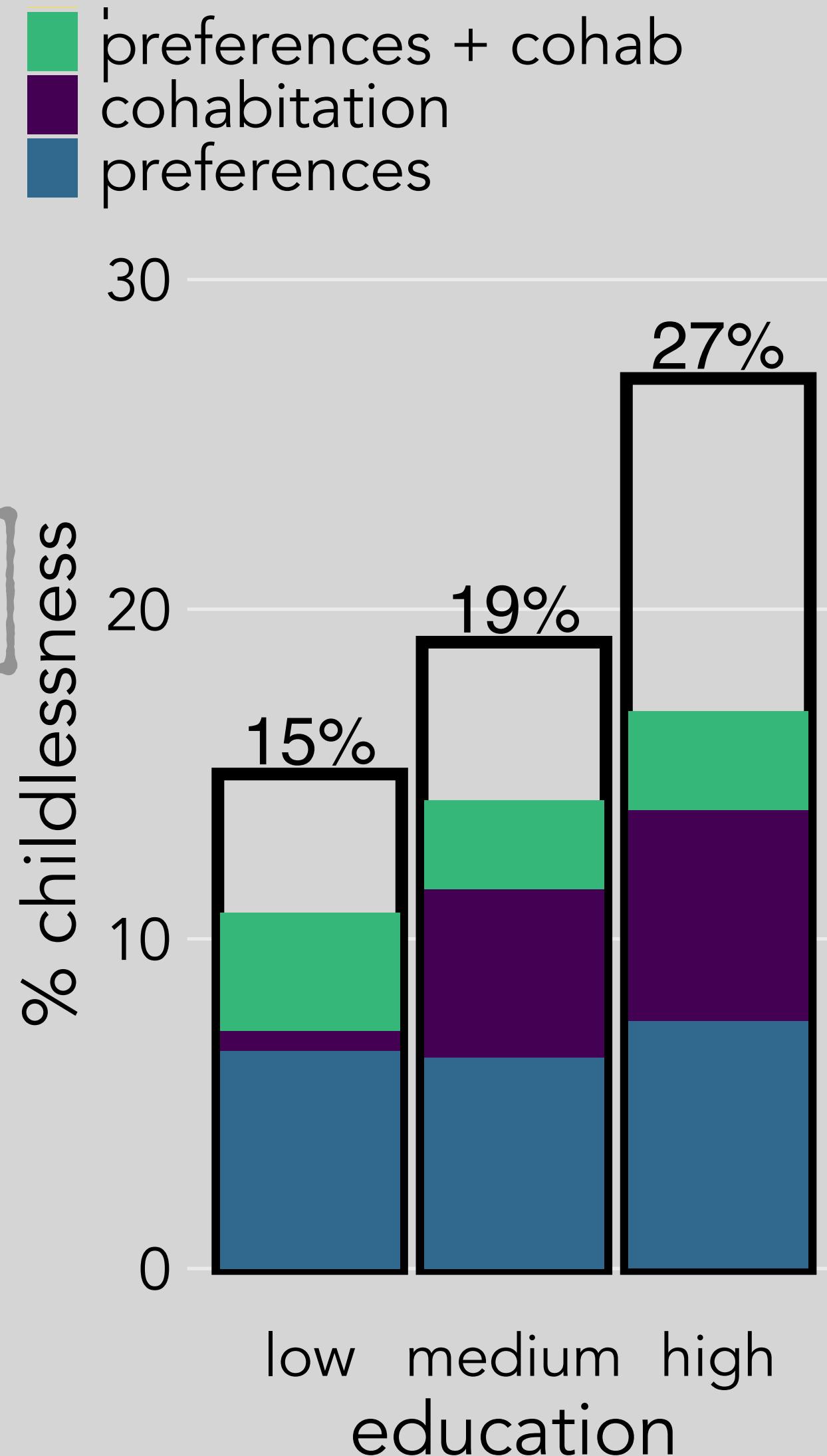
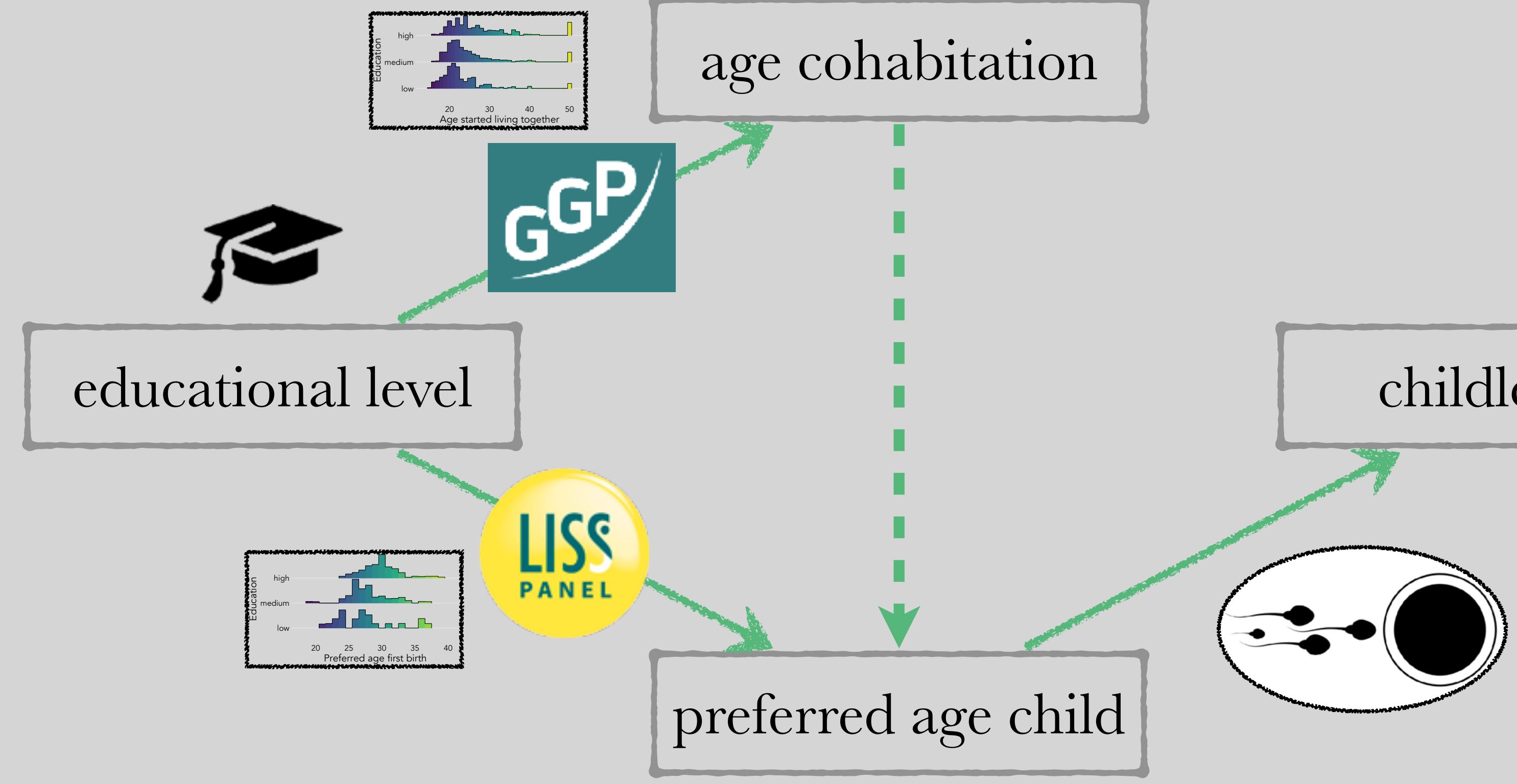






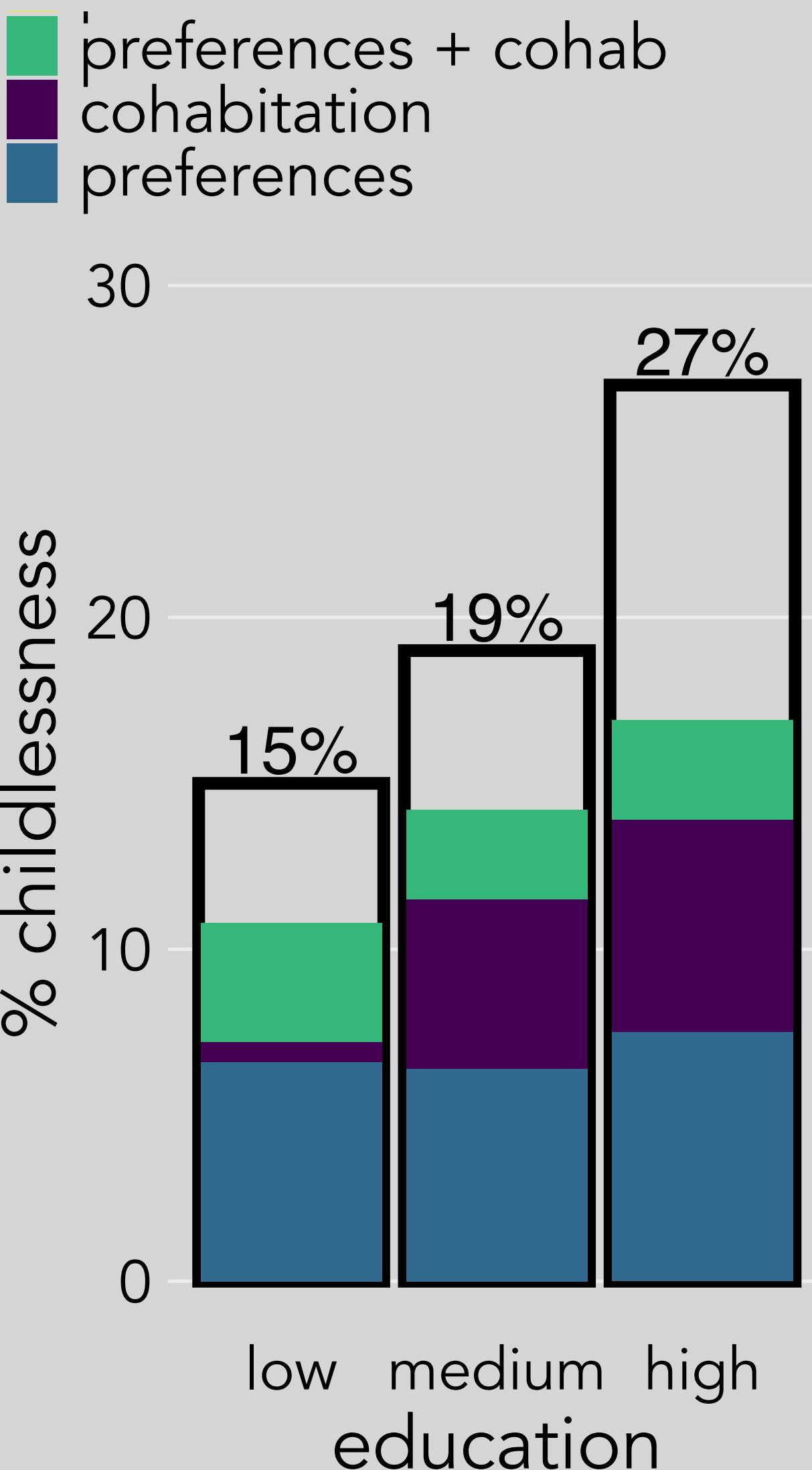
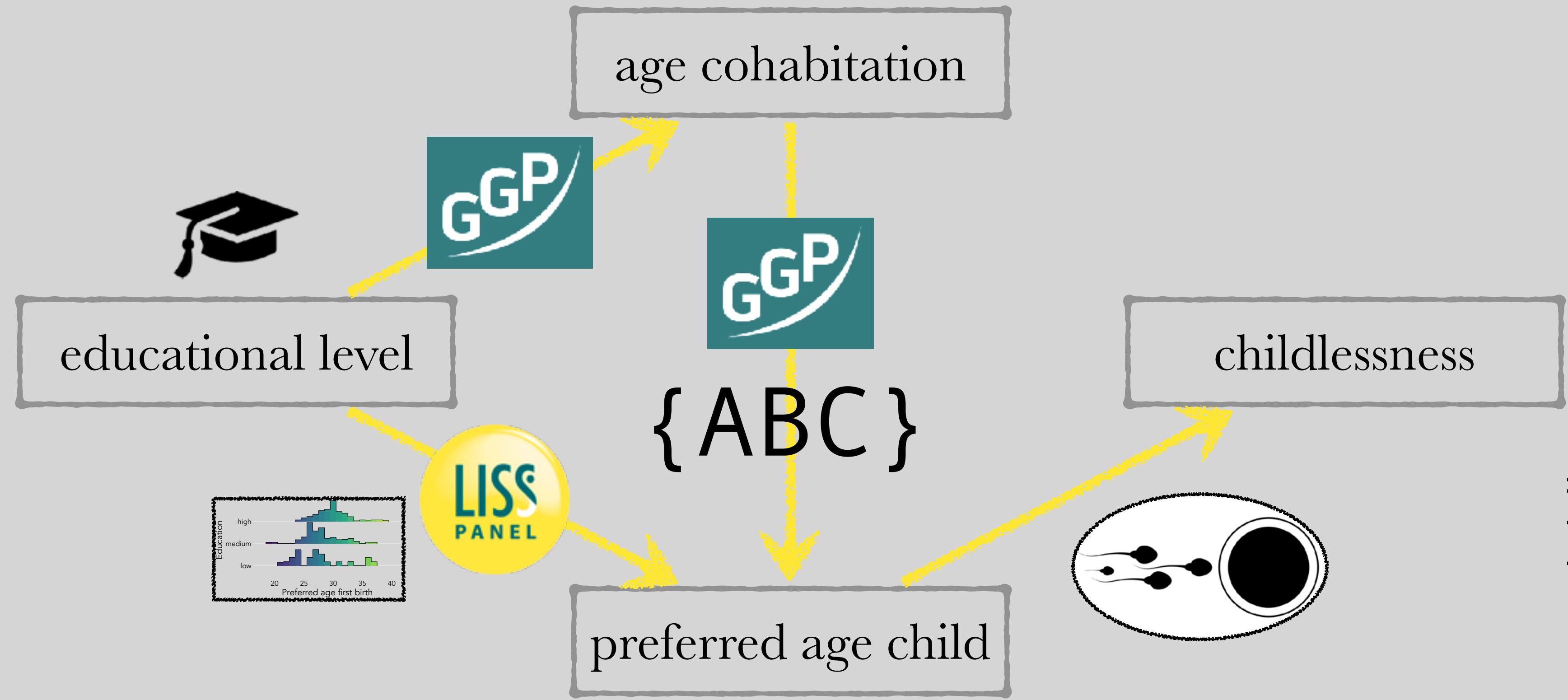






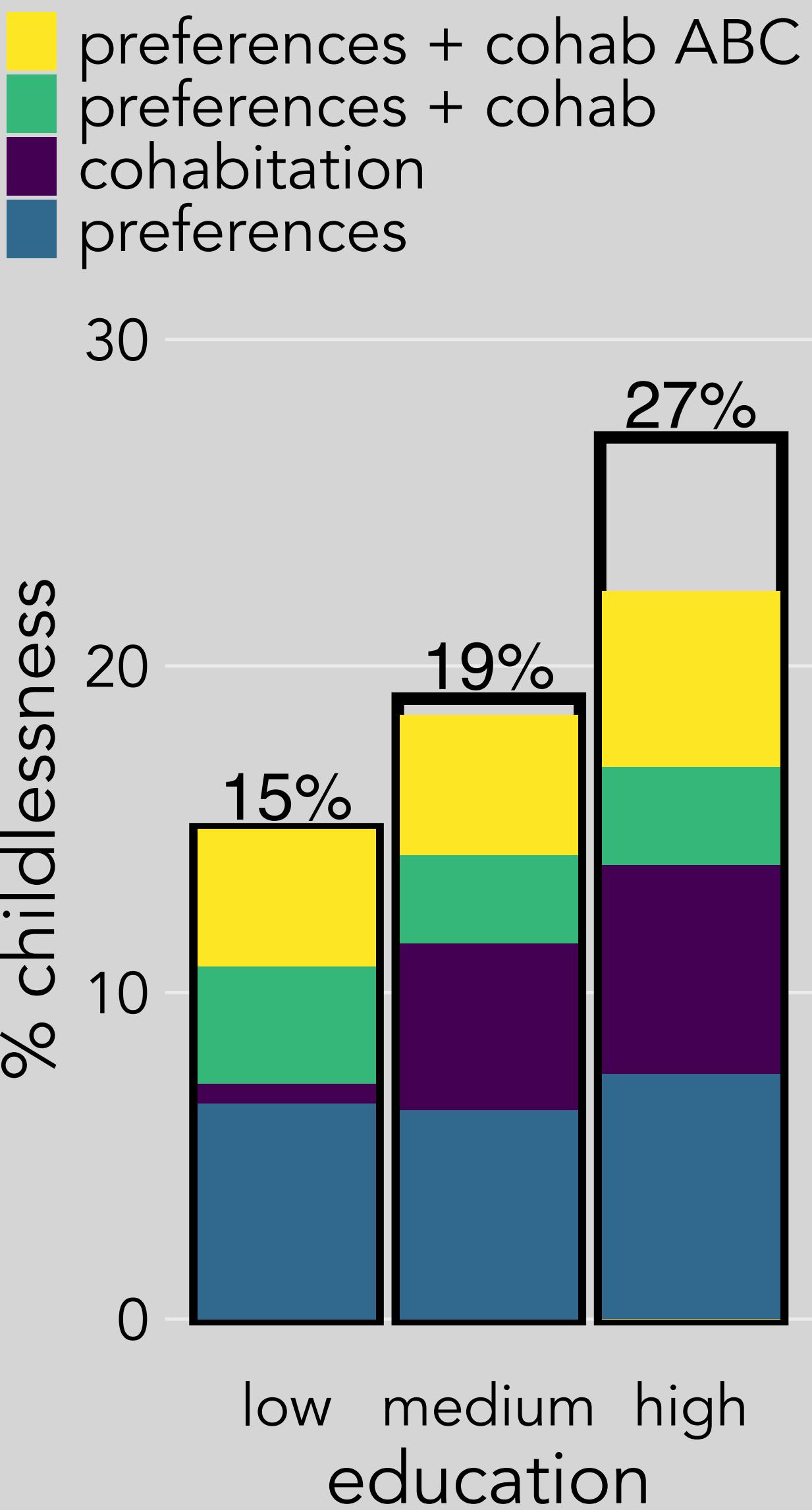
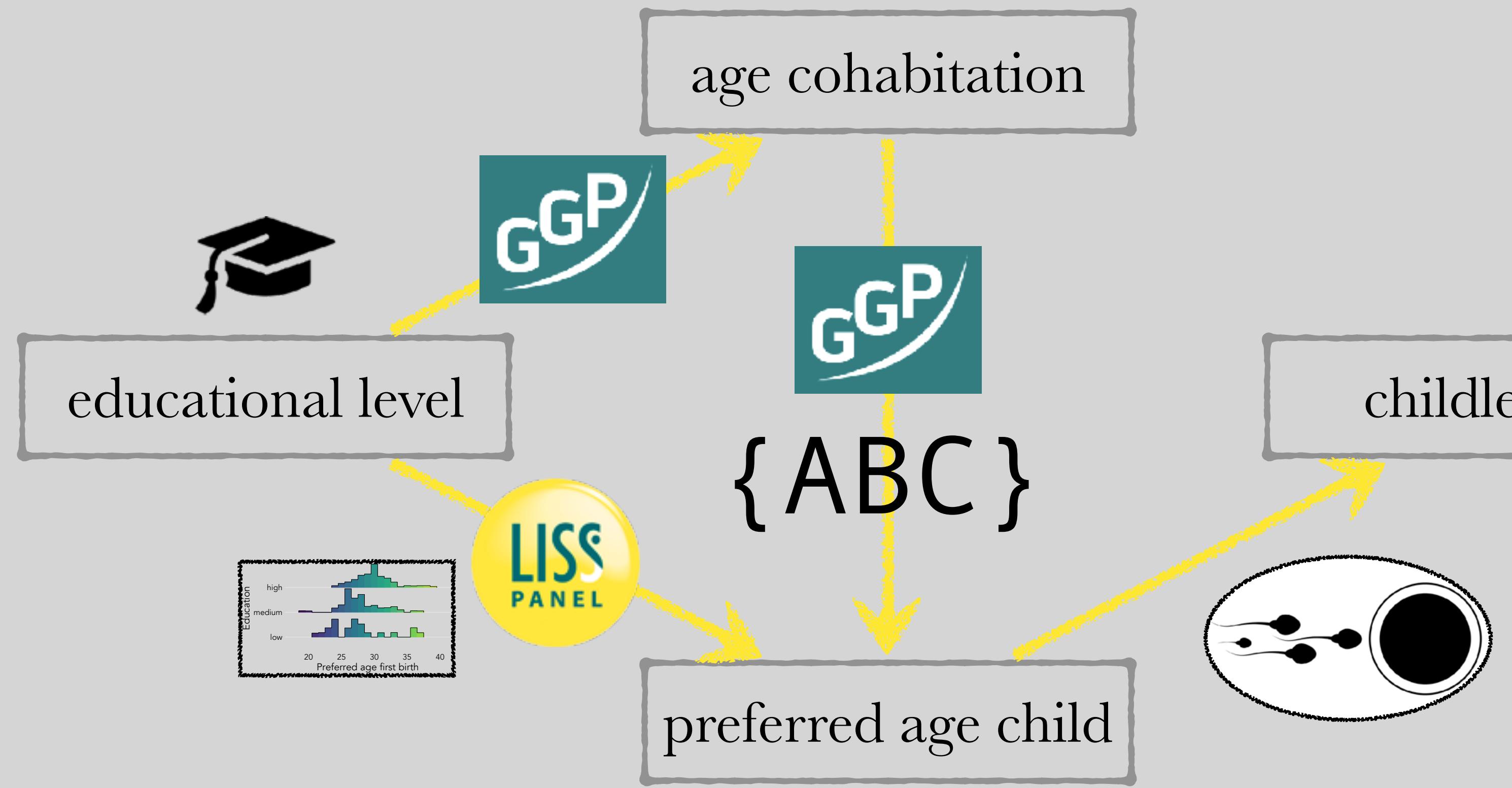
# {ABC}

## Approximate Bayesian Computation

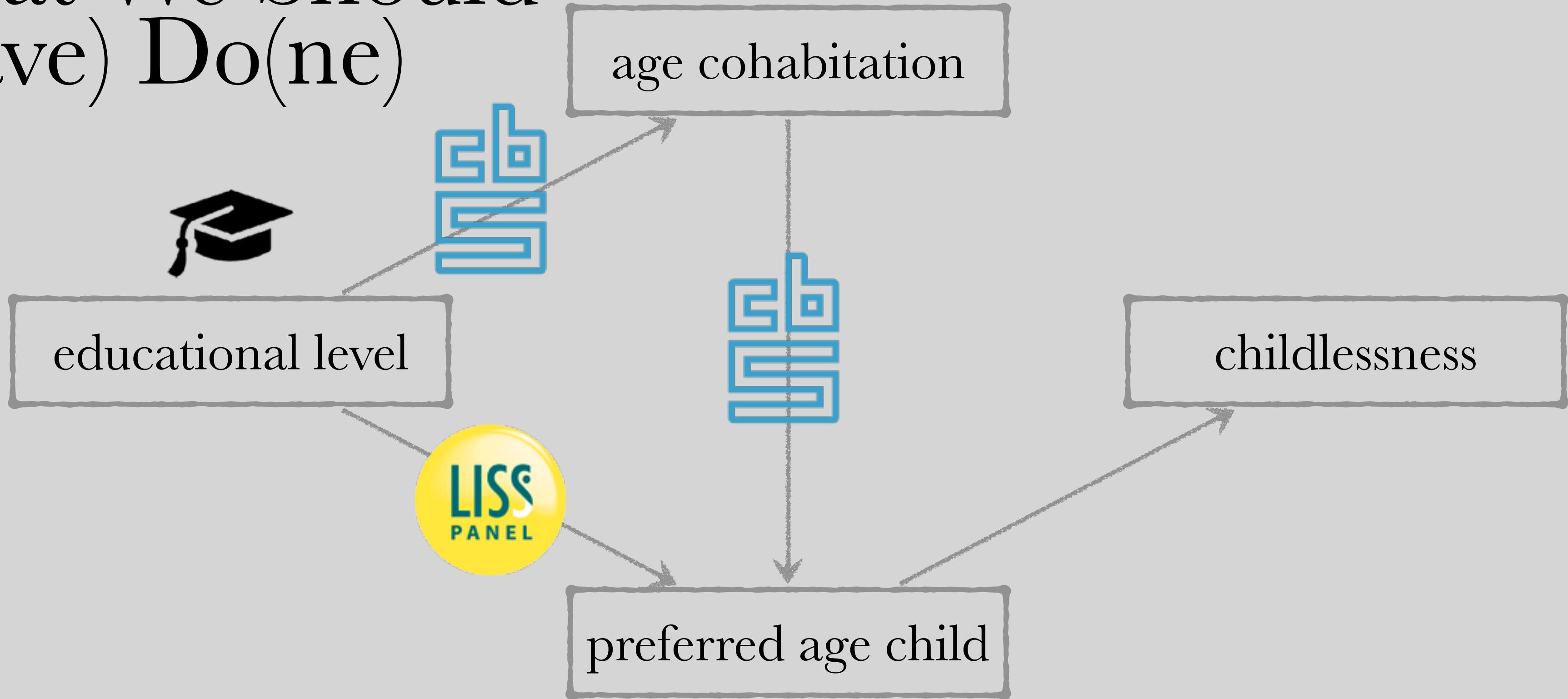


# {ABC}

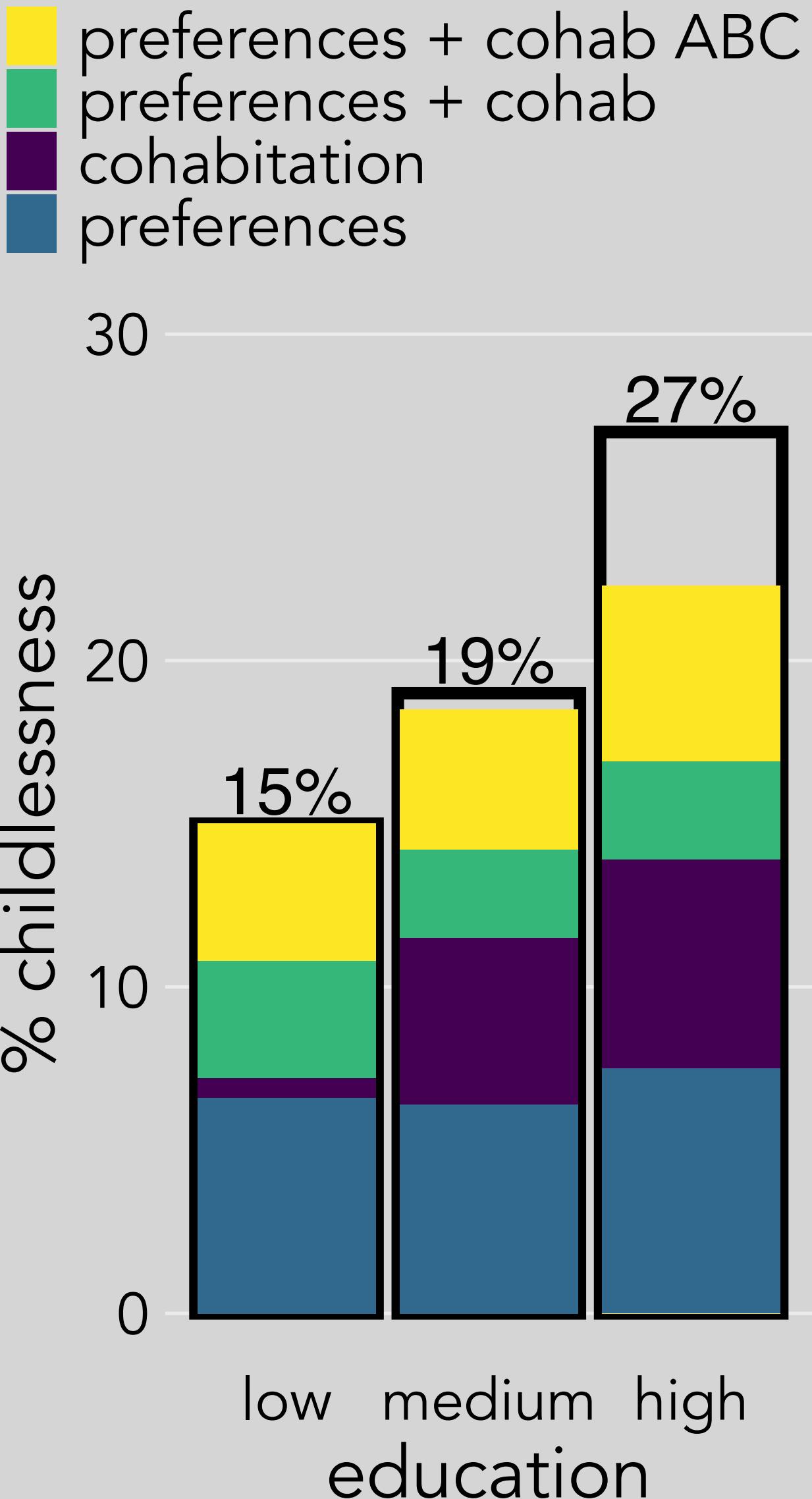
## Approximate Bayesian Computation



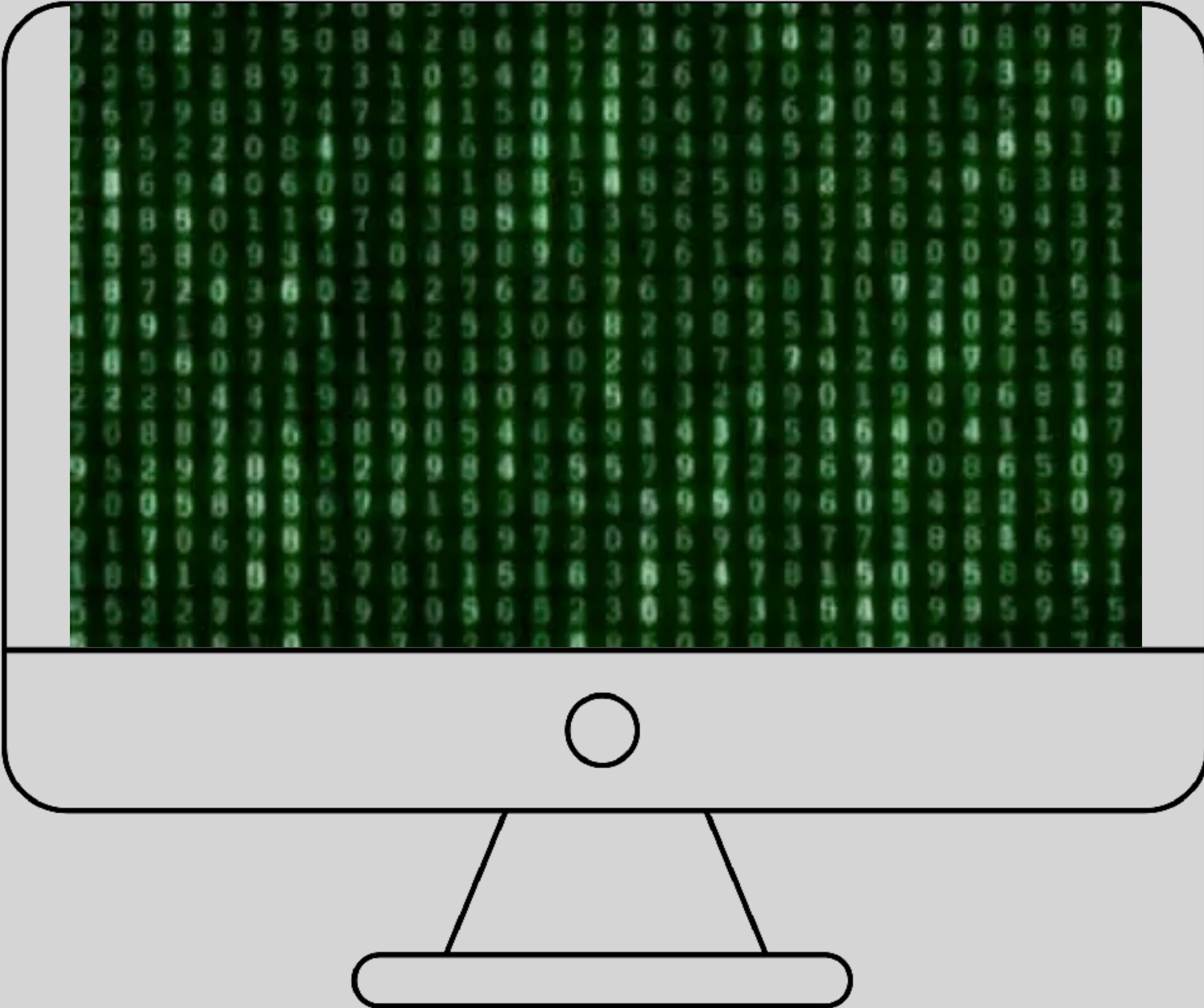
# What We Should (Have) Do(ne)



1. Cohabitation is necessary for births
2. No break-ups
3. All births are preferred
4. Preferences do not determine cohabitation
5. Preferences do not determine education
6. *Education is not related to 'biology'*
7. *Preferences are measured well*



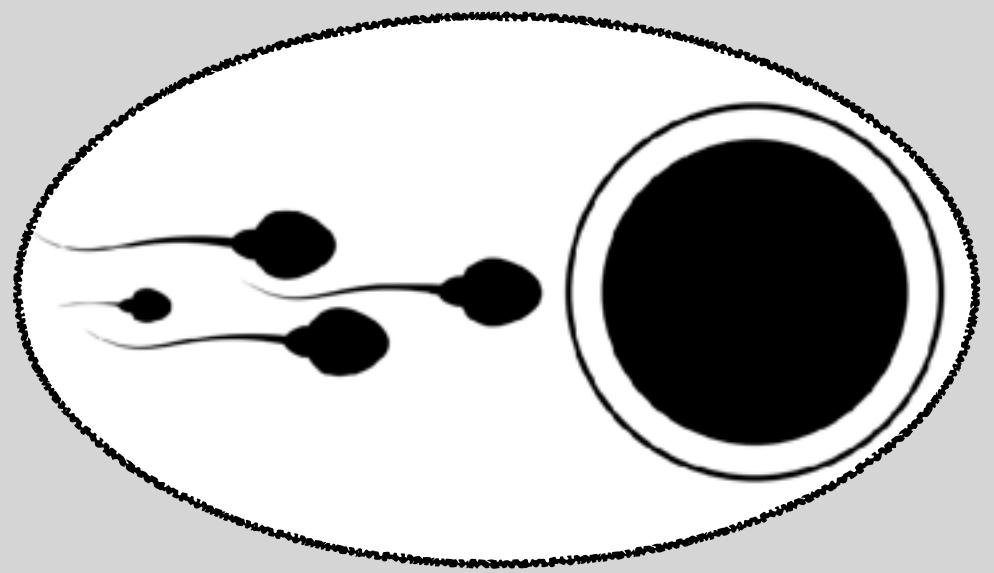
# What Is Computational Sociology About This?



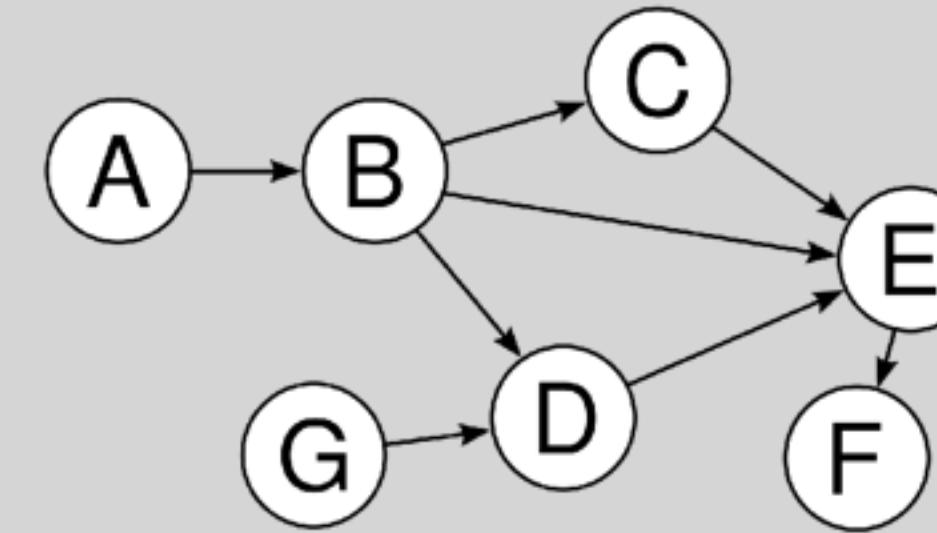
# Take-Home Messages

microsimulation  
can advance  
sociological research

microsimulation can:



include  
biological  
information



test (causal)  
mechanisms

{ ABC }

estimate unknown  
parameters

{ABC}

# Approximate Bayesian Computation

Bayes

*Posterior*

$$P(\theta | \text{data}) \propto \text{Likelihood} \times \text{Prior}$$
$$P(\theta | \text{data}) \propto P(\text{data} | \theta) \times P(\theta)$$

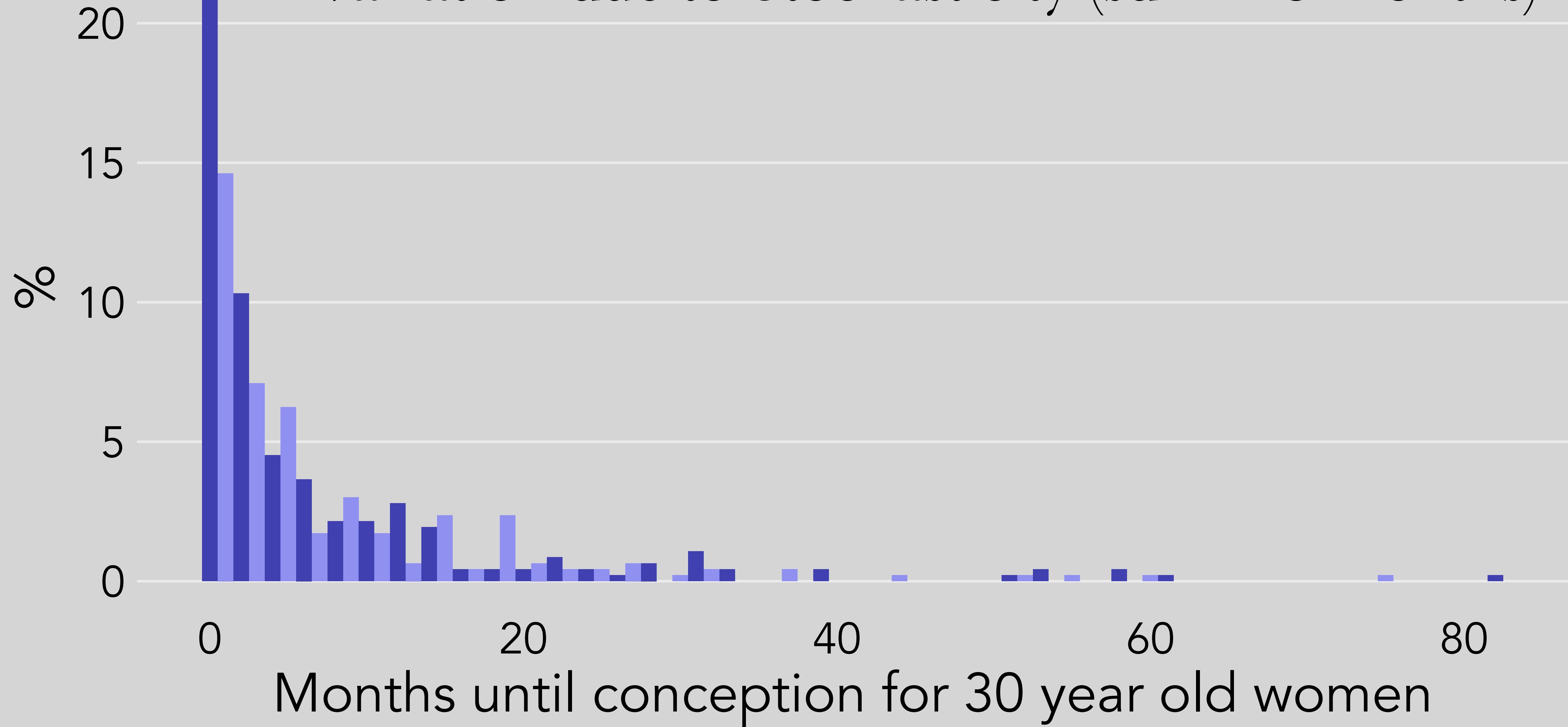
Approximate Bayes  
data = 25

*Posterior*

$$\left\{ \begin{array}{l} \text{sim}(\theta_1) = 15 \\ \text{sim}(\theta_2) = 25 \\ \text{sim}(\theta_3) = 30 \\ \text{sim}(\theta_4) = 20 \end{array} \right.$$



## Variation due to Stochasticity ( $sd = 13$ months)





Variation due to Stochasticity ( $sd = 13$  months)

Unpredictable Variation!

%

20

15

10

5

0

0

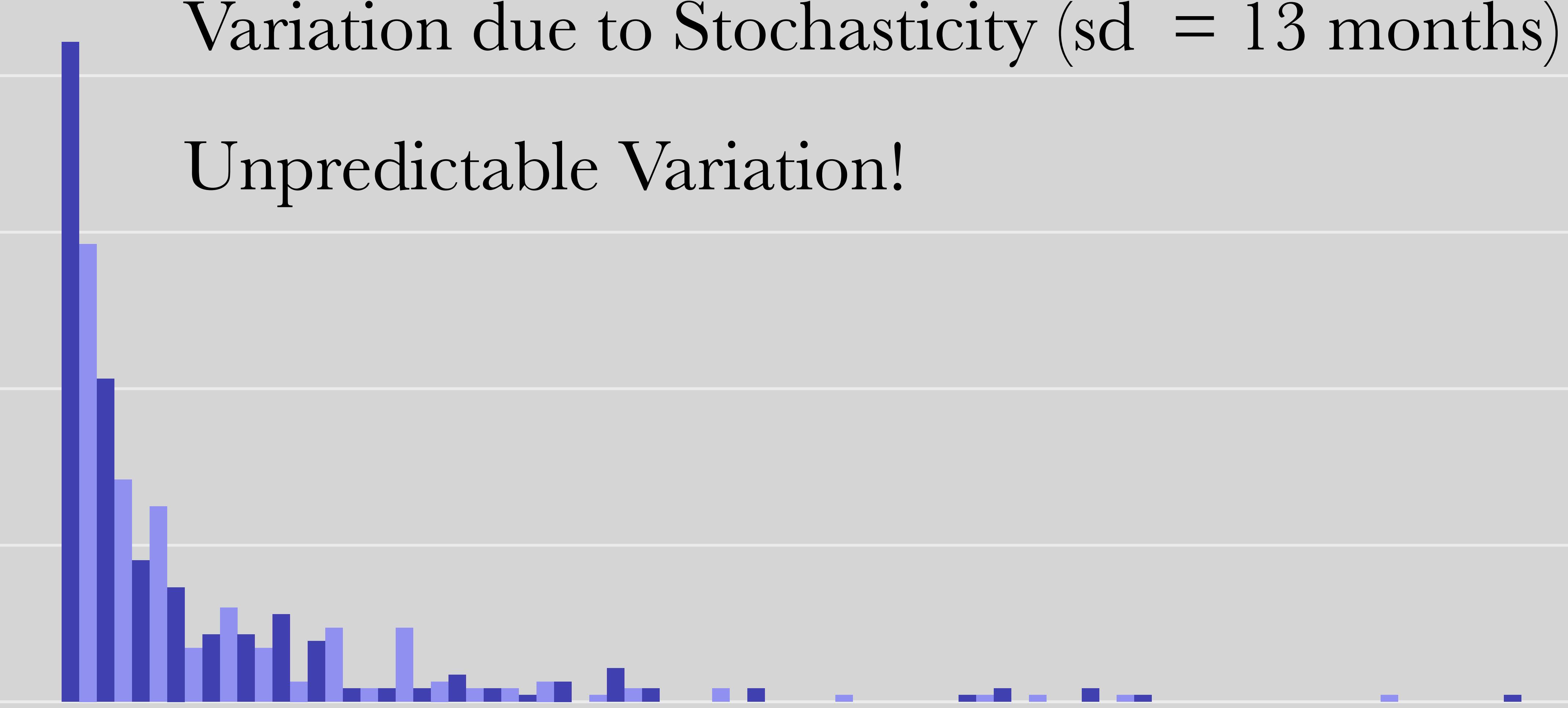
20

40

60

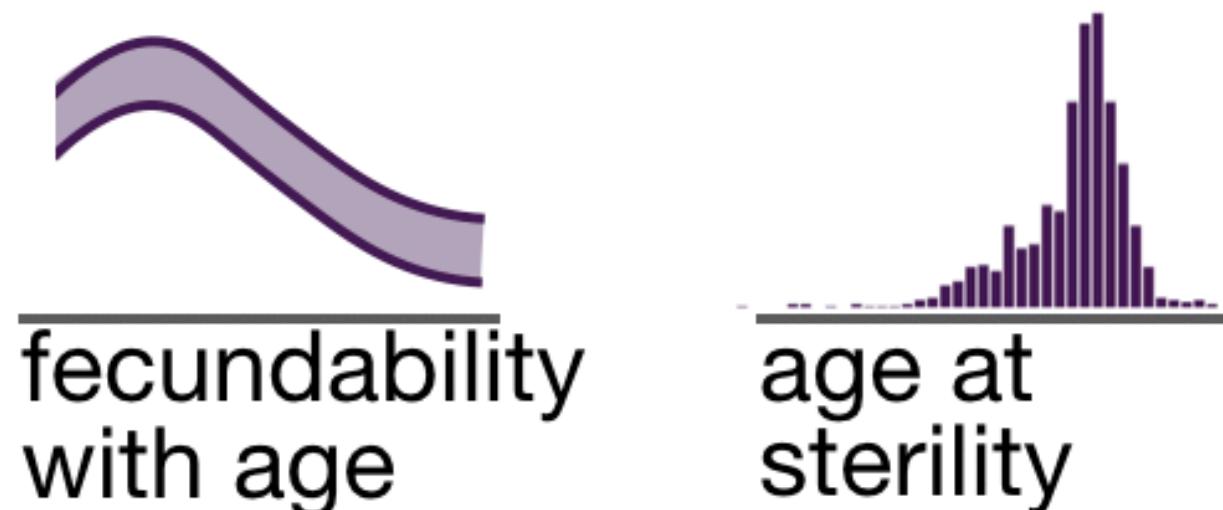
80

Months until conception for 30 year old women

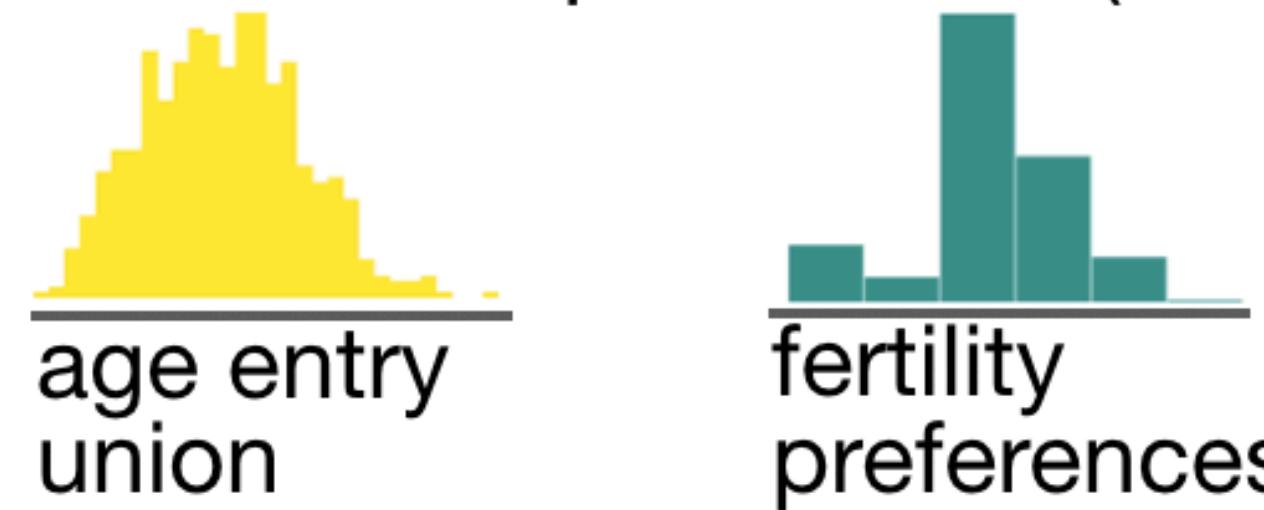


## MODEL INPUT

### biological parameters



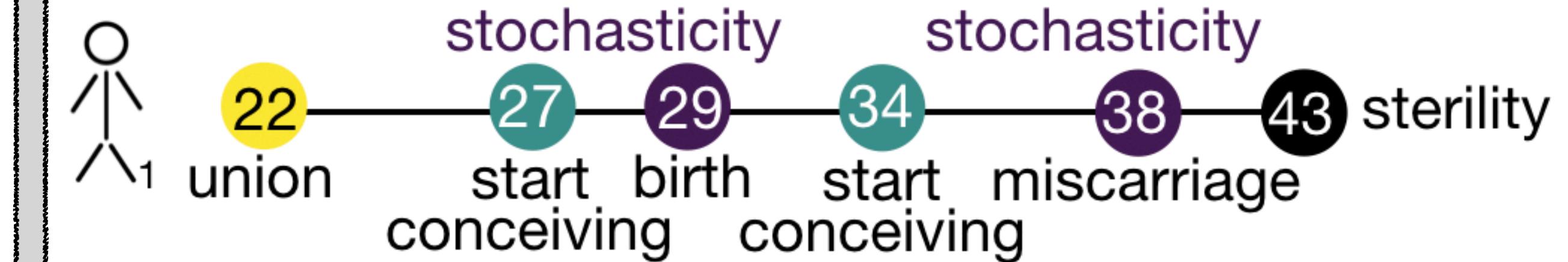
### behavioural parameters (education-dependent)



## MODEL RUN

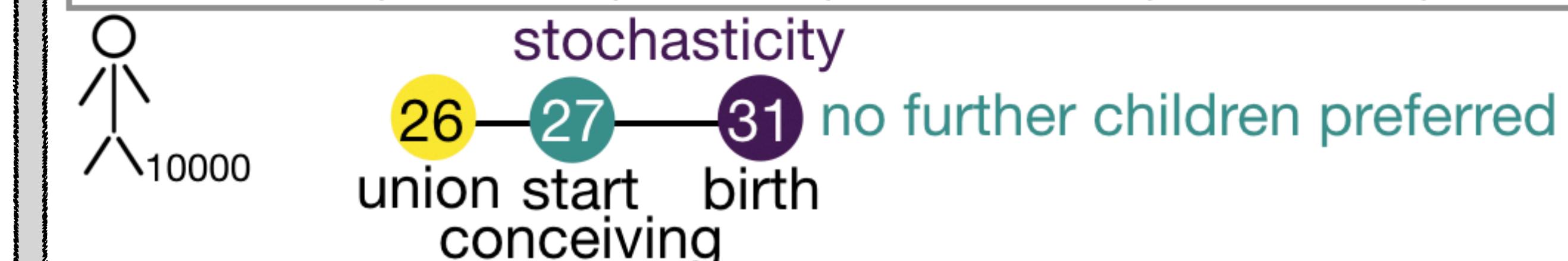
**Randomly determined traits individual 1**

in union =22 | spac. =5 | pref. =2 | fecund. =0.3 | steril. =43 | edu. =high



**Randomly determined traits individual 10000**

in union =26 | spac. =1 | pref. =1 | fecund. =0.1 | steril. =45 | edu. =low



due to:

- partner status
- preferences
- stochasticity

