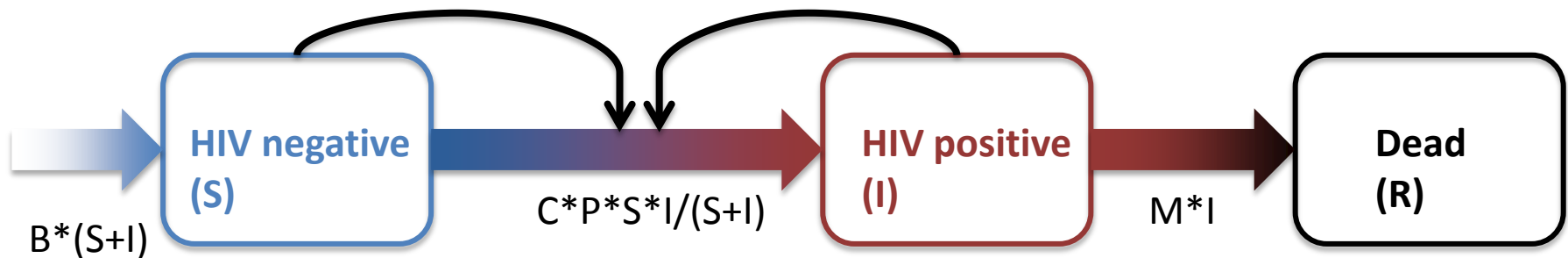


# Uncovering the (lack of) social science behind mathematical models of behaviour change for HIV prevention

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# Mathematical models in HIV epidemiology

## Compartmental models



B = Birth rate

C = Sexual contact rate

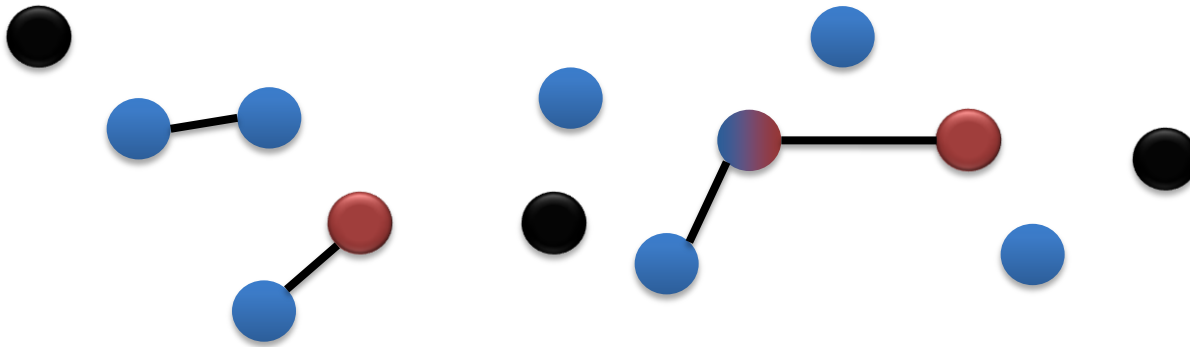
P = Probability of HIV transmission per sexual contact

$I/(S+I)$  = HIV prevalence = Probability that a random contact is with an HIV positive partner

M = Mortality rate among HIV positive people

# Mathematical models in HIV epidemiology

## Individual-based models



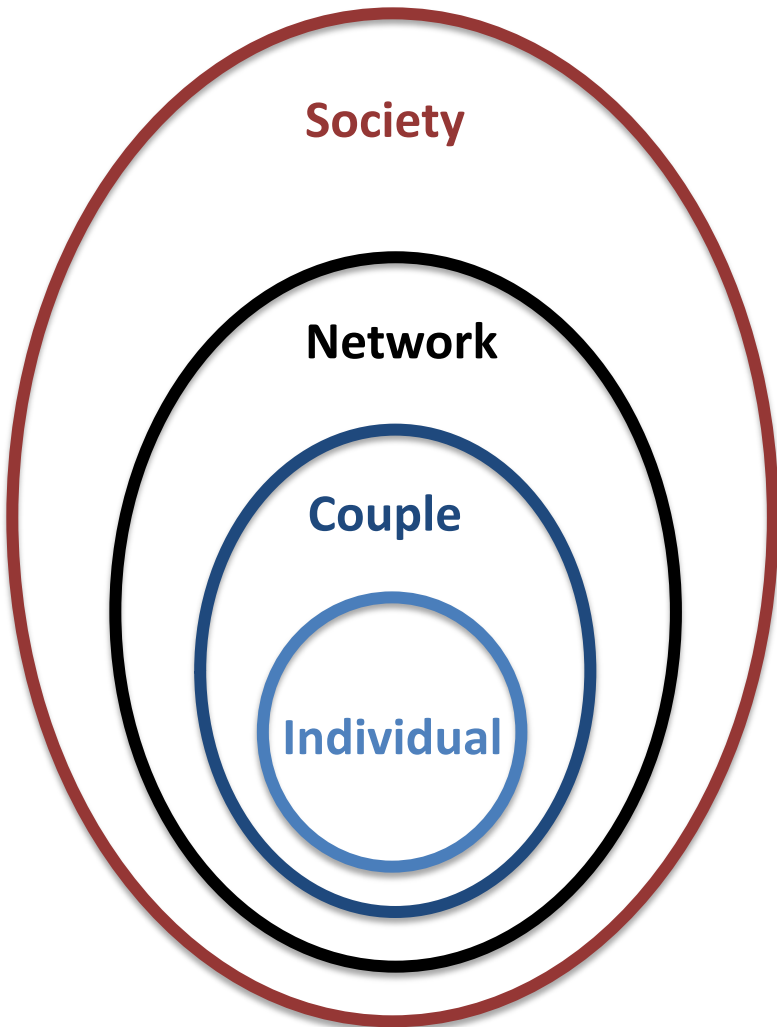
● = HIV negative

● = HIV positive

● = Dead

— = Sexual relationship

# Health behavioural theories and models in HIV prevention



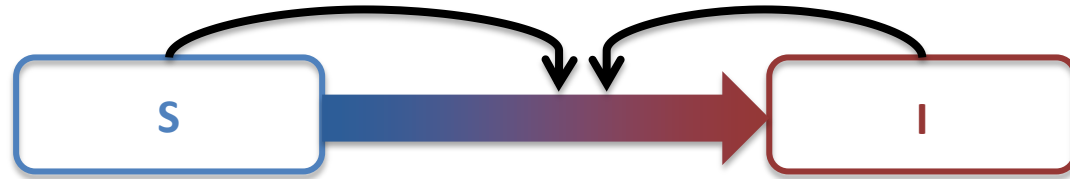
**HIV mortality rate**  
**Mass media**

**Peer pressure**

**Age gap with (prospective) partner**  
**ART status of (prospective) partner**

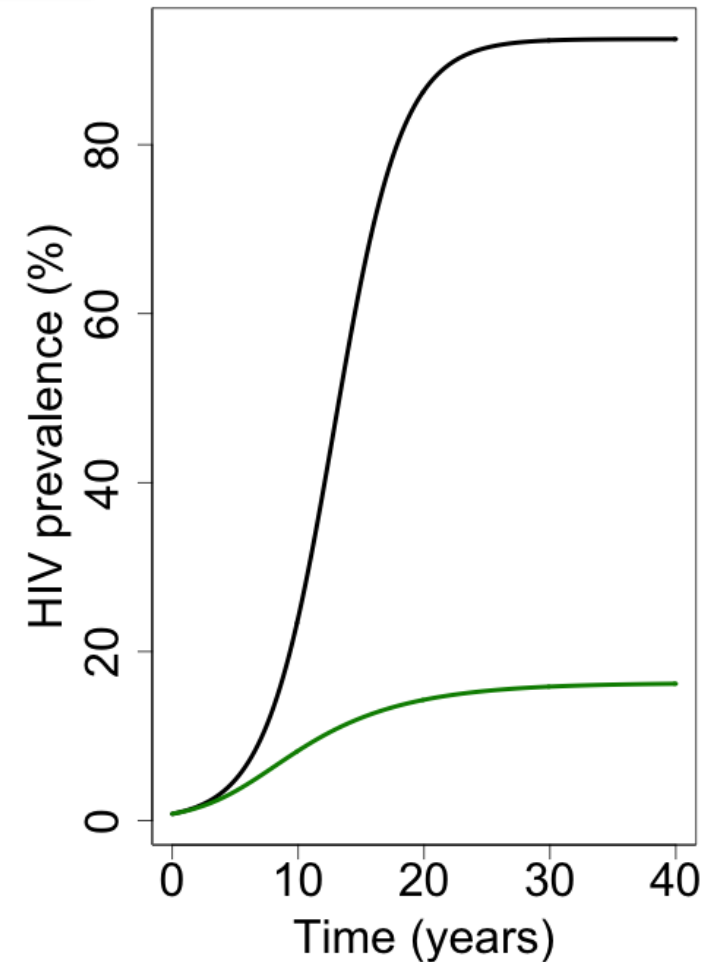
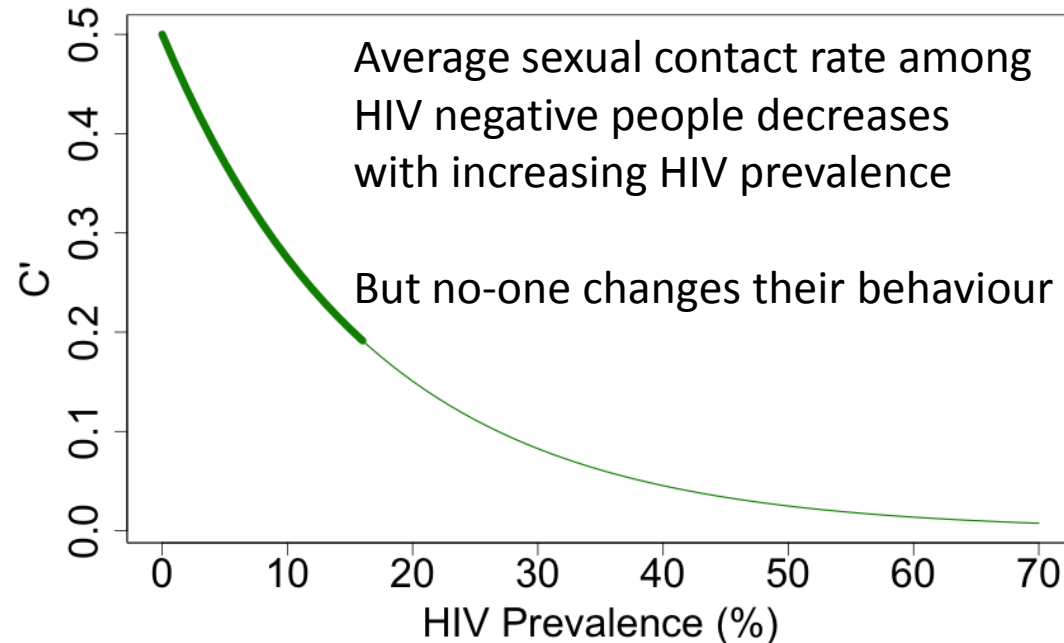
**Exposure to “some” behavioural change campaign**

# Frailty selection bias, but no behaviour change

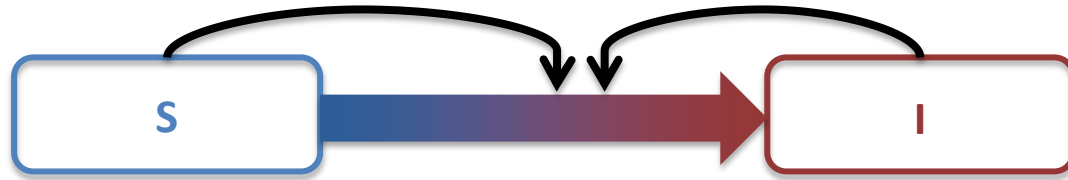


$$C' * P * S * I / (S + I)$$

$$C' = C * \exp(-a * (I / (S + I)))$$



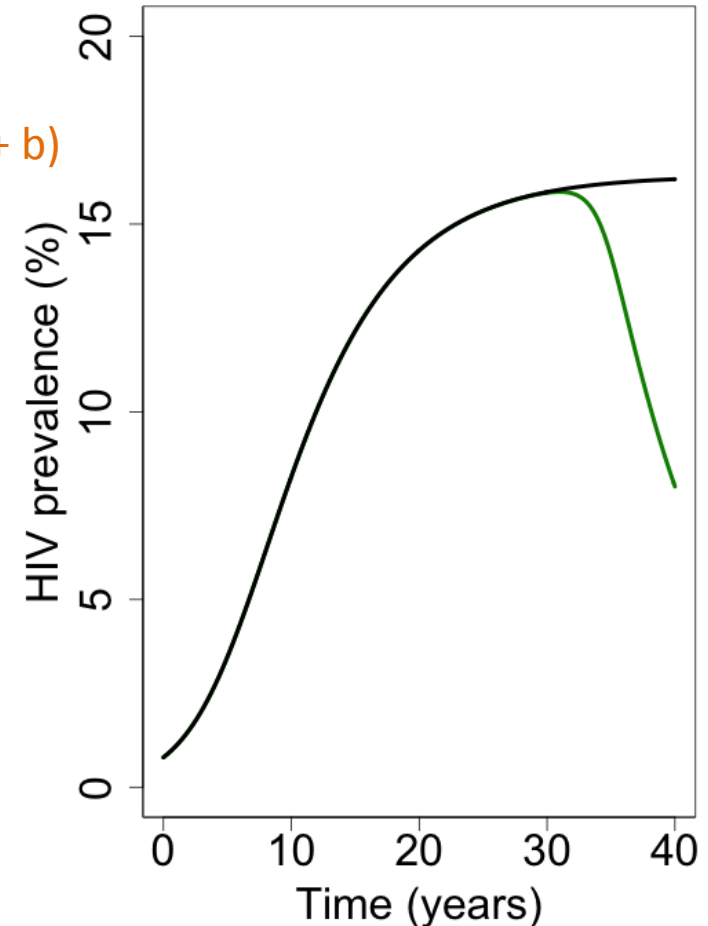
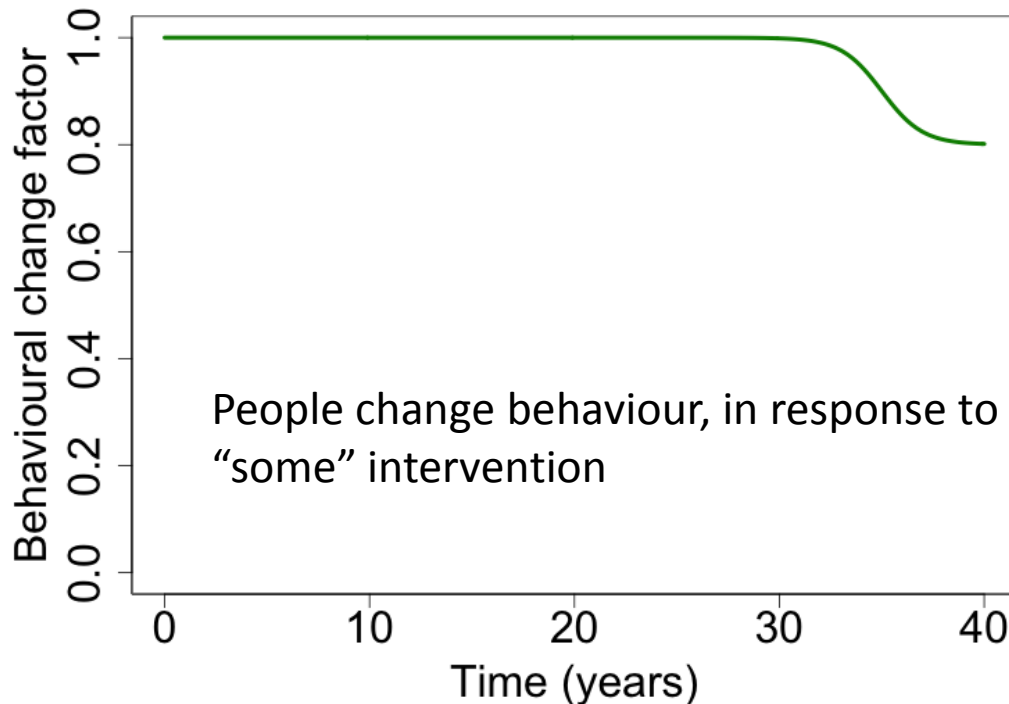
# Frailty selection bias, AND behaviour change



$$C'(t) * P * S * I / (S + I)$$

$$C0' = C * \exp(-a * (I / (S + I)))$$

$$C'(t) = C0' * ((1 - b) * \exp(d * (t - f)) / (1 + \exp(d * (t - f))) + b)$$



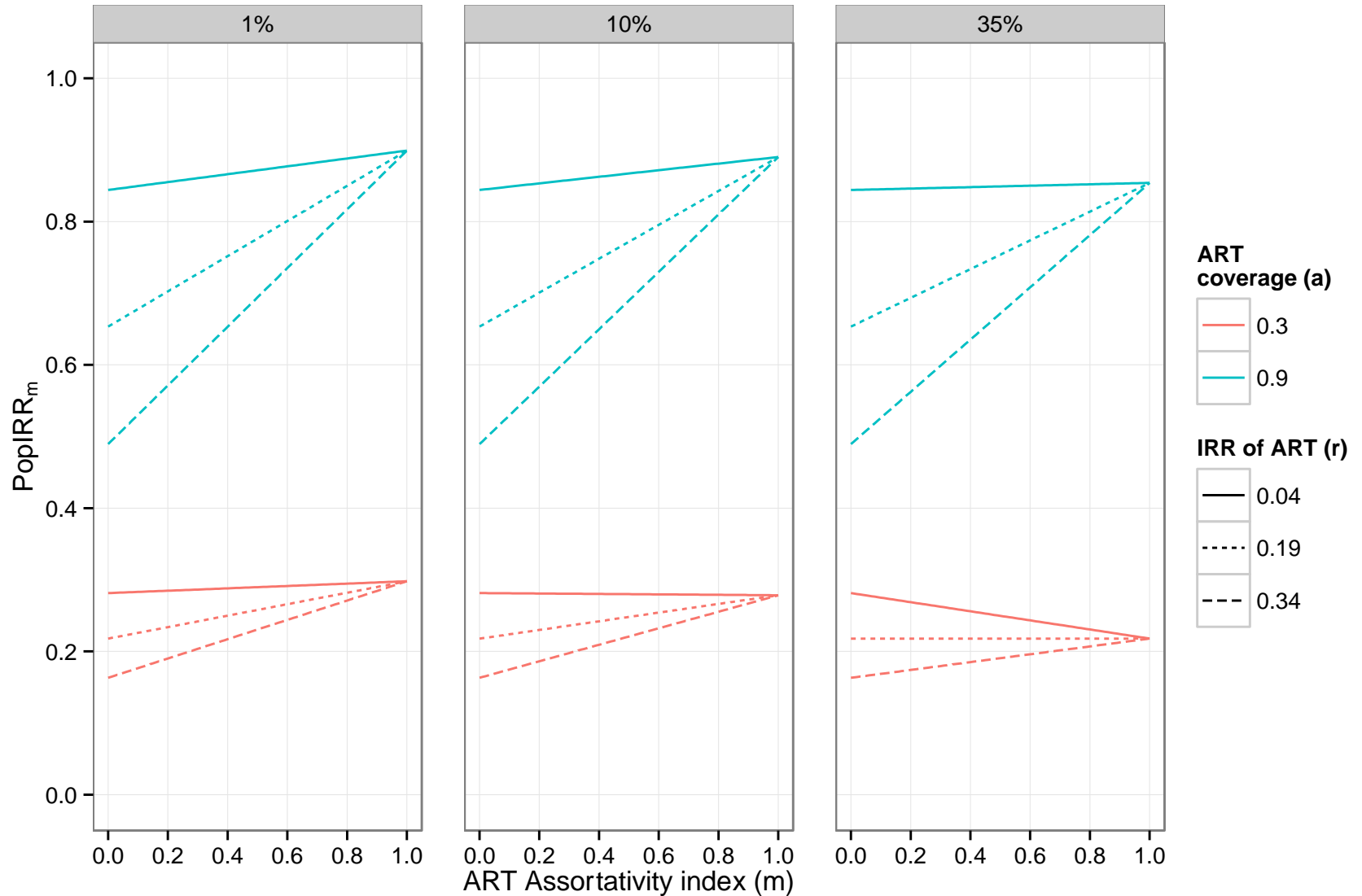


# How could ART assortativity emerge?

- People on ART prefer partners also on ART
- ART concordant couples are more stable
- People not on ART are more likely to start ART if their partner is on ART

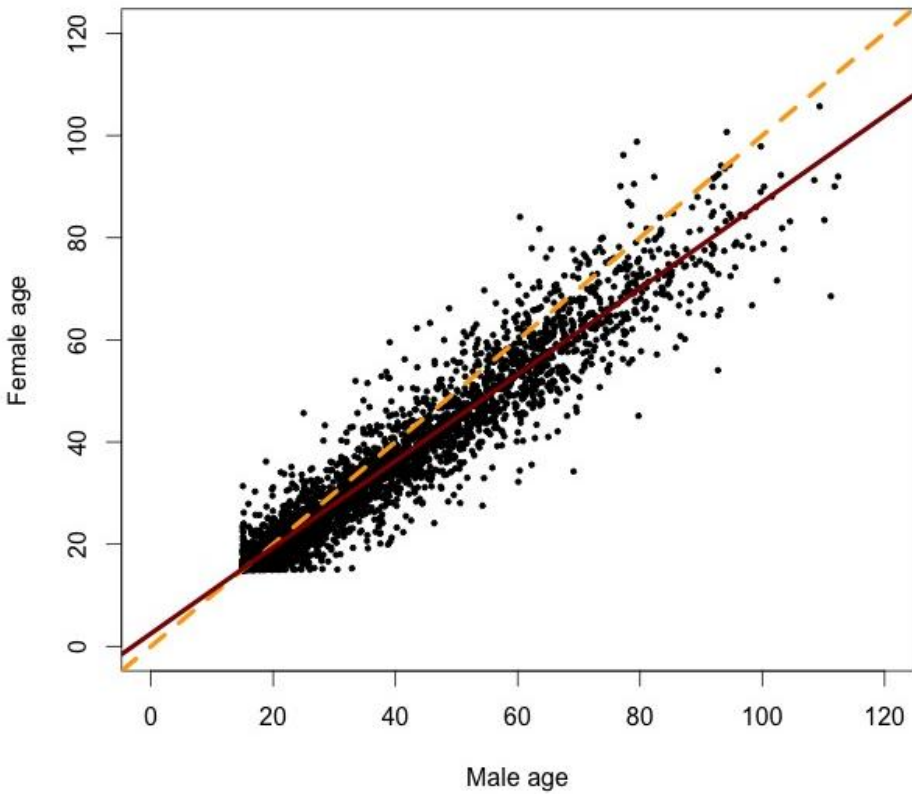


# Assortative mixing, by ART status



# Assortative mixing, by age

Age at time of relationship formation



Age at time of relationship formation

