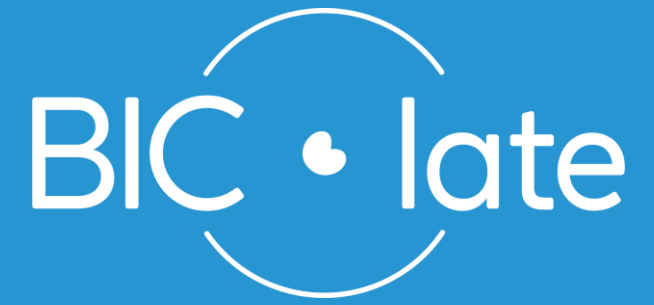




Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL



Contemporary Fecundity Curve of Europe

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Introduction

Context

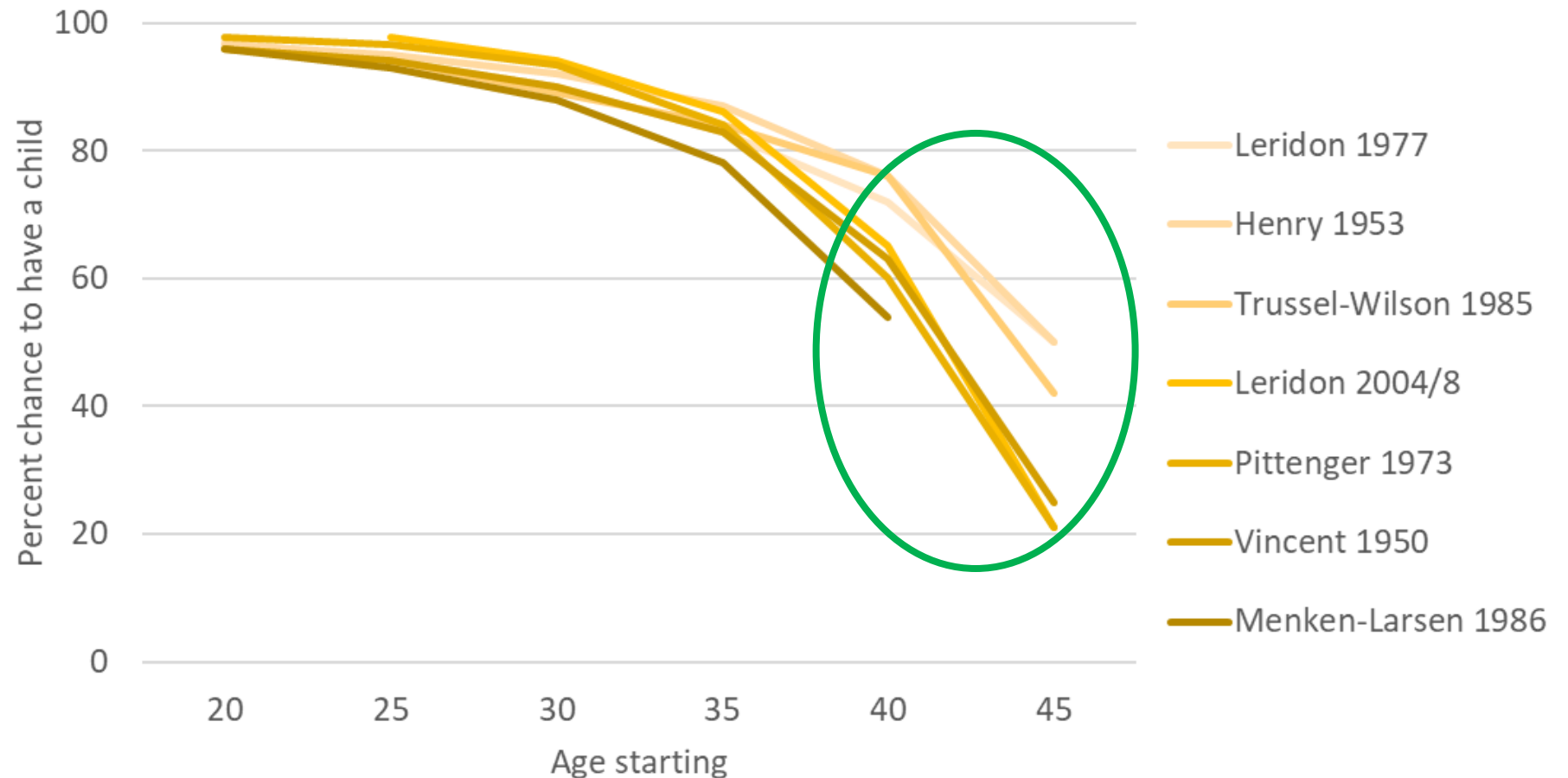
- The widespread use of contraception to prevent unwanted births, coupled with the diffusion of assisted reproduction, has led individuals and societies to **take the ability to have children for granted** (Menken et al, 1986)
- However, **historical fecundity curves** show a decrease in biological capacity to ever have a child with age
 - Especially after mid-30s
 - Endorsed by research on infertility and age (Somigliana et al. 2016)

 Fecundity – potential to ever conceive a child and carry the pregnancy to a live birth.

Biological chances to give birth to a live child based on historical data:

Large range of estimations, especially after age 35

Figure. Percent chance to give birth to a live child by age at first trying

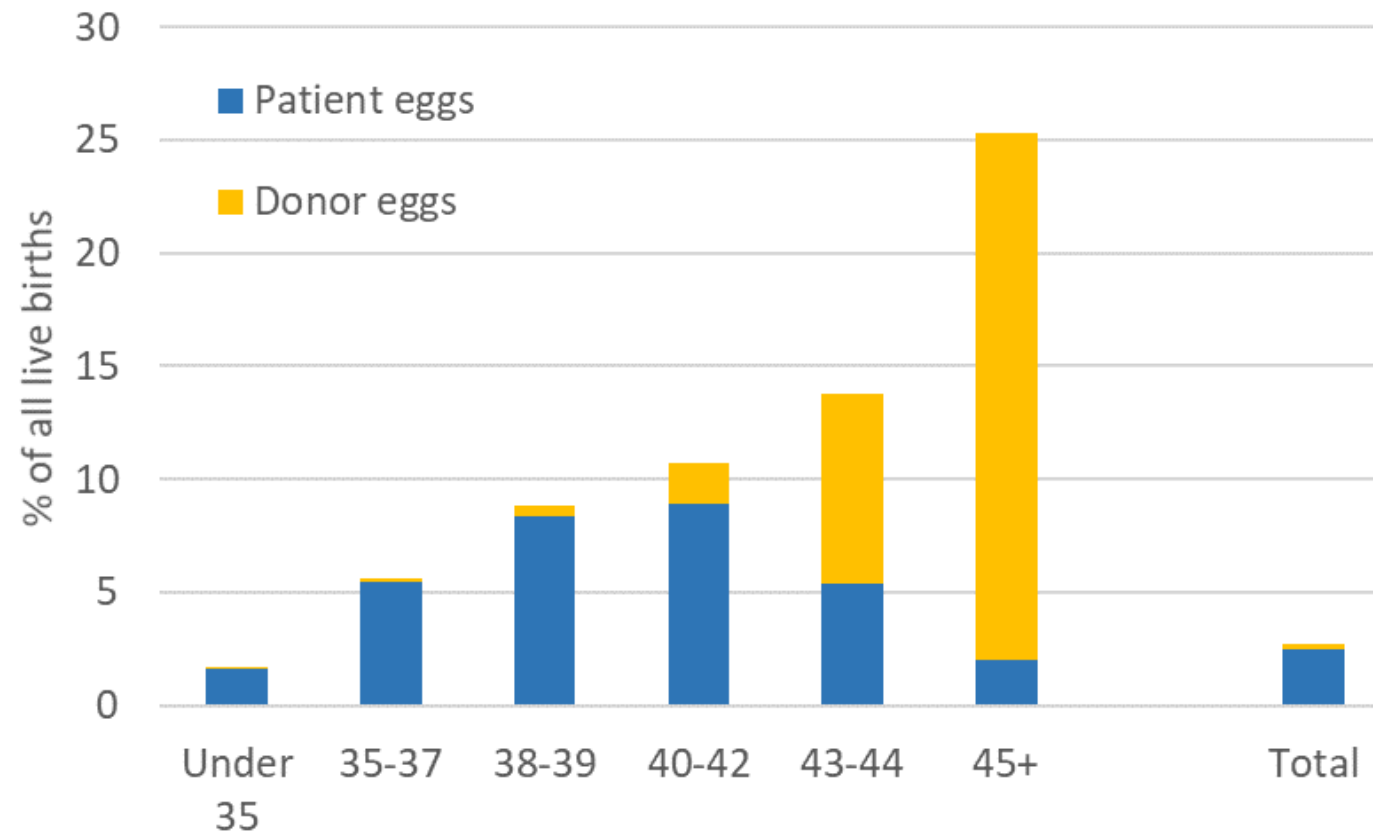


Contemporary fecundity curve

- **Two discourses** about fecundity in contemporary society:
 - Pessimism: Increase obesity, smoking, environmental toxins limits capacity to reproduce (Jick et al 1977; Mattison & Thorgeirsson 1978; Te velde et al. 2010; Skakkebæk et al 2022)
 - Optimism: Technological shifts and better awareness has increased fecundability at all ages (Stephen & Chandra 2006; Jensen et al 2005; Joffe 2000)
- In particular, assisted reproductive technologies (ART) **may alter age-specific fecundity patterns**,
 - We know that total fertility rates are increased by ART use, especially at older ages (Lazzari et al. 2021; Chanfreau et al. 2025)

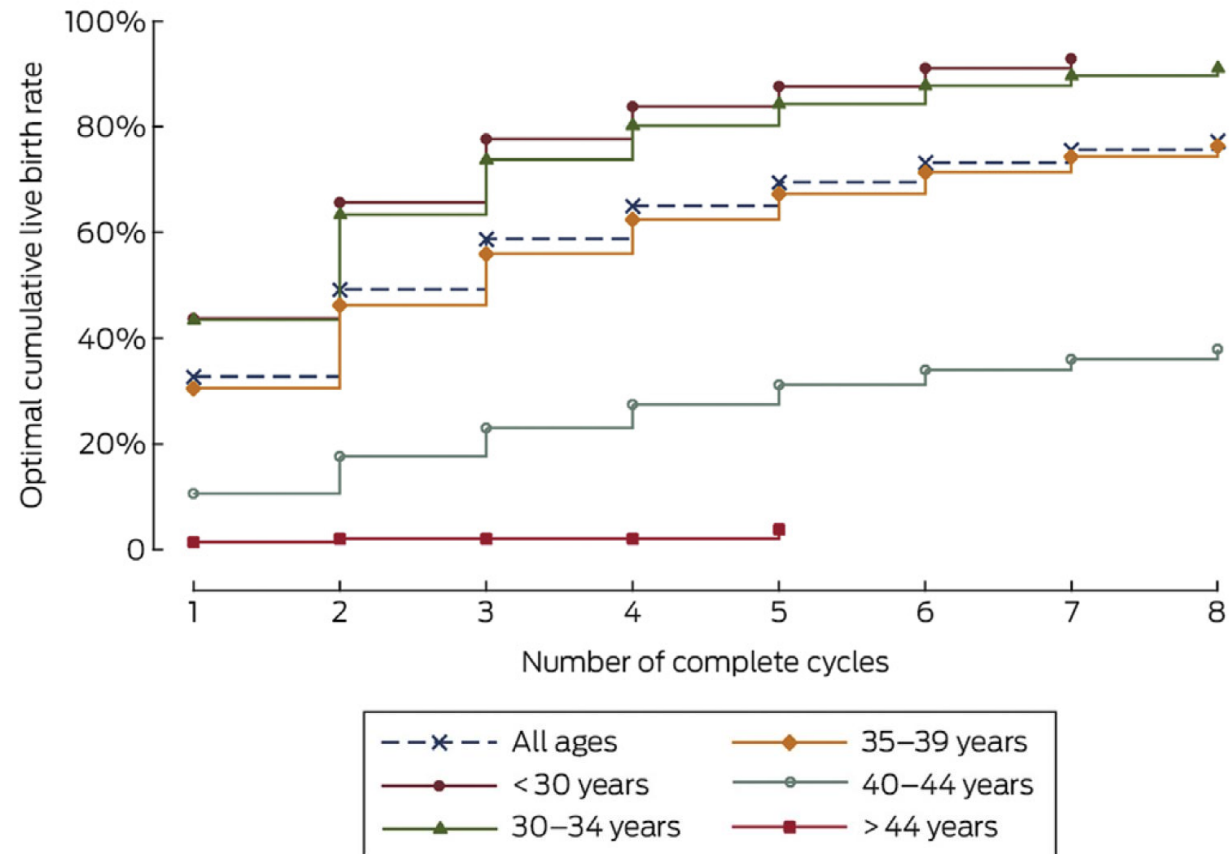
Share of live births resulting from IVF/ICSI surges with age, example of the UK

Figure. Share of all live births by age that follow an IVF/ICSI treatment, UK, 2018



But ART efficacy also diminishes with age

Figure. Cumulative live birth rates for women in Australia and New Zealand commencing assisted reproductive technology treatment during 2009-2012 and followed until 2014 or the first treatment-dependent live birth



Source: Chambers, G. M., Paul, R. C., Harris, K., Fitzgerald, O., Boothroyd, C. V., Rombauts, L., et al. (2017). Assisted reproductive technology in Australia and New Zealand: cumulative live birth rates as measures of success. *Medical Journal of Australia*, 207(3), 114–118. <https://doi.org/10.5694/mja16.01435>

Aim

- (1) Provide a clear and **up to date** assessment of the chances of women **and men** to ever have a child depending on the age at which **they start trying** and for **given duration (5, 6, 7 years)**.
- (2) Estimate the **importance of IVF/ICSI on population fecundity** in the German population

Data and method



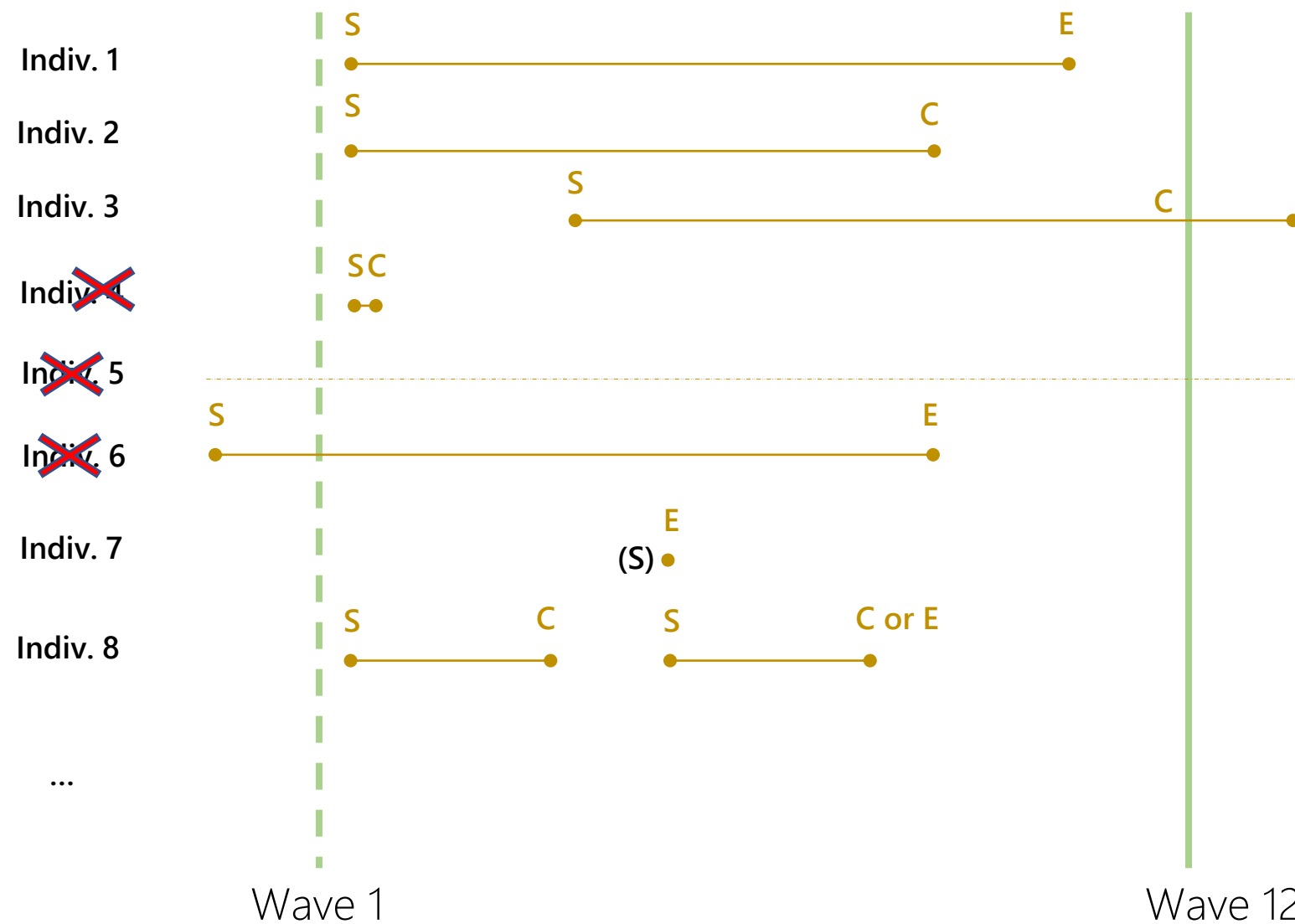
Data: pairfam panel

- pairfam (starting in 2008)
 - German yearly panel data (waves 1-13)
 - Three birth cohorts aged 15-17, 25-27 and 35-37 years
 - Recruitment occurred in two waves: 2008 and a replacement sample in 2018
- Survey sample and attrition
 - Response rate about 50%
 - Attrition: 23% Wave 1-2, then decrease to about 7% each year
 - We use the survey's calibrated design weights that (possibly partly) correct for attrition (Wetzel et al. 2021)

Survey question (asked at each wave)

- Have you tried to have a child since the last interview (males)? Have you tried to get pregnant since the last interview (females)?
 - Pre-question filter: respondents who are expecting a child
 - 4.7% of all observation spells were spent trying to have a child
- Outcome: childbirth

Life table - people at risk when trying to have a child



S: Start of episode: started trying to have a child

E: pregnancy leading to a live birth OR change in parity

C: censoring event (Birth OR Panel attrition OR stop trying)

Clock is duration since trying in years

Summary population “at risk”

- Those who said they are trying to have a child and...
 - Are in a couple or just broke up
 - Heterosexual or homosexual (female) couples
 - Recorded trying for the first time *after* the first interview
- Also includes:
 - People only seen pregnant never seen trying (because of the pre-filter on the survey question for pregnant women)
 - Short breaks (stopping for less than 3 years, most of them only for one year)

Reducing total sample to final sample step by step

Selection step	Person-years remaining
<i>Initial data cleaning</i>	
Total person-years (Waves 1-13)	99,260
(-) Remove observations for singles	65,850
(-) Remove inconsistent gender or sex change entries	65,496
(-) Remove men in same-sex relationships	65,503
(-) Exclude refreshment sample (Wave 11 anchors)	59,361
(+) Impute person-years for temporarily missing waves	62,803
<i>Defining at-risk population for conception</i>	
(-) Remove person-years after a live birth	50,551
(-) Retain only person-years with reported trying, pregnancy, or birth	11,263
<i>Handling left-truncation for main analysis</i>	
(-) Remove individuals already trying at first interview	4,403
<i>Handling discontinuous attempts</i>	
(-) Remove attempts with a break of over 3 years since a previous attempt	3,170
Final analytical sample (person-years)	3,170

Note: The final row represents the person-years for the main analytical sample (Version 2 in Table S2), which is restricted to conception attempts that begin after panel entry.

Table S1: Derivation of the analytical sample from Pairfam person-year data.

Method: estimated probability to have a child within 5, 6 and 7 years of trying

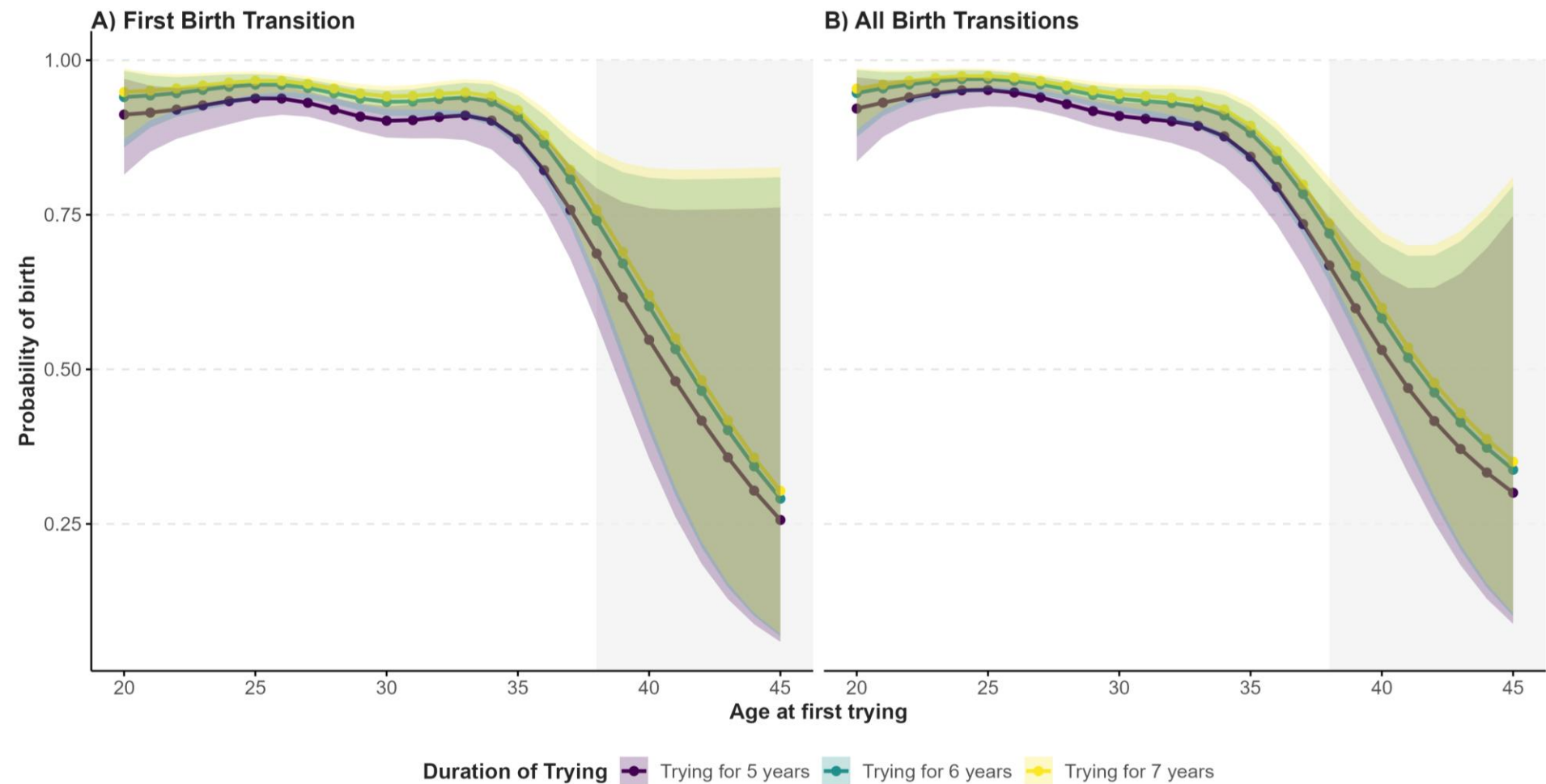
- Estimates of capacity to have a live birth by age at first trying
- Stratified:
 1. Childless versus higher parity women
 2. Female versus male
 3. With and without use of IVF/ICSI
- We use a cox model using **penalized splines** to flexibly create a fecundity curve.

Results



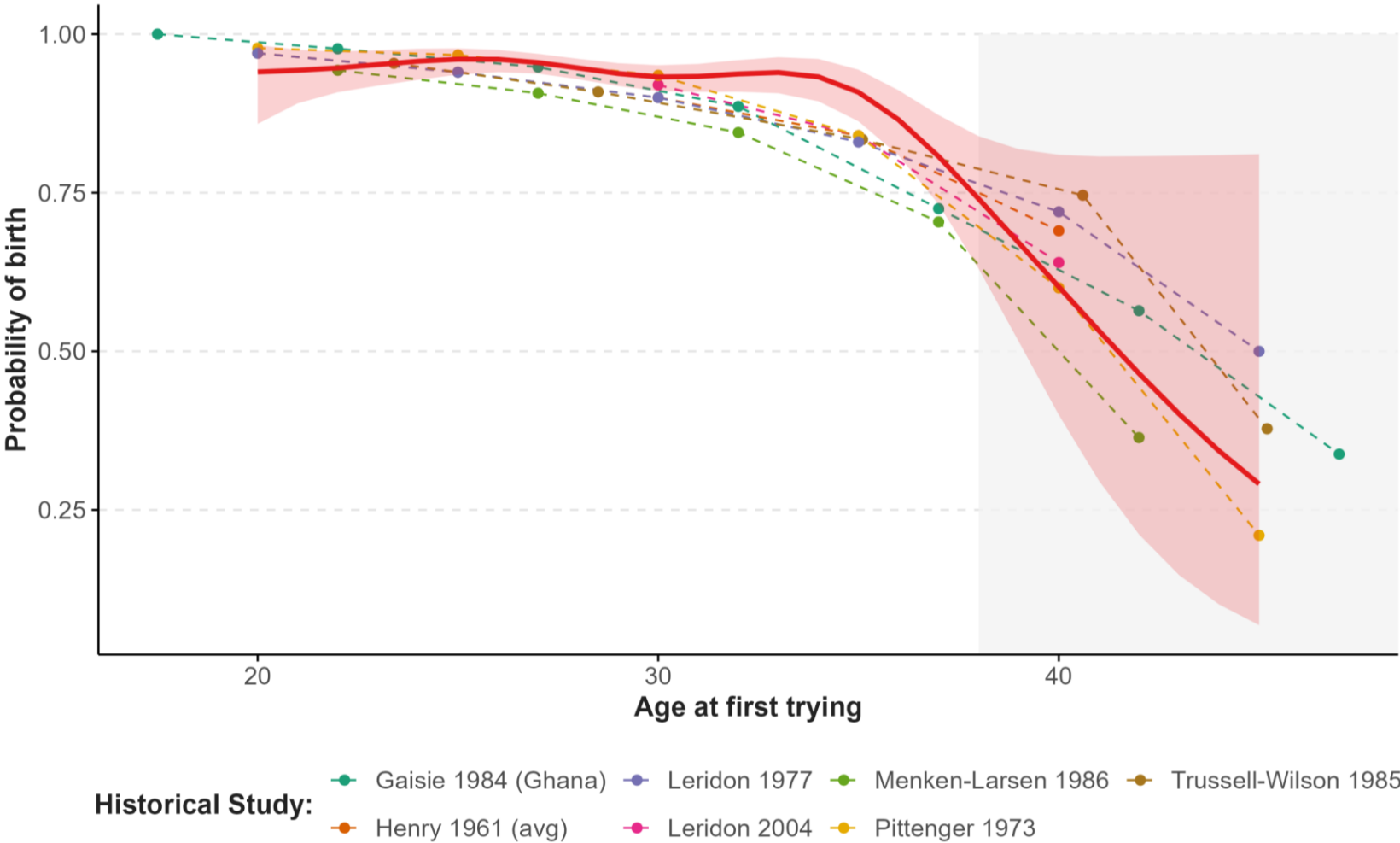
Increased likelihood of conception with attempt duration, marginal increase after 6 years

Figure. Probability to have a child within 5, 6 & 7 years from starting trying, stratified by parity



Probabilities to have a child rather stable up to the mid-30s and decrease afterwards

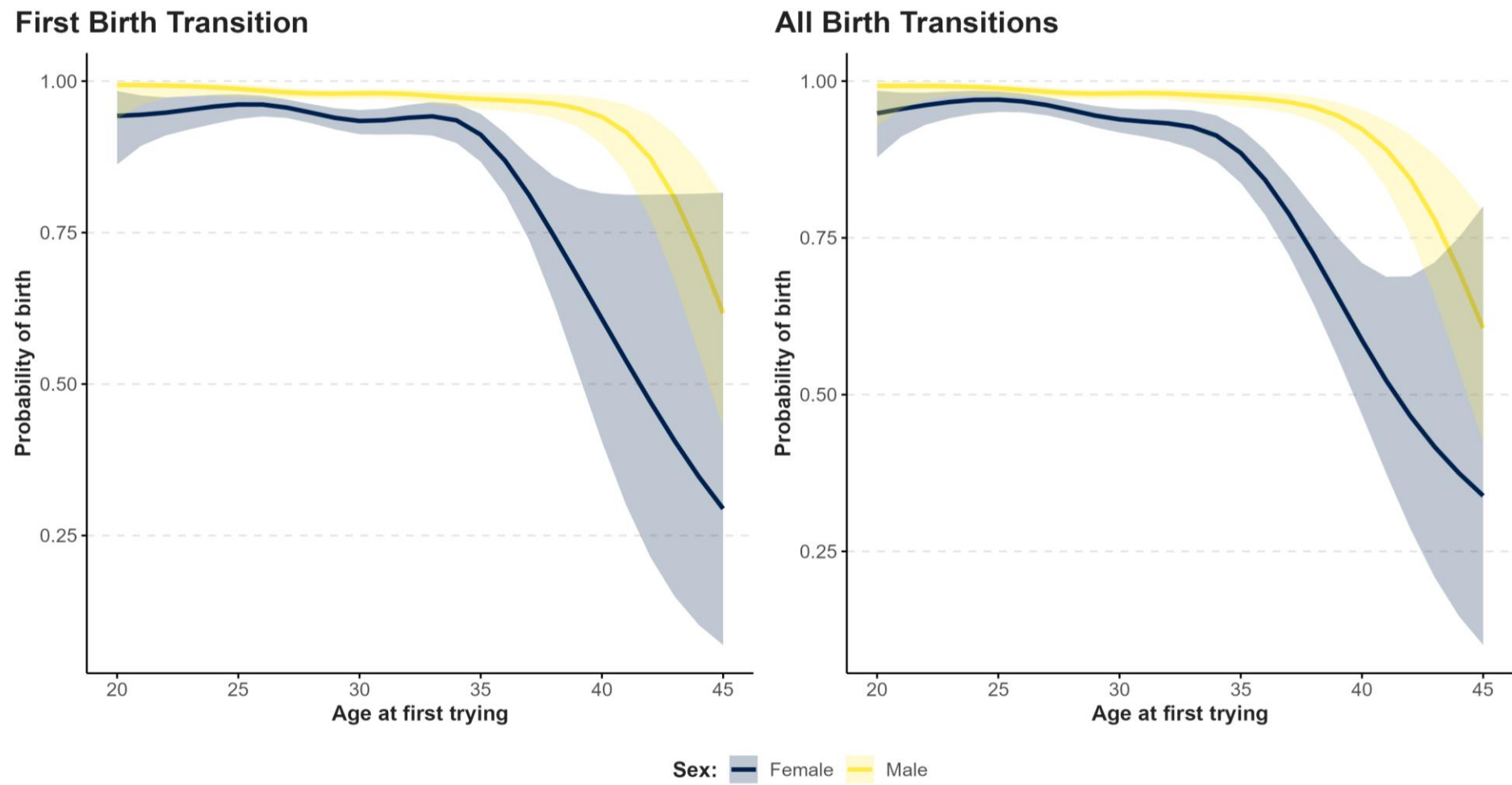
Figure. Probability to have a child **within 6 years** from age when starting trying childless women, versus historical studies.



Success chances higher among men than women after age 35, but a fast drop from age 40

Figure. Probability to have a child **within 6 years** from starting trying, stratified by gender and parity.

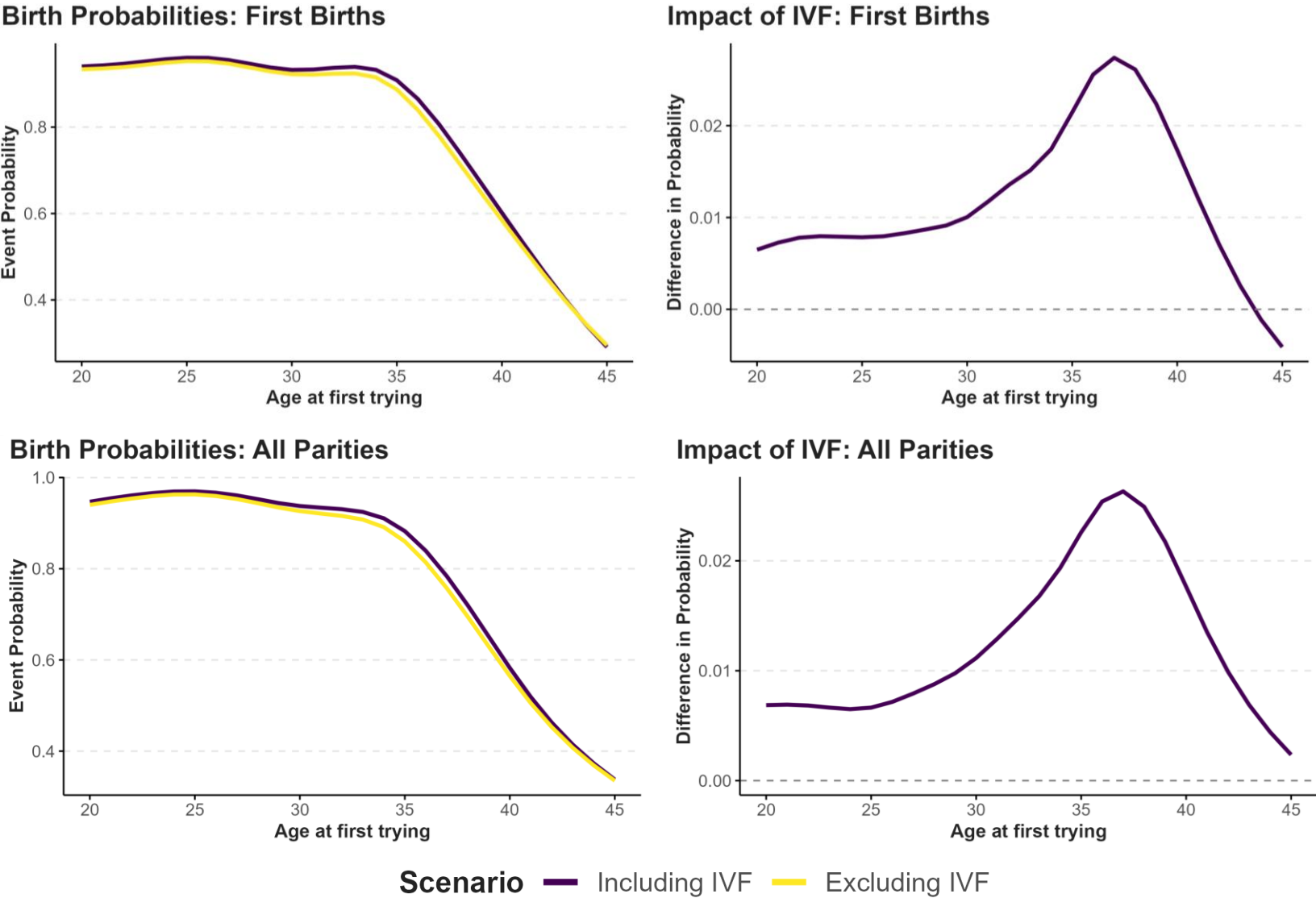
- Probably linked to the age of the partner
- Men may be less accurate in reporting reproductive attempts, which is our denominator



IVF/ISCI use has an impact in the late 30s that quickly decreases afterwards

Figure. Probability to have a child **within 6 years** from starting trying, including and excluding IVF/ISCI use, stratified by parity

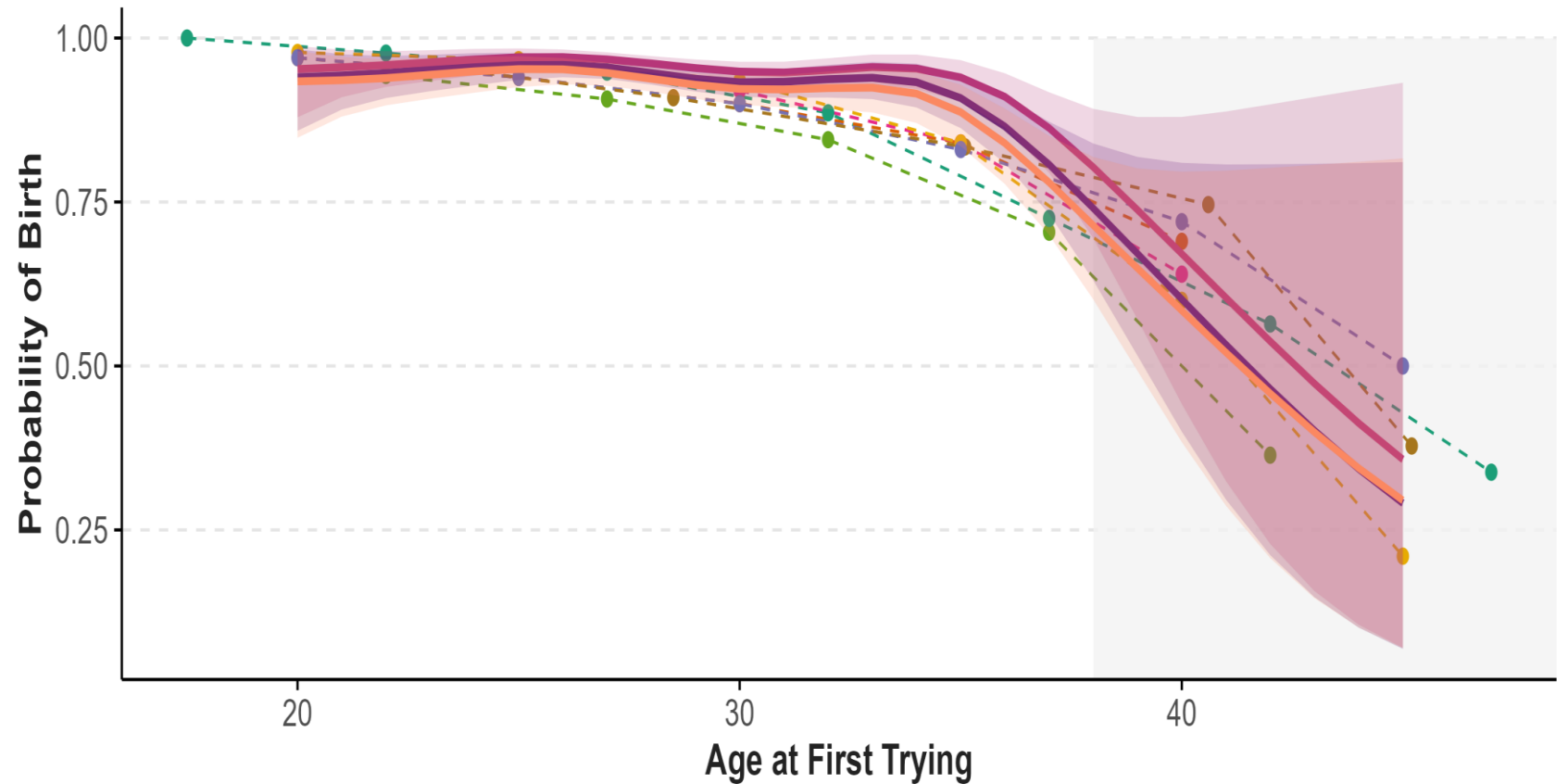
+ difference in probabilities by age between the two curves



Attempt to deal with the possible selection of less fertile women at older ages

Figure. Probability to have a child **within 6 years** from age when starting trying childless women, versus historical studies

- All women
- Excluding IVF/ICSI conceptions
- Excluding women with declared infertility



Contemporary Estimate:

— Excluding ART — Excluding Infertile — Full sample

Conclusions



Conclusions

- We find **statistically significant** differences between fecundity by age in **contemporary** and **historical** populations only in the mid-30s
- Strong **decrease** in the effectiveness of trying for an additional year after 6 years
- **Men's** likelihood of having children is **not lower** than women's, and it **starts decreasing at a later age**
- IVF increases the probability of having children up to 3% in the population in the mid-30s, but the benefit decreases sharply at older age.
 - Current IVF technology cannot mitigate the age-constraints of fecundity



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