Global population decline: Could ART be the solution?

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This talk

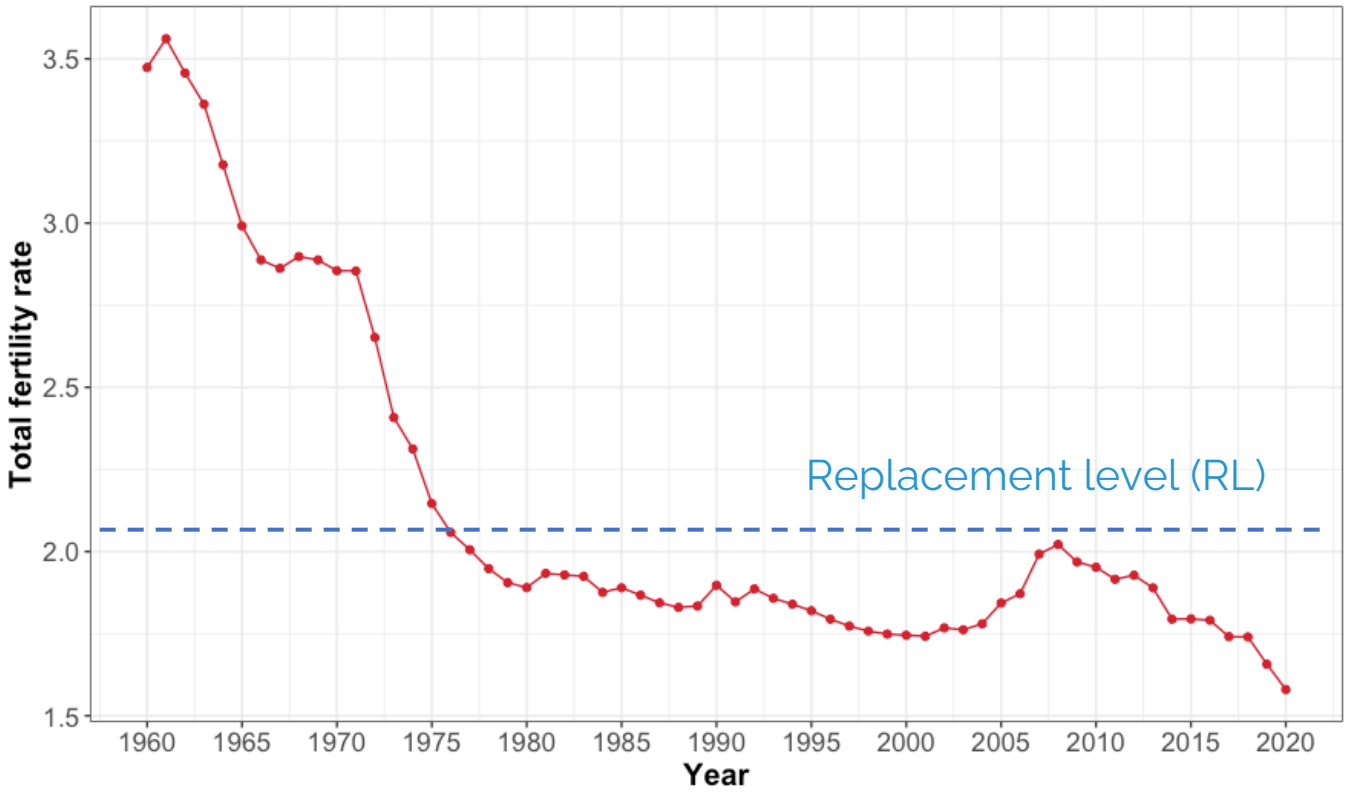
1. The demographic rationale for policies supporting ART
    - Changing reproductive attitudes
    - Age-related infertility
2. Contribution of ART to human reproduction
    - Impact on current birth rates
    - Projections
3. Could ART be the solution to low fertility rates?
    - Challenges and opportunities (i.e., oocyte cryopreservation)

Insights from:

1. Lazzari E, Baffour B & Chambers GM. (2022). Residential proximity to a fertility clinic is independently associated with likelihood of ART and IUI treatment. ***Human Reproduction*** 37(11): 262-2671
2. Lazzari E, Compans MC, and Beaujouan E. (*Conditional acceptance*). Changing childbearing age norms in Europe in times of fertility postponement. Resubmitted to ***Population Studies***
3. Lazzari E, Gray E & Chambers GM. (2021). The Contribution of Assisted Reproductive Technology to Fertility Rates and Parity Transition: An Analysis of Australian Data. ***Demographic Research*** 45 (9): 1081-1096.
4. Lazzari E, Potancokova M, Sobotka T, Gray E, and Chambers G. (2023). Projecting the Contribution of Assisted Reproductive Technology to Completed Cohort Fertility. ***Population Research and Policy Review*** 42(6)
5. S Choi, E Lazzari, C Venetis, and GM Chambers. (2023). Can medically assisted reproduction be used as a tool to reverse declining fertility rates? ***The Lancet Regional Health - Western Pacific*** *33*

Part 1.
The demographic rationale for policies supporting ART

Low total fertility rate (TFR)



F1. Total fertility rate (TFR), Australia, 1960-2020.
Data: Australian Bureau of Statistics (ABS)

- **Age-specific fertility rate** (ASFR)= Births at age x / Women at age x
- **Total fertility rate** = Sum of ASFR
- Population decline can occur when the TFR falls below RL
- ~ half of the world population lives in countries with a TFR < 2.1 (United Nations 2017)
- Negative impacts of an ageing population (Lutz et al. 2003)
- Policy attention focused on increasing fertility rates

Gap between desired and achieved family size

Most people want 2 children but fall short of their expectations (Beaujouan & Berghammer 2019):

- Barriers to the realization of their childbearing plans
- Window of opportunity for policy intervention

Preferences about *when* to have children have changed (similar family sizes but at later ages)

- Increasing shares of people in their 30s and 40s wish to have a child in the future (Beaujouan 2022; Lazzari et al. 2023)

Childbearing postponement

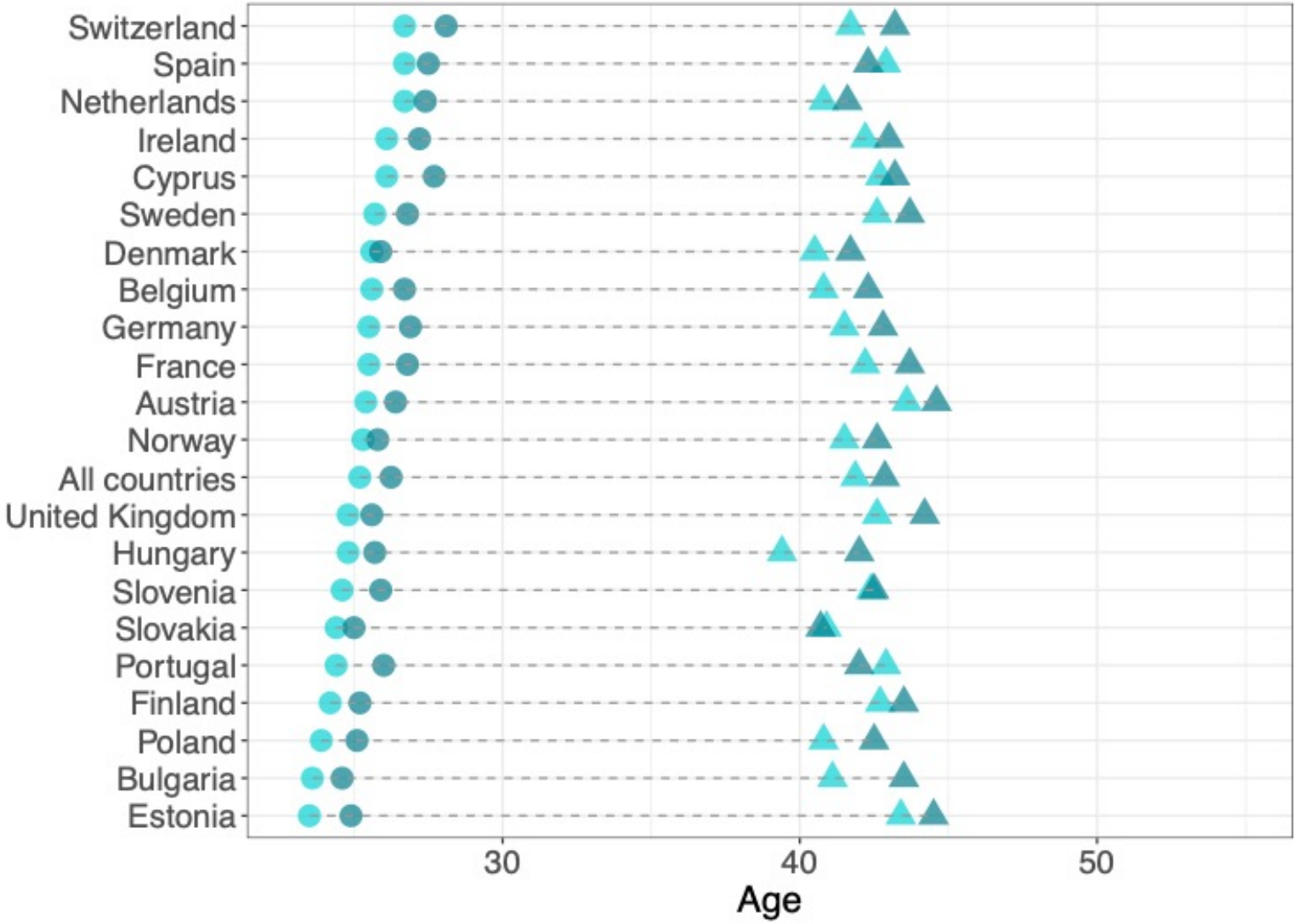
- Increasing mean age at first birth and prevalence of late births at a rate that is historically unprecedented

23% of first-time mothers aged 30 or above in 1991 vs 53% in 2020 (AIFS 2023)

5% of first-time mothers aged 35 or above in 1991 vs 17% in 2020 (AIFS 2023)

- Why do people postpone parenthood?
    - Higher opportunity-cost of having children young (Longer enrolments in education, Increased participation of women in the labour market, Housing conditions, Lack of supportive family policies (i.e., childcare subsidies) (Mills et al. 2011))
    - Change in reproductive preferences and values (longer (healthy) life expectancy, re-partnering at later ages (Gray 2015), …)

Changing reproductive preferences…



The societal expectation for women and men to delay starting families until after ~28 has become commonplace

F2. Change

in the social reproductive window for motherhood

Data: European Social Survey (Rounds 3 & 9)

Source: Lazzari, Compans, and Beaujouan (2023)

The demographic rationale for policies supporting ART

Childbearing postponement is an important driver of the decline in births.

Strong link between childbearing postponement and:

- Lower completed family size (macro-level) (Grey et al. 2022)
- Underachieved fertility desires (micro-level) (Habbema et al. 2015)

Decrease in male and female fecundity with age

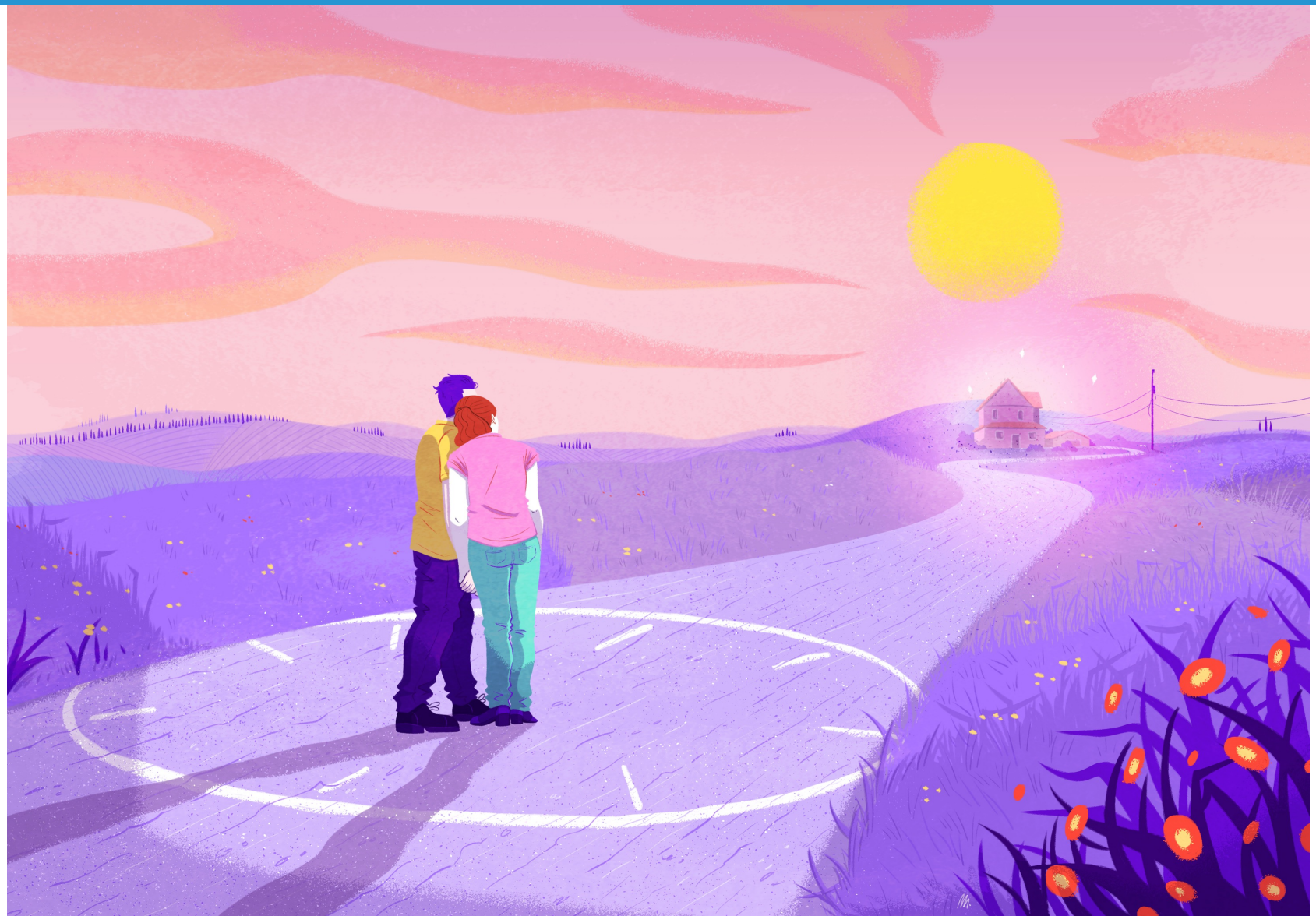
- 66% of women trying to conceive at age 35 will have a birth within 1 year, and 44% at age 40 (Leridon 2004)

Yet, more and more people choose to delay parenthood:

- Need for policies addressing infertility

Infertility presents a significant challenge to reproduction in contemporary societies where childbearing is often delayed until later in life. The use of assisted reproductive technologies may help overcome these obstacles and hence support childbearing.

Part 2.
The contribution of ART to human reproduction



Evidence so far and our empirical work

- ART reports (no. of ART cycles per 1,000 women (20-49), share of ART births)
- Few demographic studies found a small overall impact of the order of 2-5% (i.e., Hoorens et al. 2007; Tierney & Cai 2019; Sobotka et al. 2008)
- Projections are also lacking, but they are useful to understand ART potential
- Our study:
  - Estimate the contribution of ART to the total fertility rate (2010-17) and cohort completed family size (1968-86) **by age**
  - RQ: To what extent is ART supporting the recovery of childbearing at later ages?
  - Setting: Australia, relatively high proportion of ART births and supportive funding system (Chambers et al. 2014)
  - Data: Australia and New Zealand Assisted Reproduction Database (ANZARD)

The contribution of ART to total fertility rates in Australia

	2010	2017
Total fertility rate	1.95	1.74
Total fertility rate due to ART	0.08	0.09
Total fertility rate due to ART (%)	4.1%	5.0%

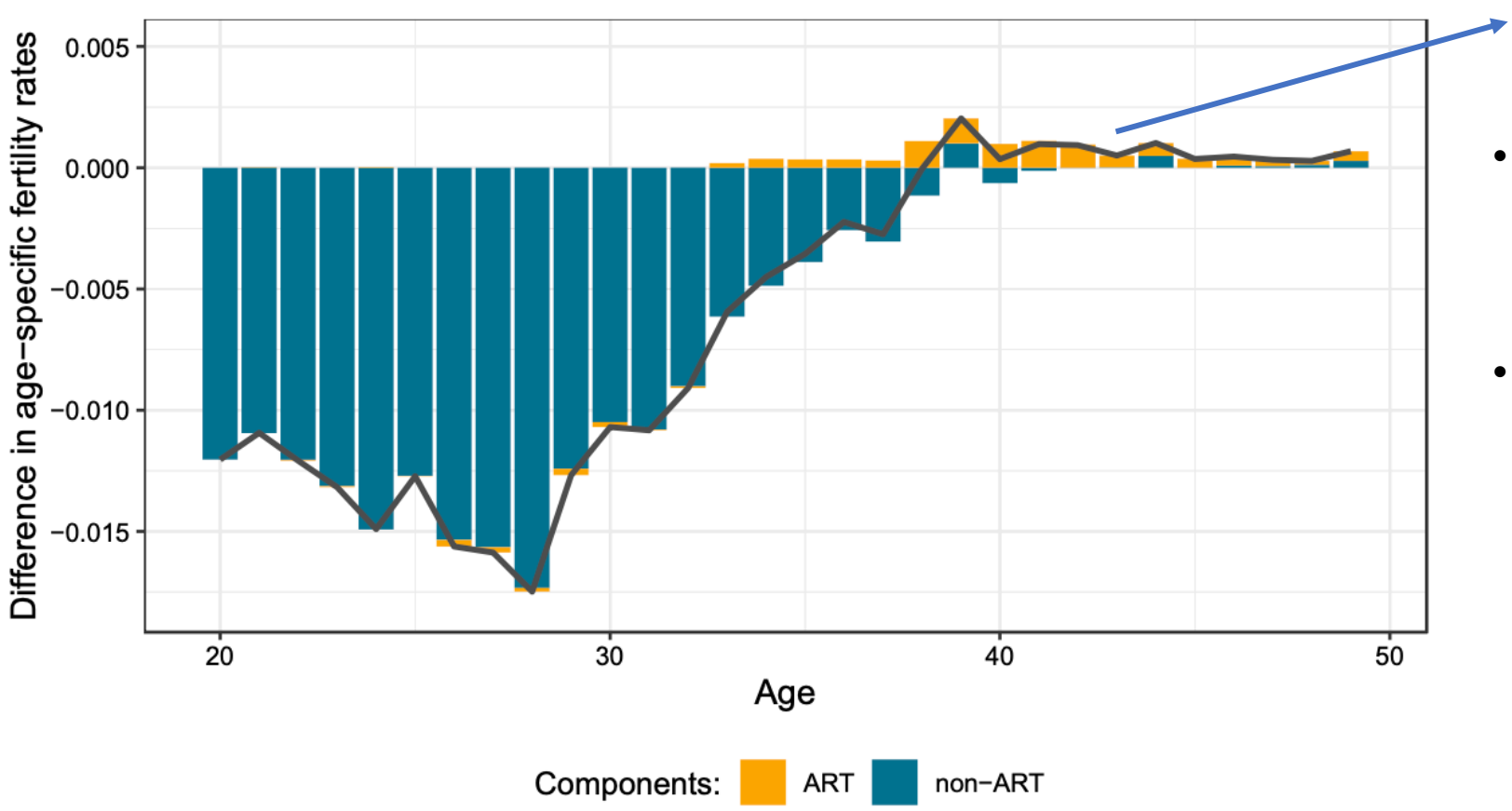
T1. Contribution of ART to the TFR and summary statistics *Data: ANZARD and ABS data.* **Source: *Lazzari, Gray, and Chambers (2021)***

Likelihood of a child being ART-conceived increases with age:

- 1 in 100 babies conceived using ART at age <=30
- 1 in 5 babies born to women aged 40-44
- 1 in 3 babies born to women aged 45+

More commonly used for first births rather than for subsequent births

The contribution of ART increases with mother's age



- Partial childbearing recovery (the TFR has declined)
- Mostly driven by the increasing use of ART at age 32+

F3. Changes in age-specific ART and non-ART fertility rates between 2010 and 2017, Australia *Data: ANZARD and ABS data* **Source: *Lazzari, Gray, and Chambers (2021)***

Projection models

What is the impact of ART on the final family size of real cohorts of women that are currently still in their childbearing years?

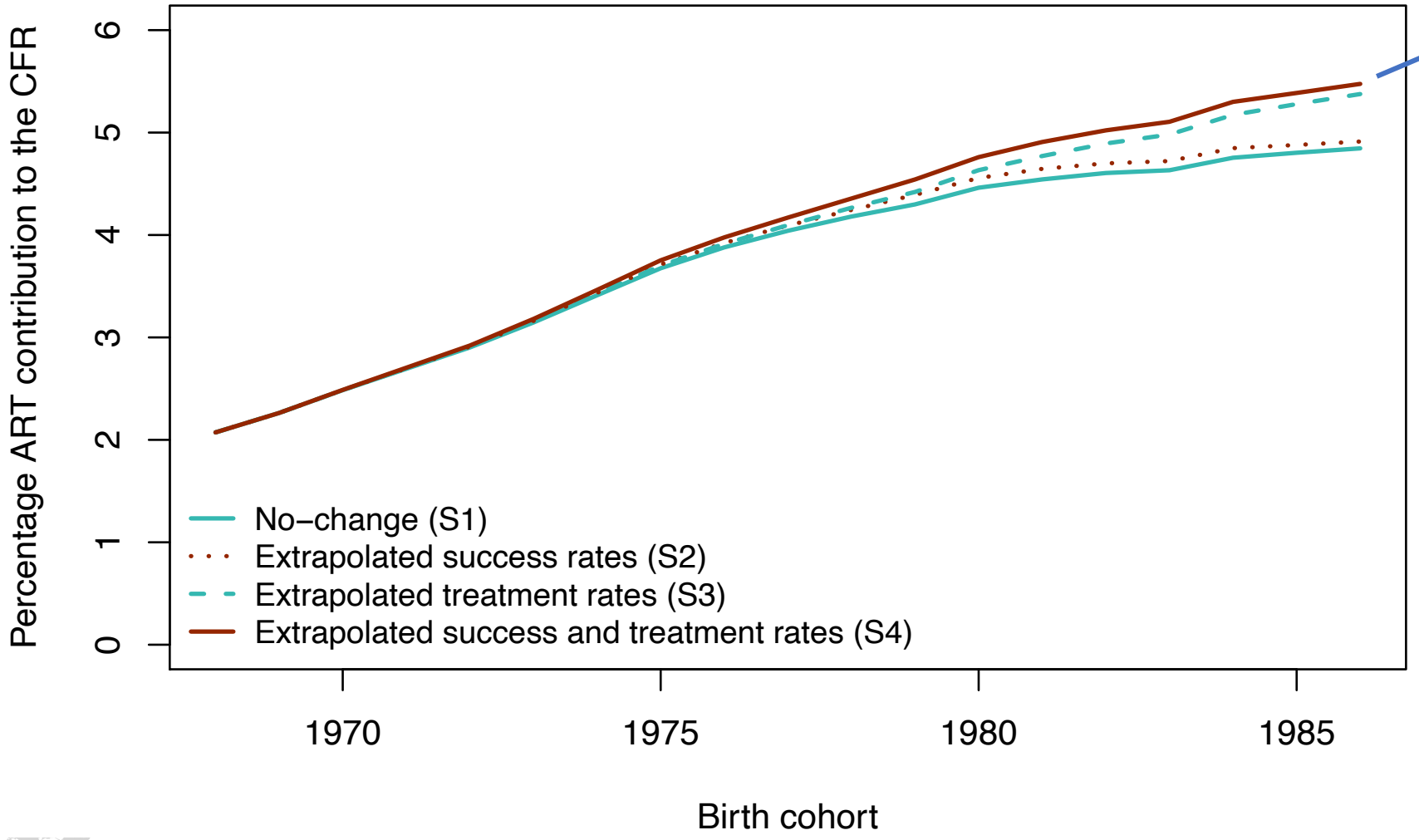
Cohorts 1969-1986 aged 31-48 in 2017

The model bring together information on 3 aspects of change:

- Childbearing postponement
- Treatment rates (**TR**) (share of women using ART treatment)
- Success rates (**SR**) (share of women having a baby after using ART treatment)

Combined in *4 what-if scenarios*

Projected contribution of ART to completed family size

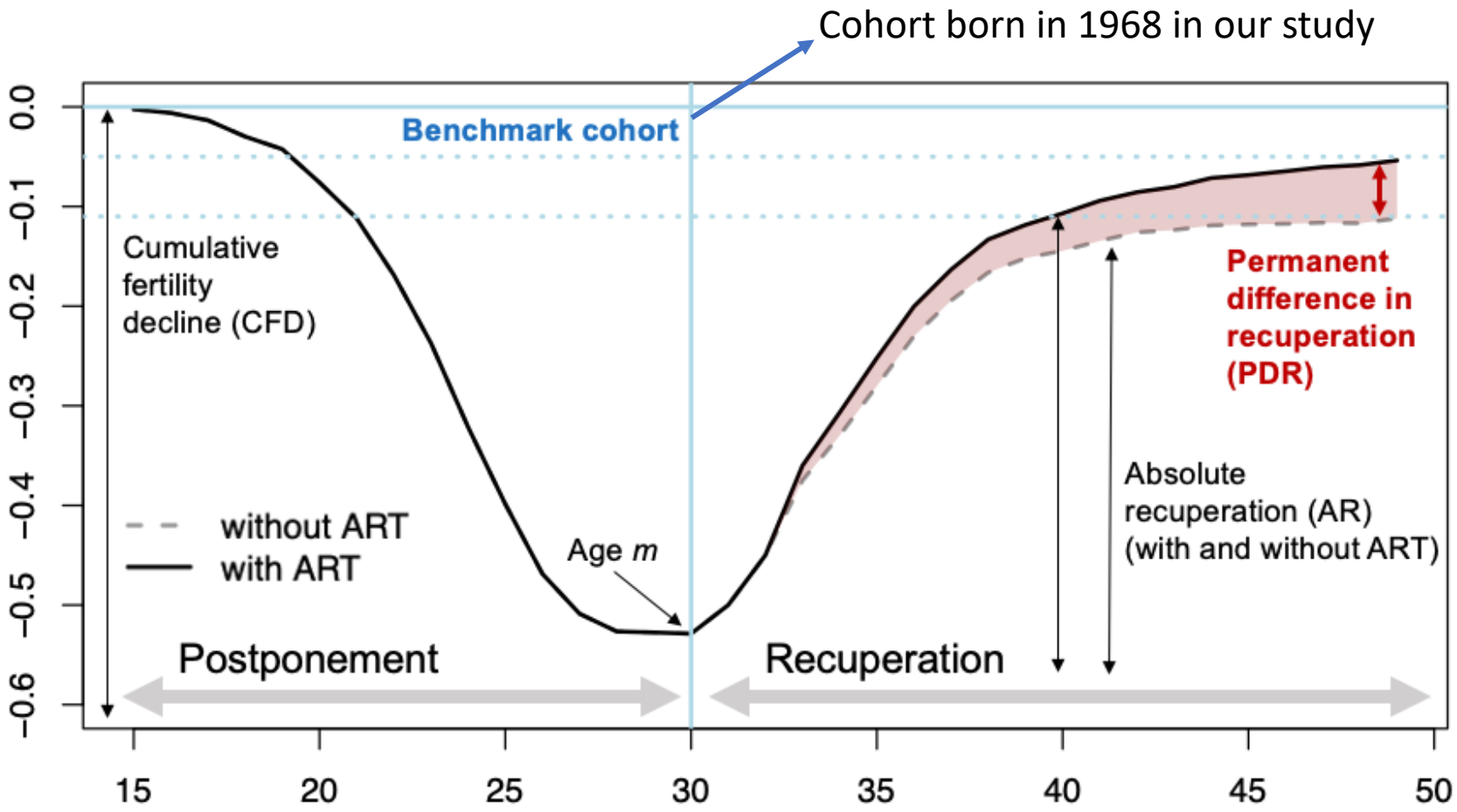


5.5% (cohort born in 1986)

Mostly due to an increase in the demand for treatment rather than to an increase in the effectiveness of treatments

F4. Observed (1968) and projected (1969-86) contribution of ART to completed family size *Data: ANZARD and ABS data* **Source: *Lazzari et al. (2023)***

Childbearing postponement and recovery



F5. A simplified scheme of postponement and recuperation, indicating the potential contribution of ART *Data: ANZARD and ABS data* **Source: *Lazzari et al. (2023)***

Results

	Birth cohort		
Year of birth	1974	1980	1986
Age at forecast in 2017	35	33	31
(a) Projected cumulated fertility decline (CFD) in CFR by age 30*			
Without ART	0.176	0.221	0.270
With ART (all scenarios)	0.169	0.209	0.257
(b) Projected absolute recuperation (AR) above age 30*			
Without ART	0.110	0.092	0.065
(%)	(62.5)	(41.7)	(24.0)
No-change Scenario (S1)	0.169	0.164	0.139
(%)	(100)	(78.5)	(54.1)
Extrapolated success and treatment rates Scenario (S4)	0.171	0.170	0.151
(%)	(100)	(81.2)	(58.6)

T2. Contribution of ART to childbearing recovery *Data: ANZARD and ABS data*
Source: *Lazzari et al. (2023)*

Summary

- Contribution to:
  - the total fertility rate (2017) of 0.09 (5% increase)
  - completed family size (cohort born in 1986) of up to 5.2%
- Up to 1 in 3 children born to women aged 45-49 are ART-conceived (1 in 4 at age 40-44)
- Projections indicate an increasing trend mostly supported by increasing demand for treatment
- Large impact on childbearing recovery
- Yet, recuperation seems to be only partial
  - permanent decline in completed family size
  - The total fertility rate remains below replacement level
- Some births conceived through ART may have occurred without treatment (overestimation)

Part 3.
Could ART be the solution to human reproduction?

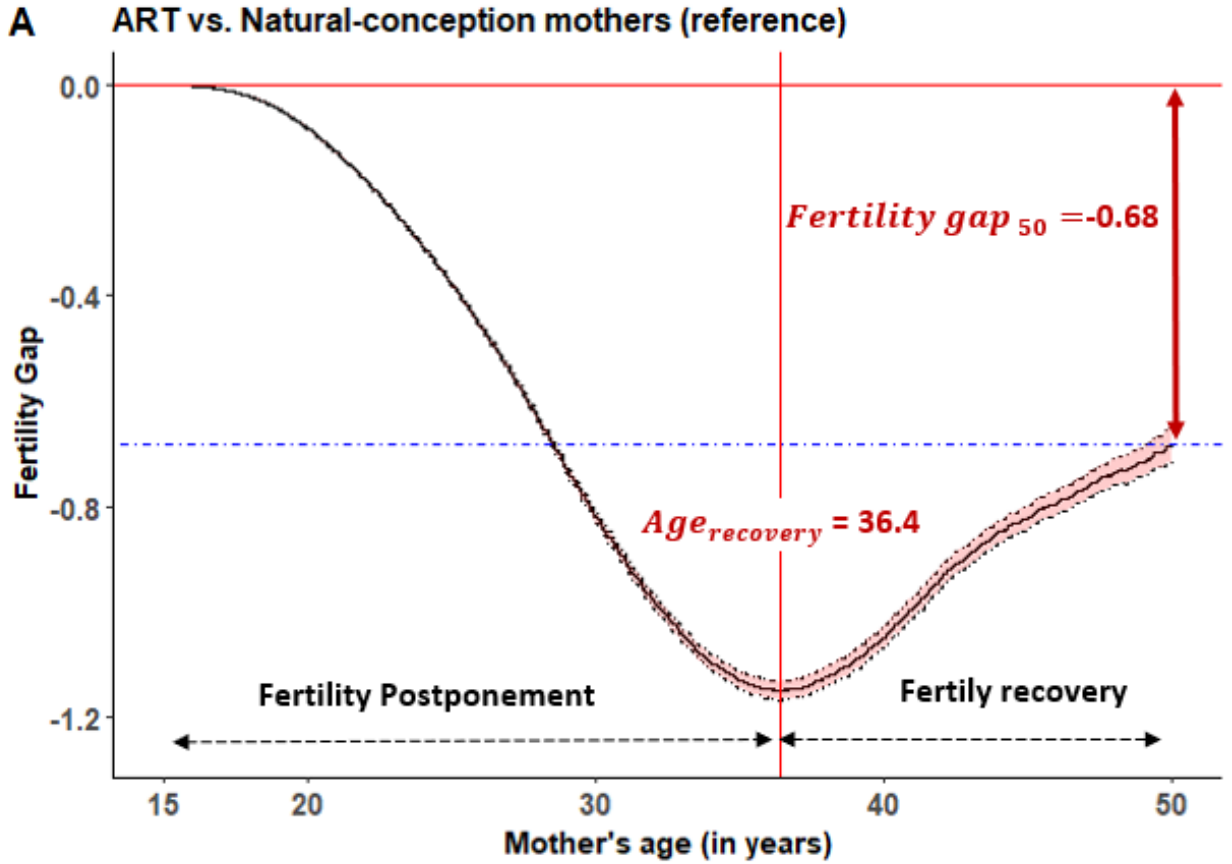
Disparities in the use of ART

- Socio-economically stratified (Goisis et al. 2020; Choi et al. 2023)
- Financial barriers are not the only cause of inequities, with socio-economic disparities observed in supportive funding environments
- For instance,
  - Different likelihood to comply with medical advice (Pampel et al. 2010).
  - Geographic proximity to clinics (Lazzari et al. 2022) further compounds socio-economic status inequalities
- Other barriers:
  - Cultural barriers
  - High psychological and physical burden

Could ART be the solution to low fertility rates?

Maybe not…

- Access to ART is selective and unfeasible for some subgroups
- Unintended behavioural responses
  - Low reproductive knowledge (Pedro et al. 2018)
- ART effectiveness also declines with age
  - Most treatments are unsuccessful



F6. Fertility Gap of ART or OI/IUI mothers compared against the Natural-Conception Mothers (reference), over the reproductive lifespan (15-50) *Data: MAR data linkage resource* **Source: *Choi et al. (2023)***

A window of opportunity for policy intervention

Maybe yes …

What if governments do not provide any funding for ART?

(At least in the short term)

- Stratified reproduction
- Greater underachievement of reproductive plans
- Deeper declines in total fertility rates

As effective as other family policies (financial transfers, parental leave, subsidised childcare) (Gray et al. 2022)

- Potential not fully exploited (not all those in need are using it)
- The only policy targeting the age-related decline in fecundity (Connolly et al. 2022)
- Further enhanced by: Fertility awareness policies and future advancement in reproductive medicine (oocyte cryopreservation?)

Thank you!

BIC • late

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References

United Nations (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248

Lutz et al. (2003). Europe's population at a turning point. *Science* 299: 1991-92.

Beaujouan & Berghammer (2019). The gap between lifetime fertility intentions and completed fertility in Europe and the United States: A cohort approach. *Population Research and Policy Review* 38: 507-535.

Beaujouan (2022). Late fertility intentions increase over time in Austria, but chances to have a child at later ages remain low. *Reproductive Biomedicine & Society Online* 14: 125-39

AIFS (2023). Births in Australia. Available at: https://aifs.gov.au/research/facts-and-figures/births-australia-2023

Gray (2015). Repartnering. In G.Heard, D. Arunachalam (Eds.), Family formation in 21st century Australia. Springer, Dordrecht, 101-121.

Mills et al. (2011). Why do people postpone parenthood? Reasons and social policy incentives. Human Reproduction Update 17: 848-860.

Gray et al. (2022). Impact of policies on fertility rates. Available at: https://population.gov.au/sites/population. gov. au/files/ 2022-03/ANU_Impacts-of-Policies-on-Fertility-Rates-Full-report.pdf

Habbema et al. (2015). Realizing a desired family size: When should couples start? *Human Reproduction* 30: 2215-21.

Leridon (2004). Can assisted reproduction technology compensate for the natural decline in fertility with age? A model assessment. Human Reproduction 19: 1548-53.

Hoorens et al. 2007. Can assisted reproductive technologies help to offset population ageing? An assessment of the demographic and economic impact of ART in Denmark and UK. Human Reproduction 22(9): 2471–2475.

Tierney & Cai (2019). Assisted reproductive technology use in the United States: a population assessment. *Fertility and Sterility* 112: 1136-1143.

Sobotka et al. (2008). The Contribution of Assisted Reproduction to Completed Fertility: An Analysis of Danish Data. Population and Development Review 34: 79-101.

Chambers et al. (2014).International Committee for Monitoring Assisted Reproductive Technology: World Report on Assisted Reproductive Technology, 2014. *Human Reproduction* 0:1-12

Goisis et al. (2020). The demographics of assisted reproductive technology births in a Nordic country. Human Reproduction 35: 1441-50.

Pampel et al. (2010). Socioeconomic disparities in health behaviors. *Annual Review of Sociology* 36

Choi et al. (2022). Population-wide contribution of medically assisted reproductive technologies to overall births in Australia: temporal trends and parental characteristics. *Human Reproduction* 37: 1047-58.

Pedro et al. (2018). What do people know about fertility? A systematic review on fertility awareness and its associated factors. *Upsala Journal of Medical Sciences* 123: 71–81.

Connolly et al. (2022). The international economics of infertility, childrearing, and assisted reproduction. *Fertility and Sterility* 119:184-85