

Oocyte cryopreservation: A socio-demographic view

Tomáš Sobotka

(Vienna Institute of Demography, Wittgenstein Centre for
Demography and Global Human Capital)

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Wittgenstein Centre
FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL

BACKGROUND

Stopping the biological clock through egg freezing has long been the ultimate feminist fantasy

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Birth trends in rich countries dominated by childbearing postponement

- “*Postponement transition*”
- Accelerating during economic recession
- Spain and Switzerland: Mean age at 1st birth > 30

→ *BIRTH TIMING*: Conflict between *economic + social rationale* vs. *biological + health rationale*

- The stretching of the life course has not been matched with a comparable trend in menopause

WHY TO HAVE KIDS LATER?

Social, cultural, technological and economic factors jointly push towards delayed childbearing

Key Factor: Expansion of high education & delayed economic independence (e.g., Ní Bhrolcháin and Beaujouan 2012)

...but also reliable contraception, economic uncertainty, delayed partnership formation, consumer aspirations, and acceptance of childlessness and sex outside marriage....

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Advantages of late parenthood for parents:

- Lower income loss & smoother career interruption (Miller 2009)
- More stable partnerships (Sobotka 2010)
- Better financial & housing situation
- Higher happiness (Myrskylä and Margolis 2012)
- Higher “readiness” for parenthood (Mills et al. 2011)

A HUGE POTENTIAL FOR SOCIAL EGG FREEZING?

Childbearing postponement implies uncertainty and risk of involuntary sterility

What are the available options?

- *Accepting childlessness* (→ stressfull: Mc Quillan et al. 2003)
- *Obtaining IVF/ICSI or IUI* (→ low success, high costs > age 40)
- *ART using donated oocytes* (→ child carrying genes of someone else)
- *Adoption* (→ risks, often seen as a 'last resort' solution)

Is cryopreservation a solution?

AGENDA

1. The rising importance of births at late reproductive ages (focus 35+)
 - *Childbearing intentions, births, and ART use*
2. *Social egg freezing*: Potential demand and use (*more uncertain & speculative*)
3. *Reality check*: forces limiting the use of social egg freezing

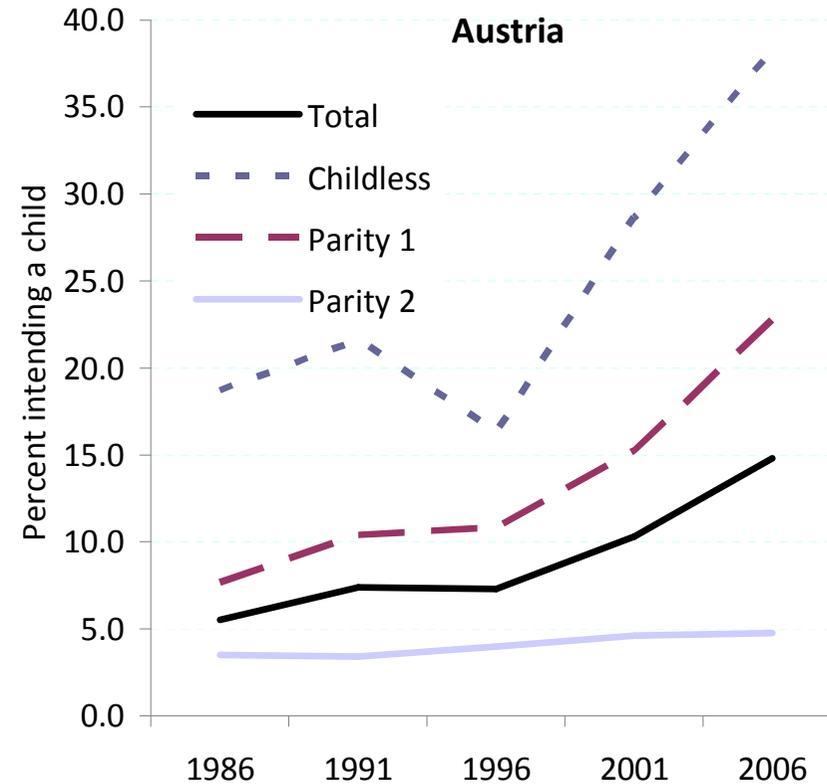
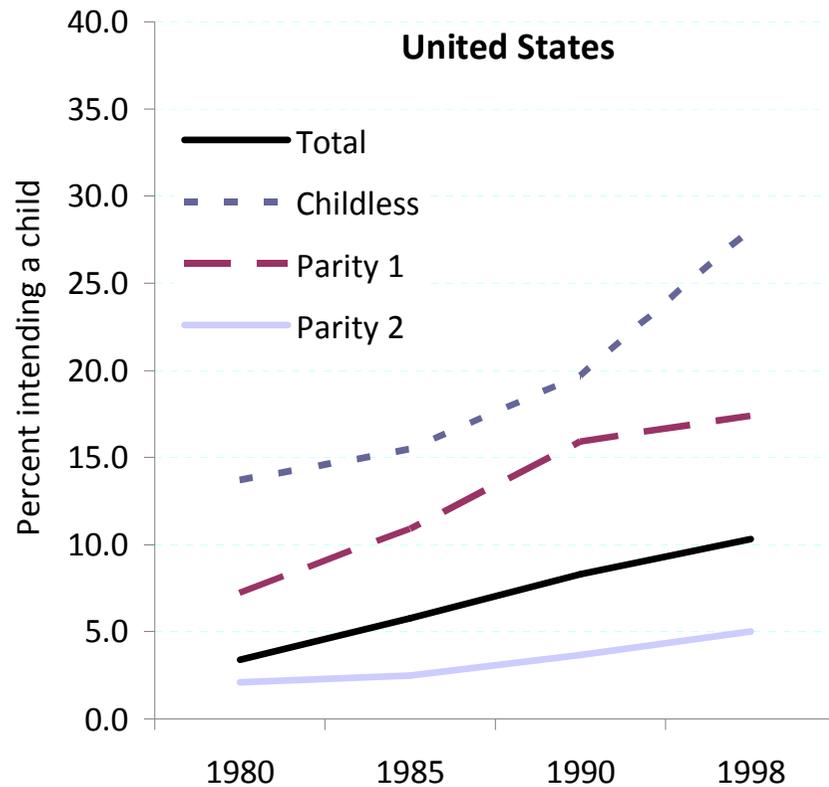
The rising importance of births at later ages

1. CHILDBEARING INTENTIONS

Rapid rise in the share of women and men aged 35+ who plan to have a child in the future

- Age 35-39: US 3% in 1980 → 10 % in 1998 (Hagewen and Morgan 2005); Austria: 6% in 1986 → 15% in 2006
- Strong differentiation by parity; sharp rise among the childless

Share of women aged 35-39 intending to have a child in the future by parity, Austria and US, 1980s-2000s



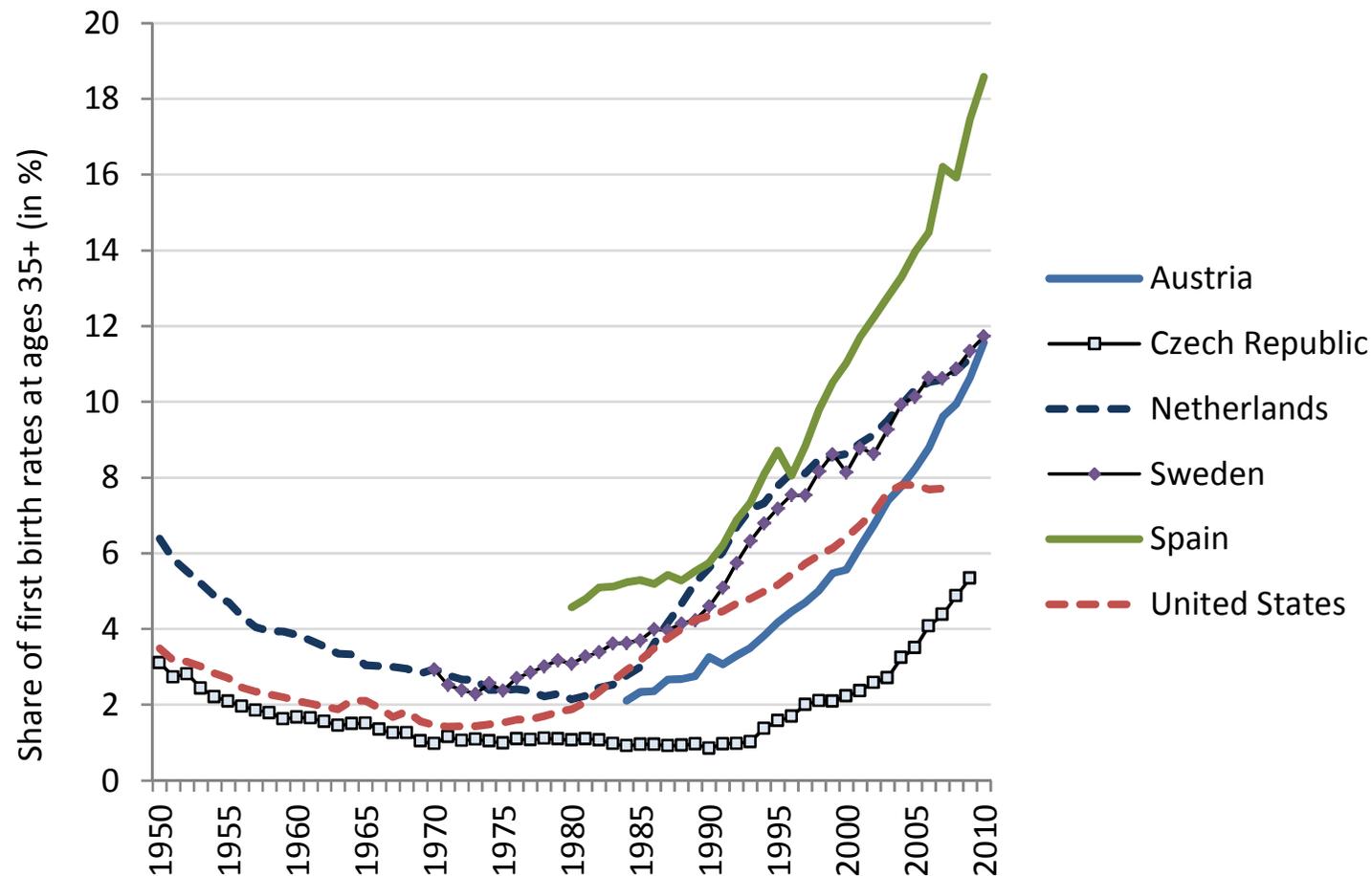
Sources: US: *Current Population Surveys* (Hagewen and Morgan 2005: Table 1); Austria: *Microcensus* surveys, computations by T. Sobotka

2. BIRTH RATES AT AGES 35+

Reversal of a century-long decline > 1980

- Rapid rise in almost all rich countries
- Particularly first births (different from the past)
 - Double effect: rising % of childless at ages >35 AND rising first birth rates among childless > 35
- Also sharp rises at ages 45+ and even 50+
 - small numbers but rising ten-fold in the US and elsewhere

Share of first birth rates among women aged 35-39 on the total fertility rate for first births, in %, 1950-2010



Sources: Computations based on *Human Fertility Database* (2012); for Spain: Eurostat (2011) and INE (2012)

Pushing the age limits of childbearing



January 2007:

a single woman named Carmela Bousada gave birth to healthy twins one week before her 67th birthday (and 18 years after reaching menopause)

...she died a couple of years later

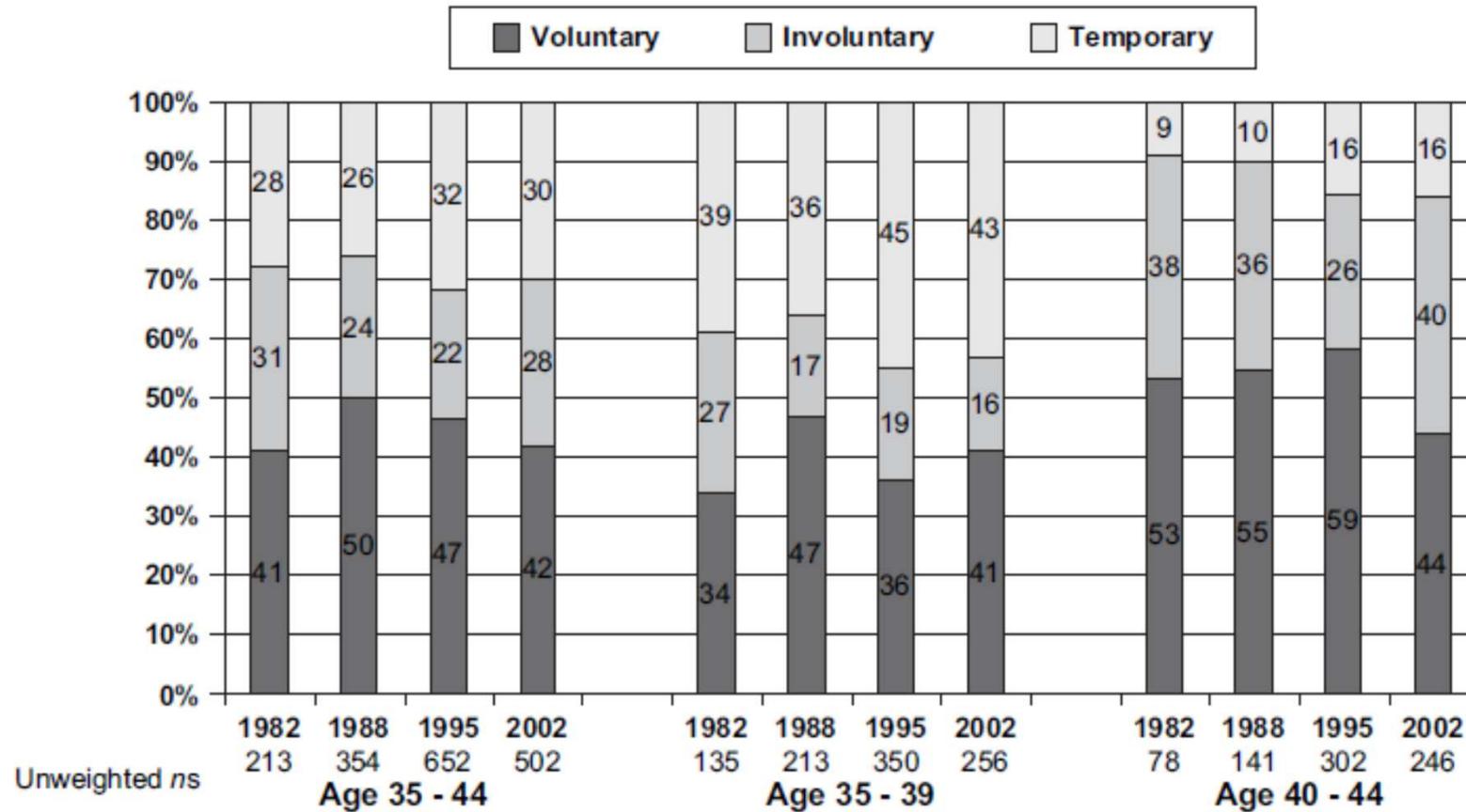
3. INFERTILITY, STERILITY, ART USE

Evidence on infertility, sterility, impaired fecundity at ages 35+

- Leridon (2008): 17% F sterile at age 40; 35% unable to have a live birth
- Impaired fecundity among married childless uS women: 39% at age 35-39, 47% at age 40-44 (data based on National Survey of Family Growth)

US: Childlessness among F: voluntary, 'temporary' and involuntary (Abma & Martinez JMF 2006, Figure 1)

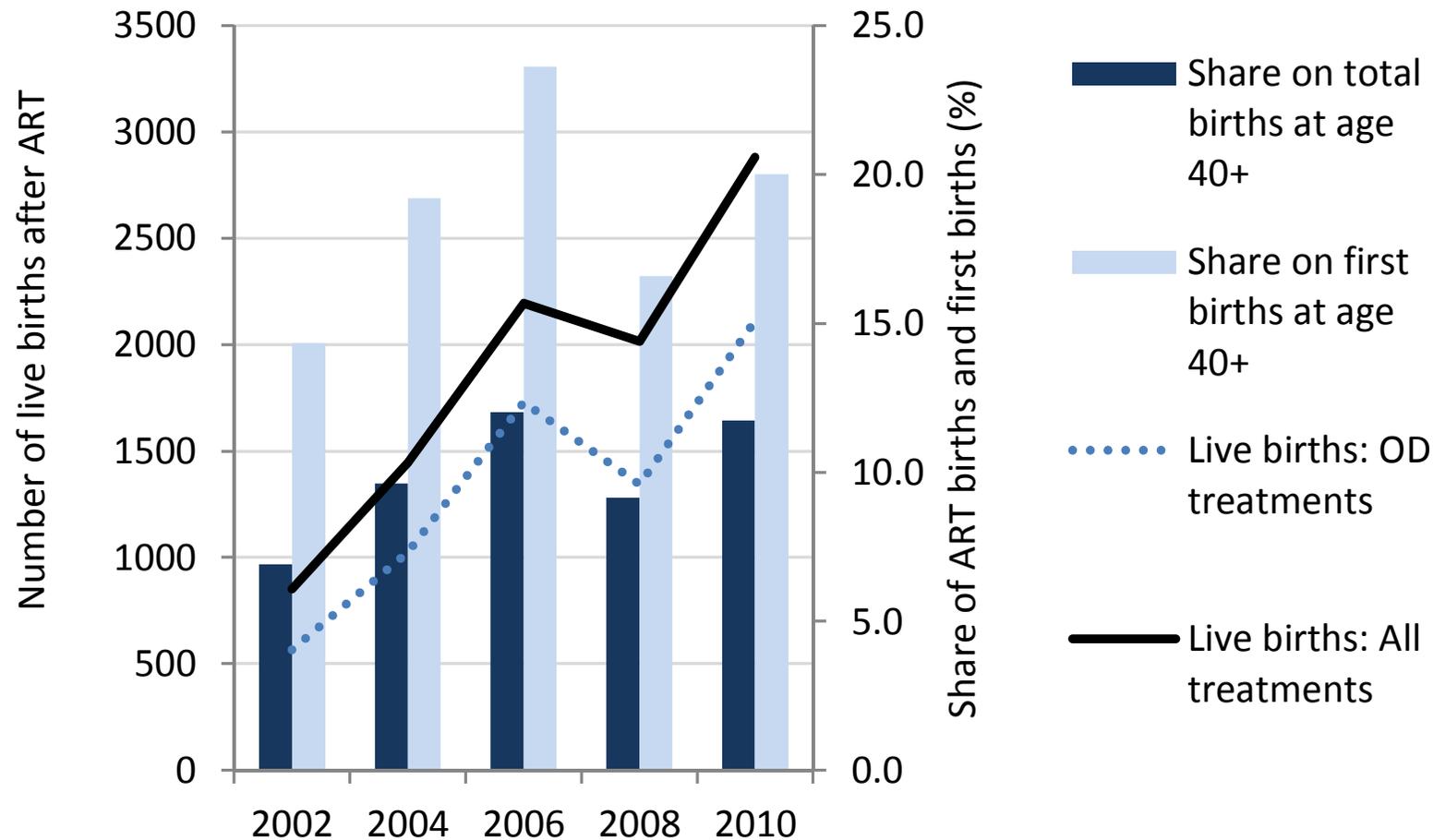
FIGURE 1. PERCENT DISTRIBUTION OF CHILDLESS WOMEN AGED 35 – 44, 35 – 39, and 40 – 44, BY CHILDLESS STATUS: 1982, 1988, 1995, AND 2002.



Evidence based on ART trends

- Continuous increase in ART use at ages 40+ despite limited success
 - But: limited data availability by age, incomplete coverage, pregnancies 'lost' from observation
- High cost of live birth from 'traditional' IVF/ICSI (Sullivan et al 2008: 753,000 EUR at ages >45)
- Gradual shift to donor oocytes (OD)
 - Spain: in 2010 more ART cycles with OD than IVF/ICSI at ages 40+
- Increasing contribution of ART to observed birth trends at high childbearing ages

Spain: Estimated number of births after ART and the share of ART births on total and 1st births, mothers aged 40+



Sources: Computations and estimates based on *Registro SEF* reports for 2002-2010, ESHRE (2012), Eurostat (2011) and INE (2012)

Social egg freezing:
Potential demand and use

Estimating potential demand for *social egg freezing*

Difficult choices faced by women delaying childbearing for “too long”

- Can SEF provide an alternative and push the boundaries of reproductive ages?
- Can it become a win-win strategy for couples planning children later in life?

PLUS: might offer success rates similar to ED, but using women's own oocytes?

MINUS:

- Still too few data to analyse long-term success rates and potential negative consequences
- Also costs, ethical issues, legal regulations may hamper its use

POTENTIAL DEMAND AND USE: Simulation exercise

Under ideal conditions for SEF use (low cost / reimbursement, high success rates, high acceptance, access to treatment...), how many women might

1. Consider getting their oocytes collected and cryopreserved
2. Use them to undergo assisted reproduction later in life

POTENTIAL DEMAND AND USE:

Simulation exercise

Estimates based on

- Combining diverse data sources on infertility, birth intentions, ART use, and ART success rates by age (*partly incomplete data*)
- Using different assumptions; separate analysis for first births
- Corresponding to Spanish first birth, fertility and ART patterns; infertility data from US women and birth intentions of Austrian women
- Using alternative scenarios about potential SEF users
- *Rough and tentative estimates!*

POTENTIAL SEF USE

How many women might ever make use of their oocytes in order to get pregnant?

- I consider only SEF use linked to fertility postponement, not use linked to medical conditions (esp. ovarian cancer)
- “Maximum estimates” of potential demand: imagine all women had a stock of cryopreserved oocytes they could use

POTENTIAL SEF USE

Share of women (out of birth cohort, in %)

MODEL / assumption	Current pattern
1. Replacement of all donor oocytes	0.67
2. Replacement of all ART > age 40	1.37

POTENTIAL SEF USE

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1. Replacement of all donor oocytes	0.67
2. Replacement of all ART > age 40	1.37
3. Used by F with difficulties achieving pregnancy or live b. > 40	
<i>Childless women</i>	
Sterility model	0.83
Infertility model	1.12
Impaired fecundity model	2.37

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Sterility model	0.83
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<i>All women</i>	
Sterility model	2.68
Infertility model	3.66
Infertility M, incl childless aged 35-39	5.04

POTENTIAL SEF USE

Share of women (of one birth cohort, in %)

MODEL / assumption	Current pattern	Shifting age at b.
1. Replacement of all donor oocytes	0.67	
2. Replacement of all ART > age 40	1.37	
3. Used by F with difficulties achieving pregnancy or live b. > 40		
<i>Childless women</i>		
Sterility model	0.83	1.24
Infertility model	1.12	1.68
Impaired fecundity model	2.37	3.55
<i>All women</i>		
Sterility model	2.68	4.03
Infertility model	3.66	5.48
Infertility M, incl childless aged 35-39	5.04	7.56

POTENTIAL DEMAND FOR *EGG FREEZING*

To achieve non-negligible use of IVF with own oocytes, women have to first have oocytes cryopreserved earlier in life

How many women might (should) ever consider *oocyte cryopreservation*?

- Different models, taking into account current reproductive behaviour and intentions, especially among childless after age 40

POTENTIAL DEMAND FOR SEF

Share of women (of one birth cohort, in %)

MODEL / assumption	Current pattern	Shifting age at b.
<ul style="list-style-type: none"><u>Childless F aiming to get pregnant > 40</u>		
Model 1: Observed birth rates	2.4-3.5	3.7-5.2
Model 2: Birth Intentions	4.5	7.5

POTENTIAL DEMAND FOR SEF

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• <u>Childless F aiming to get pregnant > 40</u>		
Model 1: Observed birth rates	2.4-3.5	3.7-5.2
Model 2: Birth Intentions	4.5	7.5
2. <u>ALL F aiming to get pregnant > 40</u>		
Model 1: Observed birth rates	7.8-8.3	11.7-12.6
Model 2: Birth Intentions	11.6	...

POTENTIAL DEMAND FOR SEF

Share of women (of one birth cohort, in %)

MODEL / assumption	Current pattern	Shifting age at b.
• <u>Childless F aiming to get pregnant > 40</u>		
Model 1: Observed birth rates	2.4-3.5	3.7-5.2
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2. <u>ALL F aiming to get pregnant > 40</u>		
Model 1: Observed birth rates	7.8-8.3	11.7-12.6
Model 2: Birth Intentions	11.6	...
The “cautious approach”		
3. <u>ALL F aiming to get pregnant > 40 & childless women > 35</u>		
Model 1: Observed birth rates	16.6-23.9	20.8-29.9
Model 2: Birth Intentions	22.8	28.2

The Real World:

Forces limiting the expansion of
oocyte cryopreservation

Why actual demand for SEF and use of IVF with own oocytes will be much lower?

The exercise was mapping potential maximum use of SEF, given current reproductive patterns and trends

Many forces will act as limiting factors

1. Uncertainty: Long-term success rates, potential pregnancy complications, health risks

- Very little data available, few observations over long “freezing” period
- Still “experimental phase”?

2. Costs: retrieval, “storage”, and, possibly, IVF use

- Two studies estimating costs of live birth following SEF with IVF use: 24,600\$ (van Loendersloot et al 2011) vs. 135,520\$ (Hirshfeld-Cytron et al. 2012)

Why actual demand for SEF and use of IVF with own oocytes will be much lower?

3. Success not guaranteed

- Some women will never achieve pregnancy after SEF
- Many others will achieve spontaneous pregnancy and SEF would be a “wasted” investment
- Van Loendersloot et al: 73.7% success rate after 4 cycles > age 40 + 10.7% spontaneous pregnancies

4. Stress surrounding SEF and IVF

5. Limited acceptance

- Online survey in Belgium (Stoop et al. 2011): 3.1% respondents (age 21-40) would consider SEF, 28.4% “maybe”

6. Early decision necessary for later successful outcome

- Ideal age for SEF ~30
- Uncertainty about having children, “discounting the future”, and ignorance about infertility will SEF “on time” use

Why actual demand for SEF and use of IVF with own oocytes will be much lower?

7. Ethical concerns

- Unequal access
- Potential pregnancy and health complications among “very old” mothers (45 / 50+)
- Fuelling further postponement of childbearing & misperceptions about the ability to achieve pregnancy at any time

Discussion

CONSIDERABLE POTENTIAL OF SEF DUE TO CONTINUING SHIFTS IN CHILDBEARING AGES

- *Eggsurance*: Strategy giving couples an extra “breathing space” (Dondorp et al. 2012)
- Women gaining high chances of achieving pregnancy with their own oocytes (and genes) well after age 40
 - Even with current reproductive pattern, up to 23% of potential SEF users (2.4-23%) and up to 5% (0.7-5.0%) of women using IVF with own cryopreserved oocytes
- Replacing some of the “traditional” ART at higher ages
- Likely decline in the use of donor oocytes
- Might be considered in conjunction with the assessments of ovarian reserve
- Potentially huge market and vast opportunities for specialised clinics with cutting-edge technology & staff

What's needed most?

Extensive data collection & monitoring across Europe:
SEF procedures, IVF use, success rates by age and parity, length of cryopreservation etc.