The changing association between maternal age and offspring well-being

Alice Goisis

UCL
Postponement of childbearing

- Childbearing postponement has been increasing across high-income countries since the 1970s/1980s
Maternal age at birth is increasing

Fraction of fertility attributable to mothers aged 35+: England & Wales

Source: Human Fertility Database
Maternal age at birth is increasing

Fraction of fertility attributable to mothers aged 35+: U.S. and Sweden
Postponement of childbearing

- Since the 1970s, in high income countries increasingly often women delay childbearing to older ages
- Increasing concerns about the consequences of being born to an older mother
  - According to the mainstream medical literature being born to an older parent may represent a significant health risk
Advanced maternal age a major risk factor

- For pregnancy and birth outcomes (e.g. Bewley et al. 2005 BMJ)
  - “Parental age has been shown to be a major factor, if not the most important factor, in producing variability in offspring” (Liu et al., 2011)
  - “The consensus is that increasing maternal age is independently associated with specific adverse pregnancy outcomes” (Nwandison and Bewley, 2006)
But..

- The magnitude of the association depends on the studies and controls used
  - Some studies suggest that the association might be confounded by maternal characteristics
How old is too old?

Health and medical concerns about childbearing at older ages

Conservative older mothers advantaged characteristics (more than) compensate for the health complications

“The optimal age for childbearing, in terms of pregnancy outcomes, remains the age range 20-35” (Bewley, Davies & Braude, 2005)

“The older mother today is at significantly lower risk [of poor health outcomes] than her contemporary two decades ago” (Carolan, 2003)
Childbearing at older ages over time in the UK

Source: Human Fertility Database
Childbearing at older maternal ages: past vs. present

- Currently, advanced age at birth positively associated with socio-economic status and behaviours
- In the past: a qualitatively different process
  - Strongly associated with higher order births
  - Socioeconomic incentives less clear
  - Different social norms regulating entry into parenthood
  - Lower quality antenatal/postnatal care and prenatal screenings
Study contribution

- Nature of childbearing at older ages likely to have changed over time
  - Limited evidence on how the profiles of older mothers have changed over time
  - No evidence on how the association between maternal age and child well-being has (as a consequence) changed over time
Research questions

- Have the profiles of older mothers changed over time?
- Has the association between maternal age and child well-being changed over time?

Cross-cohort comparison using UK birth cohorts
### Data & Method

<table>
<thead>
<tr>
<th>Survey</th>
<th>1958 (NCDS)</th>
<th>1970 (BCS)</th>
<th>2001 (MCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Representation</strong></td>
<td>England, Scotland, Wales</td>
<td>England, Scotland, Wales</td>
<td>England, Scotland, Wales, Wales, Northern Ireland</td>
</tr>
<tr>
<td><strong>Sampling</strong></td>
<td>Babies born in a single week of March 1958</td>
<td>Babies born one week in April 1970</td>
<td>Babies born between Sept 2000 and Jan 2002</td>
</tr>
<tr>
<td>Baseline sample</td>
<td>17,416</td>
<td>17,287</td>
<td>19,244</td>
</tr>
<tr>
<td>Analytical sample</td>
<td>15,952</td>
<td>16,432</td>
<td>17,484</td>
</tr>
</tbody>
</table>
## Data & Method

### Main variables
- **Dependent variable** – child health
  - LBW (birth weight less than 2.5 kg)
- **Maternal age at cohort member birth**
  - <20; 20-24; 25-29; 30-34; 35-39; 40+

### Analytical sample
- Live births
- Exclude babies weighting 4.5 kg+

### Method
- Describe the profiles of mothers by age at first birth
- Logistic models to inspect the bivariate association between maternal age and LBW
- Adjust for family/mothers’ SES, health and health behaviours
### Socio-demographic control variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1958 (NCDS)</th>
<th>1970 (BCS)</th>
<th>2001 (MCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth order</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Social Class</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Education</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Partnership at the time of birth</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Overcrowding</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>House ownership</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Health and health behaviors</td>
<td>1958 (NCDS)</td>
<td>1970 (BCS)</td>
<td>2001 (MCS)</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>-------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Previous stillbirths/miscarriages</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Smoking during pregnancy</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>C-section delivery</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Drinking during pregnancy</td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Antenatal care after 12 weeks of pregnancy</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>Mother’s height</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Complications during labour</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Complications during pregnancy</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
Have the profiles of older mothers changed over time?
% first births by maternal age

- 1958
- 1970
- 2001

Maternal Age Groups:
- <20
- 20-24
- 25-29
- 30-34
- 35-39
- 40+

Birth Cohort Groups:
- 1958
- 1970
- 2001

Legend:
- Blue: <20
- Red: 20-24
- Green: 25-29
- Purple: 30-34
- Cyan: 35-39
- Orange: 40+
% smoking during pregnancy

- 1958
  - below 20
  - 20-24
  - 25-29
  - 30-34
  - 35-39
  - 40+
- 1970
  - below 20
  - 20-24
  - 25-29
  - 30-34
  - 35-39
  - 40+
- 2001
  - below 20
  - 20-24
  - 25-29
  - 30-34
  - 35-39
  - 40+
Has the association between maternal age and child health changed over time?
Logistic regression model on LBW
Odds Ratios 40+ baseline model

Reference 25-29
## Logistic regression model on LBW

<table>
<thead>
<tr>
<th>Age Category</th>
<th>1958</th>
<th>1970</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age &lt;20 (reference 25-29)</td>
<td>1.60***</td>
<td>1.89***</td>
<td>1.36**</td>
</tr>
<tr>
<td>Maternal Age 20-24</td>
<td>1.11</td>
<td>1.35***</td>
<td>1.25*</td>
</tr>
<tr>
<td>Maternal Age 30-34</td>
<td>1.07</td>
<td>1.04</td>
<td>0.92</td>
</tr>
<tr>
<td>Maternal Age 35-39</td>
<td>1.13</td>
<td>1.11</td>
<td>0.96</td>
</tr>
<tr>
<td>Maternal Age 40 and over</td>
<td>1.59**</td>
<td>1.65**</td>
<td>1.28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of observations</th>
<th>1958</th>
<th>1970</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15,952</td>
<td>16,432</td>
<td>17,484</td>
</tr>
</tbody>
</table>
OR 40+
Adjustment for socio-demographic factors

Baseline  Adjustment for socio-demo factors

1958  **
1970  **
2001  **
OR 40+
Adjustment for health

Baseline
Adjustment for health

1958
1970
2001
OR 40+ Baseline model
First births only

1958
N=36

1970
N=37

2001
N=76
Has the association between maternal age and cognitive ability in childhood changed over time?
Data & Method

- **Dependent variable**
  - Cognitive ability
    - Verbal test
    - At age 11 (1958/2001) or 10 (1970)
    - Standardized

- **Maternal age**
  - Maternal age at cohort member birth
    - <20; 20-24; 25-29; 30-34; 35-39; 40+

- **Method**
  - Linear models
    - Model 1: unadjusted association (twin, girl)
    - Model 2: birth order
    - Model 3: birth order + parents’ socio-demographic characteristics
Model 1: baseline model

![Graph showing standardized cognitive scores versus maternal age at birth for different decades (1958, 1970, 2001).]
Model 2: adjusted for birth order

Standardized cognitive scores vs. Maternal age at birth
Model 3: Adjusted for birth order and parents’ socio-demographic characteristics
# Testing for differences across cohorts

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1: Baseline</td>
<td>-0.052</td>
<td>0.225 ***</td>
<td>0.277 ***</td>
</tr>
<tr>
<td>Model 3: birth order + socio-demographic characteristics</td>
<td>-0.094</td>
<td>-0.028</td>
<td>0.066</td>
</tr>
</tbody>
</table>
Limitations

- Small sample size
- Live births only
- How much is due to changes in context?
Summary

- The association between advanced maternal age and child well-being has changed over time.
- The results suggest this occurs because the association between maternal age and socio-demographic processes has changed over time.
Summary

- Older mothers in a contemporary cohort are relatively more advantaged socioeconomically than in older cohorts.
- Across cohorts older maternal age less likely to be associated with poor child health and more likely to be associated with better cognitive scores.
- The socio-demographic disadvantage that historically was associated with older maternal age has not only disappeared, but has turned into a potentially important advantage.
Overall conclusions

• Maternal age is a complex variable which reflects a multitude of social and health processes
• The intersection of these processes might vary over time and result in heterogeneous associations between maternal age and well-being
• Question its meaning and consequences and contextualize
Research supported by the COSTPOST project (PI Mikko Myrskylä)

- **Goisis, Alice** and Schneider, Daniel C. and Myrskylä, Mikko (2017) The reversing association between advanced maternal age and child cognitive ability: evidence from three UK birth cohorts. *International Journal of Epidemiology*

- **Goisis, Alice** and Schneider, Daniel and Myrskylä, Mikko (2018) Secular changes in the association between advanced maternal age and the risk of low birth weight: a cross-cohort comparison in the UK. *Population Studies*
Thank you!

a.goisis@ucl.ac.uk
<table>
<thead>
<tr>
<th>Year</th>
<th>% LBW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958</td>
<td>5.3</td>
</tr>
<tr>
<td>1970</td>
<td>6.8</td>
</tr>
<tr>
<td>2001</td>
<td>6.7</td>
</tr>
</tbody>
</table>