Introduction

Health at birth—a key determinant of human capital development
- Maternal stress has a negative impact on birth outcomes (Fig. 1).
- We focus on an understudied maternal stress—fear of radiation exposure
- Radiation fear at Japan's Fukushima Nuclear Power Plant (NPP) Accident in 2011

Why radiation fear?
1. Better identification of maternal stress
2. An increasingly relevant risk

The Fukushima Accident

The most catastrophic consequence of the Great East Japan Earthquake (Fig. 2)
- The earthquake triggered a devastating tsunami (Fig. 3)
- The Fukushima NPP lost its entire cooling capacity due to the tsunami, leading to three hydrogen explosions (Fig. 4)
- Radioactive materials released; Evacuation order

Radioactivity and the health consequences
- Limited in Fukushima prefecture; diminishing within a year following the accident
- Nationwide-spread; a more pressing issue of the accident

Data and Measurement

Population data linkage
Health information
- At birth—universal birth records (Jun 2010 – Dec 2011)
- At age two and five—comprehensive survey of living conditions (CSLC, 2013 and 2016)
Background characteristics
- Parental and residential information—2010 and 2015 censuses

Data Exclusion (gray areas in Fig. 5)
- Regions damaged by tsunami
- Regions contaminated by radioactivity (annual dose >1 mSv)

Measurements

<table>
<thead>
<tr>
<th>Health at Birth</th>
<th>Variables</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Health at Age 2 and 5</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] Age at interview</td>
<td></td>
</tr>
</tbody>
</table>

Prenatal vs. Postnatal Model

\[ y_{\text{inc}} = \beta_0 + \beta_1 \mathbf{c} + \epsilon_{\text{inc}} \]

for each newborn \( i \) who was born in municipality \( m \) and conceived in month \( c \).

- \( \beta_1 \) — impact of in-utero radiation fear; \( \lambda_m \) and \( \lambda_c \) — municipality and conception-month fixed effects; \( \epsilon_{\text{inc}} \) — the error term.

Validity Tests
- Systematic differences in background characteristics—No
- Changes in risks of abortion and stillbirth—No impact
- Confounding energy saving request—No discernible magnitude gap
- Placebo test of “accident” on Oct 12, 2020—No impact

A diff-in-diff Model

\[ y_{\text{inc}} = \delta_0 + \delta_1 \mathbf{c} + \epsilon_{\text{inc}} + \delta_2 \sum_{i=1}^{t} \mathbf{I}[c \leq \text{Accident} < e_b]_{\text{inc}} + \delta_3 \sum_{i=1}^{t} \mathbf{I}[c \leq \text{Accident} < e_b]_{\text{inc}} \times \text{Fear}_{\text{age}} + \lambda_m + \lambda_c + \epsilon_{\text{inc}} \]

Validity Tests
- Systematic differences in background characteristics—No
- Inter- or intra-prefecture migration—No

Methods

Results and Conclusions

Exposing to radiation fear in the first trimester has the greatest impact

**Fear wisely!”
- Timely information sharing
- Efficient risk communication
- Education about radiation risks

Rong Fu, PhD3; Yichen Shen, PhD2,3; Haruko Noguchi, PhD1,3
1Waseda University, 2Kanagawa University of Human Services, 3Waseda Institute of Social & Human Capital Studies (WISH)

Contact
Rong Fu, Waseda University, Japan
Email: nataliefu@waseda.jp
Website: https://sites.google.com/view/nataliefu-homepage