The Norwegian Mother and Child Cohort Study

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Oslo
Topics

Why did we start MoBa?

What is MoBa?

What types of scientific questions can be studied?

What are the limitations and weaknesses?

Some future prospects
Why did we start MoBa?

– To get hold of exposures in causal research

– To examine the Forsdahl-Barker hypotheses
What about environmental concerns?

No interest from the Ministry of Environment – or from other ministries during the planning phase

No interest from the Research Council of Norway

NIH application failed
Opposition

General practitioners were not generally in favour of the study

They complained to the Social Committee in Parliament

Parliament voted in favour of MoBa in 1998
MoBa was not started to study neurodevelopment or toxicants

- 2002 - environmental epidemiology - the NIEHS connection
- 2002 - neurodevelopment - the Columbia connection
What is MoBa?

- A family cohort (mother + father + child)
- Recruitment of pregnant women
- Questionnaires, biomaterials and registries
- Long term follow-up
The recruitment

From 1999 to 2008

Recruited from 50 hospitals

Week 16 to 18, routine ultrasound

Total 113 000 pregnancies
# The numbers

<table>
<thead>
<tr>
<th></th>
<th>No</th>
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<tbody>
<tr>
<td>Mothers</td>
<td>95 000</td>
<td>Pregnancies</td>
</tr>
<tr>
<td>Fathers</td>
<td>75 500</td>
<td>Twins</td>
</tr>
<tr>
<td>Children</td>
<td>114 500</td>
<td>Triplets</td>
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2016: Numbers of children by age

<table>
<thead>
<tr>
<th>Age</th>
<th>Number</th>
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<tr>
<td>7</td>
<td>3476</td>
</tr>
<tr>
<td>8</td>
<td>14184</td>
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<td>11</td>
<td>16382</td>
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<td>2294</td>
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Datacollection

Child

Mother

5 yrs

7 yrs

8 yrs

2017

13 yrs – nutrition

2017

14 yrs – mental health

Plans

18 yrs

19 yrs

2017

14 yrs – mental health
Biological samples

MoBa:
Top modern biobank – automated/manual
4.5 million samples stored

- EDTA whole blood and plasma (frozen -80° C)
- DNA extracted from whole blood (frozen -20° C)
- Urine (mothers only) (frozen -20° C)
- RNA: from cord blood (Tempus-tubes)
Funding

- Ministry of Health
- Norwegian Institute of Public Health
- Miscellaneous sources of project funding
  - Ministry of Education and Research
  - Norwegian Research Council
    - Infrastructure support to the biobank
  - National Institutes of Health, US
  - EU Research framework programmes
  - Sub-studies
Subcohorts in MoBa

- ABC (Autism Birth Cohort)
- ADHD –Study
- BraMat og BraMiljø – Environmental toxicants
- MRI study
- Mothers with epilepsy
- Children with epilepsy
- Children with cerebral palsy
- Parents with inflammatory bowel disease
- Childrens language development
- Asthma
- Children with celiac disease and diabetes (PAGE)
- Genetics (GWAS)
- E-Tox
Ministry of Education and Research

- Language and learning
- Longterm commitment from 2007:
  - Language development (2008)
  - Early child care (2011)
  - Quality in day care (2013 og 2014)
  - Vulnerable children in day care (2015)
  - Learning and development in schools (2016)
What types of scientific questions can be studied?

• Etiological questions
• Natural history of disease
• Personalized medicine
  – Prognostic factors
  – Gene-environment interactions
  – Gene-medication interactions
• Biomonitoring
• Natural experiments
The blessing of no prior hypotheses

Collect as much exposures and background variables as possible.

Create a biobank.

Follow people with questionnaires and through registries

General aim: To find causes of serious diseases
«shifting winds of scientific fashion»

– Developmental origins of health and disease

– Life course epidemiology

– Genetic epidemiology

– Environmental hazards
«But that’s the thing about birth cohorts: you may know where they start, but you never know where they’re going to end up»

Helen Pearson: The Life Project, 2016
Weaknesses and limitations

• Reflects yesterday’s exposures
• Biomaterials at only one point in time
• Lack of other tissues than blood
• No repeated clinical examinations of the whole cohort
• Low response rates to follow-up questionnaires
Large, international birth cohorts

The Norwegian Mother and Child Cohort Study (MoBa)
N=114 000, Recruitment: 1999-2008,

The Danish National Birth Cohort
N=101 000, Recruitment: 1996-2003

Japanese Environment & Children’s Study
N=100 000, Recruitment: 2011-2014

Korean Birth Cohort
N=100 000, Recruitment: 2014 –

Non-starters: US National Childrens Study, UK Life Project
Future prospects

- Firmly secured in one large institution
- Both children and adults will be followed
- Registries will be a main mechanism
- Acceptance from the children (18 years)
- Better infrastructure – remote access
- Childrens’ children
- More richely phenotyped subcohorts
Future

Systems biology meets machine learning
MoBa-research

- > 400 projects
- > 220 active projects
- > 460 scientific publications
- 44 PhDs
- International collaboration
www.fhi.no/moba