Concept of a birth cohort study as contribution to the health related environmental monitoring in Germany

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Health related environmental monitoring: aims

1. Collect data on exposure to pollutants, noise, and biological factors,
2. Identify and quantify sources of exposure,
3. Illustrate temporal and spatial trends,
4. Identify, prioritize, and measure "new"/emerging substances with high prevalence in the human body,
5. Investigate the influence of socio-economic status,
6. Assess the toxicological and health related risks,
7. Analyze the impact of exposure on public health and susceptible groups,
8. Assess the success of prevention and risk reduction measures within health and environmental policy programmes.
Experiences from two complementary approaches

German Environmental Survey (GerES)  
Environmental Specimen Bank (ESB)  

<table>
<thead>
<tr>
<th>Survey</th>
<th>Period</th>
<th>Sample size</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>GerES I</td>
<td>1985 - 1986</td>
<td>2,700 adults</td>
<td>Münster (since 1977)</td>
</tr>
<tr>
<td>GerES III</td>
<td>1997 - 1999</td>
<td>4,800 adults</td>
<td>Ulm (since 1997)</td>
</tr>
<tr>
<td>GerES IV</td>
<td>2003 - 2006</td>
<td>1,790 children</td>
<td></td>
</tr>
</tbody>
</table>

Yearly sampling of 150 students in each sampling location

Instruments I

- GerES
- ESB

Instruments (II): Questionnaires

- indoor and outdoor environment
- health information
- socio-economic status
- food consumption
- environment and health
- habits …

Why a Birth Cohort Study?

A Birth Cohort “… shares the same year or period of birth”  
(Rothman et al. 1986)

Important aspects of a birth cohort study:
1. Enrollment at birth, during pregnancy or prior to conception
2. Follow-up of child development into adulthood

- Evidence that environmental and other factors operating prenatally and in early childhood determine health in later childhood and in adulthood is increasing
- Takes special vulnerability of children during particular periods of development into account
Intentions

Developing a concept for a German Environmental Health Birth Cohort

- Focus on environmental health problems
- With regard to socioeconomic aspects and migration
- Interaction between genes and environmental risk factors
- Current German birth cohorts are medium-sized and focus on special aspects of child health
- Existing research too limited in size and scope to answer the questions

Large scale birth cohort study needed, several 10,000 to 200,000 participants, build as a platform for future research.

Impact of (low) socio-economic status

Residential - live at busy roads (x 3),

Environment: - more industrial sources nearby, - higher noise exposure

Stress, blood pressure, sleep disturbance, respiratory diseases, accidents

Toxic substances: - e.g. lead

IQ, neurotoxic, carcinogenic

Indoor air: - more second-hand smoke, - use of more dubious household chemicals, - aromatic solvents, glykoles...

Irritation of eyes/ respiratory tract, allergies, respiratory diseases, accidents, susceptibility to infections

Source: GerES IV

International Birth Cohorts

<table>
<thead>
<tr>
<th>Name</th>
<th>Start</th>
<th>Sample Size</th>
<th>Participants</th>
<th>Response</th>
<th>Main issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>US National Children's Study (NCS)</td>
<td>2009</td>
<td>100,000</td>
<td>pregnant women and newborns</td>
<td>n/a interviews, exams.</td>
<td>To discover environmental factors and individual susceptibility for disease in children</td>
</tr>
<tr>
<td>Danish National Birth Cohort (DNBC)</td>
<td>1996</td>
<td>100,000</td>
<td>pregnant women and newborns</td>
<td>60% interviews, exams.</td>
<td>Disease causation at the beginning of life</td>
</tr>
<tr>
<td>Norwegian Mother and Child Cohort Study (MoBa)</td>
<td>1998</td>
<td>108,000</td>
<td>pregnant women and newborns</td>
<td>43% interviews, exams.</td>
<td>To find causes of serious diseases in mothers and children.</td>
</tr>
<tr>
<td>Spanish Longitudinal Study of Parents and Children (ALSPAC)</td>
<td>1991</td>
<td>14,541</td>
<td>pregnant women and newborns</td>
<td>62% interviews, exams.</td>
<td>To assess factors (genotype + environment), which influence child health and development</td>
</tr>
<tr>
<td>Japanese Environment and Children's Study (AECS)</td>
<td>2011</td>
<td>100,000</td>
<td>pregnant women and newborns</td>
<td>n/a interviews, exams.</td>
<td>To examine environmental, psychological, genetic factors that impact on development</td>
</tr>
<tr>
<td>Birth Generation Research Study (AlSPAC)</td>
<td>2002</td>
<td>9,778</td>
<td>pregnant women and newborns</td>
<td>31% interviews, exams.</td>
<td>To examine environmental and genetic causes of growth, development and health</td>
</tr>
</tbody>
</table>

Approach

Review of existing birth cohort studies
First draft for conceptual design and framework
Collecting possible research questions
Developing possible scenarios
developing the exposure and outcome assessment for addressing the research questions
elaboration of the overall concept
**German Birth Cohorts**

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<tr>
<td>The German Multicenter Atopy Study (MAS-90)</td>
<td>1990</td>
<td>1,314 newborns + parents</td>
<td>n/a</td>
<td>Interviews, examinations, biol. samples</td>
<td>…environmental exposures to allergic and atopic diseases</td>
<td></td>
</tr>
<tr>
<td>The GINI Study + The LISA Study</td>
<td>1995</td>
<td>8,128 newborns</td>
<td>35%</td>
<td>Interviews, examinations, biol. samples</td>
<td>…impact of environmental exposures and life-style on the immune system</td>
<td></td>
</tr>
<tr>
<td>The Duisburg Cohort Study</td>
<td>2000</td>
<td>294 pregnant women and newborns</td>
<td>n/a</td>
<td>Interviews, examinations, biol. samples</td>
<td>…influence of diverse on the early development</td>
<td></td>
</tr>
<tr>
<td>Survey of Neonates in Pomerania (SNiP)</td>
<td>2002</td>
<td>7,000 newborns</td>
<td>47%</td>
<td>Interviews, examinations, biol. samples</td>
<td>…impact of environment, genetics, life-style on health</td>
<td></td>
</tr>
<tr>
<td>The German KIGGS Survey</td>
<td>2003</td>
<td>17,341 children (Age 0-17)</td>
<td>67%</td>
<td>Interviews, examinations, biol. samples</td>
<td>…representative information about health</td>
<td></td>
</tr>
<tr>
<td>The Environmental Determinants of Diabetes in the Young (TEDDY)</td>
<td>2004</td>
<td>7,801 newborns</td>
<td>45%</td>
<td>Interviews, examinations, environmental + biol. samples</td>
<td>…impact of genetic factors and environmental exposures on developing diabetes</td>
<td></td>
</tr>
<tr>
<td>German Neonatal Network (GNN)</td>
<td>2009</td>
<td>20,000 planned premature newborns</td>
<td>n/a</td>
<td>Interviews, examinations, biol. samples</td>
<td>…long-term effects of genetic, clinical, social risk factors, and specific treatment</td>
<td></td>
</tr>
</tbody>
</table>

**Recruitment**

- Recruitment as early in pregnancy (→ 1st trimester) as possible
- But: Broad approach to enroll at different stages of pregnancy and even shortly after delivery
- Therefore: Multimodal approach via gynecologists, private midwives, prenatal care providers, maternity wards…
  
  …but also pharmacies and other public institutions
- Incentives and professional PR-Tools needed to make the participant’s benefit clear

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**Study Locations**

Selection of study locations should be based on:

- socioeconomic status
- metropolitan status
- geography
- birth per year

Also needed:

- Study centers with experience in recruitment
  
  → taking The German National Cohort into account

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**Particulate Matter (PM 10)**

- Data from Umweltbundesamt 2010

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Main Research Issues

1. The Impact of Environmental Pollutants and Noise on Neurodevelopment and Cognitive Abilities
2. The Impact of Endocrine Disruptors on Reproductive Development
3. The Impact of Environmental Pollutants on Pregnancy and Birth Outcomes
4. The Impact of Indoor/Outdoor Air Pollution and Inhalation Allergens on Asthma, Allergy and Wheezing
5. The Impact of Environmental Pollutants on Obesity, Insulin Resistance and Diabetes

Perspectives

- Work still in progress!
- Feasibility studies in the near future
- Significance of the longitudinal database as a platform for future studies
- A national resource to answer important questions