Environmental Factors related to the onset of allergic diseases examined in JECS

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☑️ The author has no conflict of interest to disclose with respect to this presentation.
**Background of The Japan Environment Children’s Study (JECS)**

Post industrial revolution epidemic of non communicable diseases represented by allergic diseases and developmental disorders. Global health concern about the environmental risk to children.

- Danish National Birth Cohort, 1996–
- **Miami Declaration (1997) by G8 Environmental Minister**
- Norwegian Mother and Child Cohort Study, 1999–
- **G8 Environmental Ministers Meeting (Banff, 2002)**
- US National Children’s Study, Vanguard, 2005– (cancelled)
- **JECS planning started, 2006**
- **G8 Environmental Ministers Meeting (Syracusa, 2009)** highlighted research on children’s environmental health
  - **JECS pilot, 2009–**
  - **JECS, 2010–**
  - UK Life Study, 2015– (cancelled)
  - Korean birth cohort study (Ko-CHENS), 2015–
- **G7 Environmental Ministers Meeting (Toyama, 2016)**

**Overview of the Japan Environment & Children’s Study (JECS)**

**@Core Hypothesis:** Exposure to ambient chemicals during the fatal stage and early childhood adversely effects children’s health

**@Method:** Birth cohort study

**@Sample Size:** Main Study: 100,000 pairs of mothers and children
  - Sub-Cohort Study: 5,000 pairs of mothers and children

**@Study Duration:** 13 years (2011-2028) since recruitment (2011-2014)

**@Expected outcomes:**

1. Identification of environmental factors with impacts on children’s health
2. Creation of sound environment for future generations
3. Establishment of a framework for children’s study
Local Governments

Cooperating Local Medical Institutions (Hospitals and Clinics)

Ministry of the Environment

- Design environmental policies on the basis of the study results
- Budgeting

Local Governments

Cooperate

Ministry of Health, Labor and Welfare

Ministry of Education, Culture, Sports, Science and Technology

Foreign countries currently with a cohort study

Regional Centers (at 15 locations nationwide)

- Each regional center requests the cooperation of local medical institutions (university hospitals, general hospitals and clinics)
- Register participants (expected mothers) and collect biological specimens

Cooperating Local Medical Institutions (Hospitals and Clinics)

- PR for public awareness and participation.
- Recruit when the Mother-Child Health Handbook is issued.
- Supply administrative data in accordance with applicable legislation.

Cooperate

Ministry of Health, Labor and Welfare

- Central role for implementation
- Data system management, specimen storage, and accuracy control.
- Support and supervise Unit Centers.

Medical Support Center (National Center for Child Health and Development)

- Medical support
- Prepare a protocol for the measurements of outcomes.
- Guidance and support to health care professionals involved in the study.

Research organization

Location of regional centers

- Core Center
- Medical Support Center
- 15 Regional Centres

Hokkaido
Koushin
Toyama
Kyoto
Hyogo
Tottori
Fukuoka
South Kyushu/Okinawa
Miyagi
Fukushima
Kanagawa
Aichi
Osaka
Kochi

Ministry of Education, Culture, Sports, Science and Technology

National Core Center (National Institute for Environment Studies)

- Design environmental policies on the basis of the study results
- Budgeting

Supervise

Central role for implementation

Data system management, specimen storage, and accuracy control.

Support and supervise Unit Centers.

Medical Support Center (National Center for Child Health and Development)

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Regional Centers (at 15 locations nationwide)

- Recruit participants and follow them up until age 13.
- Collect biological specimens and conduct questionnaire surveys.
- Communicate with participants through individual consultation.

Ministry of the Environment

Ministry of Health, Labor and Welfare

Ministry of Education, Culture, Sports, Science and Technology

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Foreign countries currently with a cohort study

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Design environmental policies on the basis of the study results

Budgeting

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Medical support center

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Regional Centers (at 15 locations nationwide)

- Recruit participants and follow them up until age 13.
- Collect biological specimens and conduct questionnaire surveys.
- Communicate with participants through individual consultation.
Recruited participants in each regional center

Total Participants
103,106 mother-child pairs

47% of the whole regional newborns
(ca. 3% of the whole nationwide newborns)

Noticed as the third largest 100,000-scale birth cohort study in the world, besides those in Denmark and Norway!
Sample collection

**Enrollment of 100,000 pregnant women**

- Early pregnancy
  - Informed consent
  - Questionnaire
  - Collection of mother’s blood and urine samples

- Mid to late pregnancy
  - Medical examination of baby at birth
  - Collection of cord blood samples
  - Collection of parent’s blood samples and mother’s hair
  - Collection of baby’s dried blood samples

- Birth
  - Collection of mother’s milk
  - Collection of baby’s hair

- 1 month old
  - Questionnaire (every 6 months)
  - Examination (every several years)
  - Collection of environmental samples

- 6 months old to 12 years old
  - Measurement of chemicals
  - Exposure dataset
  - Statistical analyses
  - Long-term storage (in specimen bank)

Identification of environmental factors with impacts on children’s health

**Exposures of interest**

<table>
<thead>
<tr>
<th>Chemicals from environment/occupation</th>
<th>Metals, POPs, pesticide, organofluorine compounds, aroma compounds, phthalate metabolites, phenols, others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical environment</td>
<td>Noise, heat, ionising radiation, housing condition, neighbourhood</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Stress, nutrition, daily rhythm, smoking and alcohol, infections, medications</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td>Education, house-hold income, social bonding, community support</td>
</tr>
<tr>
<td>Genetics/-omics</td>
<td>Genomics, epigenetics, metabolomics,</td>
</tr>
</tbody>
</table>
### Target compounds to be analyzed in bio-specimens

<table>
<thead>
<tr>
<th>Group</th>
<th>Target compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>Lead, cadmium, total mercury, methyl mercury, anemias and its compounds including, arsenobetaine, metylarsonic acid, dimethylarsinic acid, trimethylnitrone oxide, etc.</td>
</tr>
<tr>
<td>Inorganic substances</td>
<td>Iodine, perchlorate, nitrate nitrogen, etc.</td>
</tr>
<tr>
<td>Chlorinated POPs (Persistent organic pollutants)</td>
<td>Polychlorinated biphenyl (PCBs), hydroxylated polychlorinated biphenyl (OH-PCB), dioxins (PCDDs, PCDFs, Co-PCBs), pechchlorobenzene (PCB), etc.</td>
</tr>
<tr>
<td>Pesticides (including pesticide-POPs)</td>
<td>Chlorodanes, DDT and its metabolites (DDDE, etc.), din compounds for agriculture (dieldrin, etc.), heptachlor, hexachlorocyclohexane (HCH), mirex, chlordane, toxaphene, organochlorine pesticide metabolites (DMP, DDE, DDT, DDT, etc.), fenitrothion metabolite (methylnitrophenol), acephate metabolite (methamidophos), pyrethroid metabolites (PBA, DCCA, etc.), dichlorocarbamate fungicide metabolites (ethylen thiourea, etc.), neonicotinoid metabolites, pentachlorophenol (PCP), atrazine, dymron, glyphosate, flutaline, floridone, fluosulfamide, etc.</td>
</tr>
<tr>
<td>Brominated POPs</td>
<td>Polychlorobiphenyls ethers (PBEs), polybrominated phenyls (PBPs), hexabromocyclododecan (HBCD), etc.</td>
</tr>
<tr>
<td>Organofluorine compounds</td>
<td>Perfluorooctanoic acid (PFOA), perfluorooctane sulfate (PFOS), perfluorononanoic acid (PFNA), etc.</td>
</tr>
<tr>
<td>Aroma compounds</td>
<td>Nitromuns, cyclic musks, etc.</td>
</tr>
<tr>
<td>Phthalate metabolites</td>
<td>Mono (2-ethylhexyl) phthalates, etc.</td>
</tr>
<tr>
<td>Phenols</td>
<td>Bisphenol A, Monophenols, Parabens, etc.</td>
</tr>
<tr>
<td>Others</td>
<td>Triclosan, benzophenone, N, N-dietethyl-meta-toluidine (DEET), polyaromatic hydrocarbons (PAHs) and their metabolites (1-hydroxypyrene, 3-hydroxyanthrahebe, etc.), cotinine, thiocyanate, dichlorobromine, phytosterogen, caffeine, pyridine, acylamide, tributyl phosphate, tributoxyethyl phosphate, 8-hydroxydeoxyguanosine (8-OHdG), etc.</td>
</tr>
</tbody>
</table>

Kawamoto T et.al. BMC Public Health 2014: 14:25

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### Cohorts consisting of JECS study

**Main Study** = 100,000  
- Biological sample collection from mothers, children and fathers  
- Questionnaire administration during pregnancy, at birth, 1 month, 6 month, and every 6 month after that until children reach 13 years of age  
- Medical record, resident registry and school record transcription  

**Sub-Cohort Study** = 5,000  
- Home visit—Indoor and outdoor air quality, particulate matter, house dust, noise, dwelling inspection... at 1.5 and 3 years  
- Psychological development test, physical examination, blood and urine collection at 2 years of age and every 2 years thereafter.  

**Adjunct Studies** = participants recruited by each regional center  
conducted by regional centers with extramural funding  

**Pilot Study** = 400  
- to evaluate the feasibility, acceptability and cost of the proposed procedures and processes to be used in the Main Study
Outcome variables of allergy

**Main Study** = 100,000
- Doctor diagnosed patient reported allergic history collected from questionnaire during pregnancy.
- Blood serum total IgE and allergen specific IgE (Immuno CAP) in pregnant mother and her partner (father)
- ISAAC questionnaire,

**Sub-Cohort Study** = 5,000
- In addition to Main study outcomes
- Atopic dermatitis diagnosed by UK working party diagnostic criteria
- FeNO2, Spirogram at 8, 10, and 12 years of age.
- Total IgE and allergen specific IgE (DLC methods) at 2, 4, 6, 10, 12 yrs.

**Adjunct Studies** = participants recruited by each regional center conducted by regional centers with extramural funding

**Pilot Study** = 400
- FeNO2, Spirogram at 6, 8, 10, and 12 years of age.
- Total IgE and allergen specific IgE (DLC methods) at 2, 4, 6, 10, 12 yrs

Measured exposures and outcomes in the published works

**Main study**
- Questionnaire in pregnancy
- Parental blood metals (Cd, Pb, Hg, Se, Mn) in pregnancy
- Parental serum IgE (specific and total) in pregnancy
- Birth weight and length of off-springs

**Adjunct study**
- Maternal vit.D in pregnancy
- Desert dust exposed in Toyama, Kyoto, and Tottori regions

**Pilot study**
- Allergenic proteins contained in house dust collected from children’s bed sheets
Publications related to allergic diseases

- Having small-for-gestational-age infants was associated with maternal allergic features in the JECS birth cohort. Saito M et.al Allergy 2018 Sep;73(9):1908-1911
- Associations Between Metal Levels in Whole Blood and IgE Concentrations in Pregnant Women Based on Data From the Japan Environment and Children’s Study. Tsuji M et.al. J Epidemiology 20180098
- Allergy and mental health among pregnant women in the Japan Environment and Children’s Stud. Yamamoto-Hanada K et.al. JACI in Prac 2018;6:1421-1424
- Association between vitamin D deficiency and allergic symptom in pregnant women. Kanatani KT et.al. Plos one 14(4) e0214797

Three quarters of pregnant women who joined JECS have allergic diathesis

Prevalence of allergen specific IgE positive pregnant women (n=65,569)

<table>
<thead>
<tr>
<th>Allergen</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>73.9</td>
</tr>
<tr>
<td>Mite</td>
<td>48.0</td>
</tr>
<tr>
<td>Cedar</td>
<td>55.6</td>
</tr>
<tr>
<td>Egg white</td>
<td>1.0</td>
</tr>
<tr>
<td>Animal</td>
<td>20.5</td>
</tr>
<tr>
<td>Moth</td>
<td>28.0</td>
</tr>
</tbody>
</table>

73.9 % pregnant women were sensitized to any allergen. JCP showed the highest prevalence 55.6%. House dust mite was sensitized in 48% of them.
About half parents of participants have history of any allergic diseases

Any allergic diseases doctor-diagnosed

Maternal atopic dermatitis and higher total IgE were positively associated with Small for Gestational age (SGA) of off-springs

### Results of multivariable analysis in the relationship between quartile concentration of Hg in pregnant women and allergen-specific IgEs

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Hg (ng/g)</th>
<th>Animal dander</th>
<th>HDM</th>
<th>JCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 (≤2.55)</td>
<td>1.00 (referent)</td>
<td>1.00 (referent)</td>
<td>1.00 (referent)</td>
<td></td>
</tr>
<tr>
<td>Q2 (2.56–3.61)</td>
<td>0.91 (0.82–1.00)</td>
<td>0.057</td>
<td>1.06 (0.96–1.18)</td>
<td>0.214</td>
</tr>
<tr>
<td>Q3 (3.62–5.11)</td>
<td>0.98 (0.89–1.08)</td>
<td>0.734</td>
<td>1.23 (1.12–1.36)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Q4 (≥5.12)</td>
<td>0.86 (0.78–0.95)</td>
<td>0.003</td>
<td>1.35 (1.22–1.49)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Notes:**
- Odds ratios and corresponding 95% confidence intervals.
- P-values were obtained using multivariable logistic regression analysis adjusted for age, BMI, allergic diseases (asthma, allergic rhinitis, atopic dermatitis, allergic conjunctivitis, food allergy, drug allergy), smoking during pregnancy, smoking habits of partner, alcohol consumption during pregnancy, owning pets, month of T1 blood sampling, and geographic region.
Allergy and mental health among pregnant women in the Japan Environment and Children’s Study

Yamamoto-Hanada K et.al. JACI in Pract 2018;6:1421-1424

Participants: pregnant women (main study)

Outcome variables: K-6* in pregnancy
SF8(MCS*)
SF8(PCS*)

Exploratory variables: TIgE, sIgE in pregnancy
past history of allergic diseases

* K-6: Kessler’s K-6 Non-Specific Psychological Distress Scale
MCS: mental component summary
PCS: physical component summary

Depression of pregnant women was associated with higher titer of House Dust Mite, animal allergens mix, moth, any allergic diseases (Asthma, Eczema, rhino-conjunctivitis, Food allergy, Drug allergy and contact dermatitis)

<table>
<thead>
<tr>
<th>K-6 (≥5)</th>
<th>None (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any depression</td>
<td></td>
</tr>
<tr>
<td>log_IgE, nonspecific (continuous)</td>
<td>1.02 1.01 1.03 .0001 1.01</td>
</tr>
<tr>
<td>IgE (nonspecific) ≥170 UA/mL</td>
<td>1.05 1.01 1.09 .0112 1.05</td>
</tr>
<tr>
<td>IgE sensitization to any specific allergen</td>
<td>1.02 0.98 1.05 .2901 1.01</td>
</tr>
<tr>
<td>IgE_Der p 1</td>
<td>1.06 1.03 1.10 &lt;.0001 1.05</td>
</tr>
<tr>
<td>IgE_Japanese cedar</td>
<td>1.00 0.97 1.04 .7775 0.98</td>
</tr>
<tr>
<td>IgE_egg white</td>
<td>1.04 0.89 1.21 .6205 1.02</td>
</tr>
<tr>
<td>IgE_animal allergen mixes</td>
<td>1.08 1.04 1.12 .0001 1.05</td>
</tr>
<tr>
<td>IgE_moth</td>
<td>1.06 1.02 1.09 .0012 1.05</td>
</tr>
<tr>
<td>Any allergic diseases</td>
<td>1.23 1.19 1.27 &lt;.0001 1.25</td>
</tr>
<tr>
<td>Asthma</td>
<td>1.31 1.25 1.37 &lt;.0001 1.28</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>1.18 1.14 1.21 &lt;.0001 1.20</td>
</tr>
<tr>
<td>Eczema</td>
<td>1.18 1.14 1.23 &lt;.0001 1.17</td>
</tr>
<tr>
<td>Allergic conjunctivitis</td>
<td>1.28 1.22 1.35 &lt;.0001 1.32</td>
</tr>
<tr>
<td>Food allergy</td>
<td>1.35 1.26 1.44 &lt;.0001 1.33</td>
</tr>
<tr>
<td>Drug allergy</td>
<td>1.28 1.17 1.40 &lt;.0001 1.35</td>
</tr>
<tr>
<td>Contact dermatitis</td>
<td>1.45 1.31 1.61 &lt;.0001 1.55</td>
</tr>
</tbody>
</table>

Yamamoto-Hanada K et.al. JACI in Pract 2018;6:1421-1424
Severe depression of pregnant women was associated with higher titer of sIgE to Egg white, Asthma, Eczema, Allergic conjunctivitis, Food allergy and Contact dermatitis.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>None (reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgE, nonspecific (continuous)</td>
<td>0.039</td>
</tr>
<tr>
<td>IgE, nonspecific ≥170 U/mL</td>
<td>0.163</td>
</tr>
<tr>
<td>IgE, sensitization to any specific allergen</td>
<td>−0.041</td>
</tr>
<tr>
<td>IgE, Der p 1</td>
<td>−0.099</td>
</tr>
<tr>
<td>IgE, Japanese cedar</td>
<td>0.012</td>
</tr>
<tr>
<td>IgE, egg</td>
<td>0.174</td>
</tr>
<tr>
<td>IgE, animal allergen mixes</td>
<td>0.031</td>
</tr>
<tr>
<td>IgE, moth</td>
<td>−0.051</td>
</tr>
<tr>
<td>Any allergic disease</td>
<td>−0.994</td>
</tr>
<tr>
<td>Asthma</td>
<td>−0.934</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>−0.827</td>
</tr>
<tr>
<td>Eczema</td>
<td>−0.606</td>
</tr>
<tr>
<td>Allergic conjunctivitis</td>
<td>−1.105</td>
</tr>
<tr>
<td>Food allergy</td>
<td>−1.19</td>
</tr>
<tr>
<td>Drug allergy</td>
<td>−1.705</td>
</tr>
<tr>
<td>Contact dermatitis</td>
<td>−1.501</td>
</tr>
</tbody>
</table>

Physical aspect of quality of life (SF8-PCS) in pregnant women with any allergic disease (asthma, eczema, allergic rhino-conjunctivitis, food allergy, drug allergy and contact dermatitis) was worse than those without allergic disease.
Mental aspect of quality of life (SF8-MCS) in pregnant women with any allergic disease (asthma, eczema, allergic rhinoconjunctivitis, food allergy, drug allergy and contact dermatitis) was also worse than those without.

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**SF-8 (MCS)** | None (reference)  
---|---  
IgE, nonspecific (continuous) | -0.046  
IgE (nonspecific) ≥ 170 UA/mL | -0.113  
IgE sensitization to any specific allergen | -0.021  
IgE, Der p 1 | -0.125  
IgE, Japanese cedar | -0.038  
IgE, egg | -0.32  
IgE, animal allergen mixes | -0.113  
IgE, moth | -0.066  
Any allergic disease | -0.514  
Asthma | -0.574  
Allergic rhinitis | -0.424  
Eczema | -0.385  
Allergic conjunctivitis | -0.899  
Food allergy | -0.576  
Drug allergy | -0.676  
Contact dermatitis | -0.783  

Adjsutors for multivariate analysis: maternal age, place of residence, marital status, having another child, history of abnormal pregnancy, current smoking status, employment status, and maternal education level. Statistically significant results shown in bold font.

Yamamoto-Hanada K et al. JACI inPrac 2018;6:1421-1424

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**Applied nutritional investigation**

**Dietary intake of fish and ω-3 polyunsaturated fatty acids and physician-diagnosed allergy in Japanese population: The Japan Environment and Children’s Study**

Kei Hamazaki M.D., Ph.D., a,b,c, Akiko Tsuchida M.Sc. a,b, Ayako Takamori Ph.D. 1,b, Tomomi Tanaka M.D., Ph.D. b,c, Mika Ito M.D., Ph.D. d, Hidekuni Inadera M.D., Ph.D. a,b, Japan Environment and Children’s Study (JECS) Group1

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Hamazaki K et al. Nutrition 2019:61:194-201
Fish and ω-3 PUFA intake were associated with increased risk for some allergic diseases except asthma

<table>
<thead>
<tr>
<th></th>
<th>Any of four allergies</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fish intake</td>
<td>7.3</td>
<td>20.3</td>
<td>31.7</td>
<td>45.9</td>
</tr>
<tr>
<td></td>
<td>(Median g/d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>15 741</td>
<td>15 561</td>
<td>15 918</td>
<td>15 689</td>
<td>15 712</td>
</tr>
<tr>
<td>Cases</td>
<td>7409</td>
<td>7612</td>
<td>7969</td>
<td>7975</td>
<td>7889</td>
</tr>
<tr>
<td>OR</td>
<td>1.00</td>
<td>1.08 (1.03-1.13)</td>
<td>1.13 (1.08-1.18)</td>
<td>1.16 (1.11-1.22)</td>
<td>1.13 (1.08-1.19)</td>
</tr>
<tr>
<td>aOR</td>
<td>1.00</td>
<td>1.05 (1.00-1.10)</td>
<td>1.08 (1.04-1.13)</td>
<td>1.11 (1.06-1.16)</td>
<td>1.07 (1.02-1.12)</td>
</tr>
</tbody>
</table>

|                | ω3PUFA                | 0.91 | 1.37 | 1.75 | 2.21 | 3.13 |
|                | (Median g/d)          |   |   |   |   |   |
| n              | 15 694                | 15 734 | 15 637 | 15 867 | 15 689 |
| Cases          | 7428                  | 7744 | 7819 | 8025 | 7837 |
| OR             | 1.00                  | 1.08 (1.03-1.13) | 1.11 (1.06-1.16) | 1.14 (1.09-1.19) | 1.11 (1.06-1.16) | <0.0001 |
| aOR            | 1.00                  | 1.04 (1.00-1.09) | 1.06 (1.01-1.11) | 1.07 (1.02-1.13) | 1.03 (0.97-1.09) | 0.11 |

Hamazaki K et al. Nutrition 2019:61:194-201
## Fish intake

<table>
<thead>
<tr>
<th>Quintile for fish intake</th>
<th>1 (low)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (high)</th>
<th>P_{\text{trend}}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median intake of fish, g/d</td>
<td>4.7</td>
<td>20.7</td>
<td>35.5</td>
<td>53</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>All participants, n</td>
<td>8481</td>
<td>8504</td>
<td>8562</td>
<td>8552</td>
<td>8562</td>
<td></td>
</tr>
<tr>
<td>Any of four allergies</td>
<td>3397</td>
<td>3051</td>
<td>3702</td>
<td>3670</td>
<td>3571</td>
<td>0.02</td>
</tr>
<tr>
<td>Asthma</td>
<td>1.00</td>
<td>1.00(0.90-1.16)</td>
<td>1.16 (0.97-1.21)</td>
<td>1.13 (0.86-1.20)</td>
<td>1.07 (1.01-1.14)</td>
<td>0.02</td>
</tr>
<tr>
<td>Adjusted odds ratio</td>
<td>1.00</td>
<td>1.00 (0.90-1.16)</td>
<td>1.16 (0.97-1.21)</td>
<td>1.13 (0.86-1.20)</td>
<td>1.07 (1.01-1.14)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

**Atopic dermatitis**

**Allergic rhinitis**

## ω3PUFA intake

<table>
<thead>
<tr>
<th>Quintile for ω3PUFA intake</th>
<th>1 (low)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (high)</th>
<th>P_{\text{trend}}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median intake of ω3PUFA, g/d</td>
<td>0.89</td>
<td>1.40</td>
<td>1.83</td>
<td>2.36</td>
<td>3.48</td>
<td></td>
</tr>
<tr>
<td>All subjects, n</td>
<td>8541</td>
<td>8557</td>
<td>8578</td>
<td>8554</td>
<td>8601</td>
<td></td>
</tr>
<tr>
<td>Any of four allergies</td>
<td>3342</td>
<td>3038</td>
<td>3702</td>
<td>3670</td>
<td>3571</td>
<td>0.001</td>
</tr>
<tr>
<td>Asthma</td>
<td>1.00</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>0.001</td>
</tr>
<tr>
<td>Adjusted odds ratio</td>
<td>1.00</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>1.10 (1.00-1.22)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Atopic dermatitis**

**Allergic rhinitis**

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Hamazaki K et al. Nutrition 2019:61:194-201
Time course of daily dust level in kilometers (upper) and pollen counts in cubic meters (lower) during the study period (shaded).

For dust levels, blue indicates Kyoto (Higashi-Osaka); red, Toyama; and green, Tottori (Matsue). For pollen counts, blue indicates Kyoto (Kyoto City area); purple, Kyoto (Nagahama area); green, Kyoto (Kizugawa area); red, Toyama; and orange, Tottori.


Pregnant women had an increased risk of allergic symptoms on high desert-dust days. The increased OR was mostly driven by those who showed positive IgE to Japanese cedar pollen when pollen simultaneously dispersed. No clear risk increase was observed in the absence of pollen or for participants with negative IgE to Japanese cedar pollen. The risk elevation was observed from low levels of desert dust in a dose-dependent manner even on control days.

**RESEARCH ARTICLE**

**Association between vitamin D deficiency and allergic symptom in pregnant women**

Kumiko T. Kanatani1,2*, Yuichirou Adachi3, Kei Hamazaki3, Kazunari Onishi4, Tohshin Go2, Kyoko Hirabayashi1, Motonobu Watanabe5, Keiko Sato2,7, Youichirou Kurozawa6, Hideki Inada7, Hiroshi Oyama8, Takeo Nakayama1, for the Japan Environment and Children’s Study Group11

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* Membership of the Japan Environment and Children’s Study Group is provided in the Acknowledgments.


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**Serum concentration of vitamin D varies throughout the year**

![Graph showing serum concentration of vitamin D throughout the year](image)

Fig 1. Serum 25(OH)D levels in relation to sampled months. Serum 25(OH)D was lowest in August and highest in March. There was a clear seasonal change with a peak at the end of summer and a trough in early spring. The median level of serum 25(OH)D in each season was 15, 14, 19, and 20 ng/mL in winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug) and autumn (Sep-Nov).

Serum 25(OH)D was less than 20ng/mL in 1,233 of 1,745 samples (70.7%). The adjusted odds ratio (aOR) for occurrence of any allergic symptom in deficient cases compared with non-deficient cases was 1.33 (95% CI: 1.07–1.64, p = 0.01). Further, vitamin D deficiency significantly enhanced the risk increase at desert dust events and at pollen exposure (p-values for interaction<0.1).

Table 2. Odds ratio (OR) and its 95% Confidence Interval (95%CI) for allergic symptom development.

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D deficiency</td>
<td>1.33</td>
<td>1.07–1.64</td>
<td>.009</td>
</tr>
<tr>
<td>IgE to cedar pollen</td>
<td>1.28</td>
<td>1.21–1.35</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>(per class increase)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IgE to house dust mite</td>
<td>1.10</td>
<td>1.03–1.18</td>
<td>.008</td>
</tr>
<tr>
<td>(per class increase)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vit. D deficiency increased the risk of allergic symptom when exposed to desert dust events and IgE positive to JCP and HDM was also risk factors.


Egg protein was detected from house dust collected From bed sheets in all participants’ houses

![Graph showing protein levels of different allergens](image)

From Pilot Study

Wilcoxon rank-sum test  * p < 0.001

Kitazawa H et.al. Allergology International 2019
Summary

• The primary aim of JECS is to examine environmental influence on children’s health
• Half of pregnant mothers have history of allergic diseases and ¾ of mothers have been sensitized with any allergens
• Hg influences allergen sensitization in different manner due to the kinds of allergens.
• Adjunct studies revealed the influence of desert dust on allergy and a pilot study showed house dust of all participants’ house contained egg proteins.
• Important exposure variables including environmental chemicals that might influence the onset of allergic diseases are to be analyzed
Acknowledgement

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Osaka

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and Development

Kochi

Fukuoka

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& Okinawa