Chemicals found in children's bodies and their health effects
Contactos

José Manuel Camacho  
Community Outreach Coordinator  
Center for Environmental Research and Children’s Health (CERCH)  
University of California, Berkeley

Melissa Mallory  
Education Program Advisor  
California Department of Education

Lizette Rocha  
Education Program Assistant  
California Department of Education
CHAMACOS Study Objectives

• To measure environmental exposures in pregnant women and children.
• To determine the relationship between Environmental Exposures and:
  • neurodevelopment
  • growth
  • respiratory disease
• To reduce exposure to children and pregnant women with interventions and community outreach.
• To learn about policies to reduce the incidence of diseases related to the environment.
Many Factors Influence Maternal and Child Health

Immediate environment
- Genes
- Nutrition
- Housing Quality
- Family Relations

Other factors
- Health
- Enrichment
- Home environment
- Pesticides

Greater environment
- Violence
- Discrimination
- Poverty
- Acculturation
RISK

Ecological (acute & chronic)

- Aquatic
- Terrestrial

Human health (acute & chronic)

- Populations & Subpopulations
- Special protection for children
Children at Higher Risk of Exposure
Enrollment: 1999-2000

601 pregnant women living in the Salinas Valley:

- They received prenatal care in 5 prenatal care clinics that serve low-income residents
- They planned to give birth at Natividad Medical Center

- 92% Spanish-Speaking
- 85% Born in México
- 54% \( \leq 5 \) years in USA
- 44% 6th grade education or less
- 44% worked in agriculture during pregnancy
- 84% other agricultural workers in home

** Primarily Mexican immigrants from low-income households**
Exposures

- **Pesticides**
  - Organophosphates
  - Pyrethroids
  - Manganese Fungicides
  - Ethylene bisdithiocarbamates (EBDCs)
  - Another current use of pesticides
  - Organochlorines
  - Flame retardants
  - Bisphenol A
  - Phthalates
  - Allergens (pollen / mold)
  - Housing quality
  - Social factors (race, nationality, income)
Outcomes

- Birth outcomes (duration of pregnancy, birth weight, etc.)
- Neurobehavioral development
- Respiratory functioning
- Obesity and child metabolic syndrome
- Puberty onset
- Thyroid hormone
California, The Leading Agricultural State

Salinas Valley
Areas With High OP Use
Prenatal and child OP metabolites in CHAMACOS and NHANES*

* National Health and Nutrition Examination Survey
Bradman et al. EHP, 2005, 2011
ORGANOPHOSPHATE PESTICIDES
Length of Gestation was Shorter for Infants of Women with Higher OP Pesticide Exposures

For every 10 fold increase in OP metabolites in the later half of pregnancy, there was a half week decrease in gestation

Eskenazi et al., EHP, 2004

Photo by Julie Fisher
Higher use of some fumigants, (ex. methyl bromide and chloropicrin) also associated with slightly lower developmental scores.

Like OPs, methyl bromide at high levels can be bad for children's brains. We are working to learn more about fumigants.

Methyl bromide is no longer used in the Salinas Valley or CA!
Representative drawings of 4-year-old Yaqui children from the valley and foothills of Sonora, Mexico.
Child Behavior Checklist 1½ - 5 year old DSM-Oriented Scale

- Afraid to try new things
- Avoids looking others in the eye
- Can’t stand having things out of place
- Disturbed by any change in routine
- Doesn’t answer when people talk to him/her
- Doesn’t get along well with other children
- Repeatedly rocks head or body
- Shows little affection towards people
- Speech problem (describe)
- Strange behavior (describe)
- Upset by new people or situations (describe)
- Withdrawn, doesn’t get involved with others

Pervasive Developmental Disorder
Prenatal OPs and Behavior

Children born to moms with higher levels of OPs while pregnant tended to score:

- ↑ PDD at 24 months (maternal report)
- ↑ ADHD at 5 years (maternal report)
- ↑ ADHD at 5 years (CPT)
Nearby OP Use and Child Development

- When more OPs were used near homes during pregnancy, children had lower developmental scores at 7 years.
- This is similar to what we saw when there were higher levels of OPs in the urine.
- Detections in urine probably come from pesticides in food and less from pesticide drift. Using maps, we are better able to see that living near where pesticides are used can increase drift exposure.
Prenatal OPs and Neurodevelopment

Children born to moms with higher levels of OPs while pregnant tended to score:

- ↓ neurodevelopment at 24 months
- ↓ verbal skills at 3 ½ years
- ↓ neurodevelopment at 7 years
Organophosphate pesticides and asthma

We wanted to know:

Is there a link between exposure to organophosphate pesticides (OP) and asthma symptoms in CHAMACOS study?
Prenatal and childhood (0-5Y) OP metabolites related to respiratory symptoms at school age

Models adjusted for:
Child’s gender, age, Maternal smoking, ETS, Season of birth, PM2.5, Breastfeeding, Mold, Traffic, Cockroaches
Raanan et al., EHP, 2015.

Increased risk per 10-fold increase

- Prenatal OP metabolites
- Postnatal OP metabolites
In our CHAMACOS families

We measured OP pesticides in the urine of:

- Mothers during pregnancy
- Children between 6 months and 5 years of age

We asked mothers if their child had asthma symptoms at 5 and 7 years of age
Results of exposure to OP pesticides and asthma

We found more asthma symptoms in:

- Children whose mothers were exposed to higher levels of OP pesticides during the second half of pregnancy
- Children who were exposed to higher levels of OP pesticides in childhood
OP use has also decreased!
Certified Organic Cropland in California

Source: United States Department of Agriculture, 2010
Pesticides (fungicides) containing manganese

- Widely used in Salinas
- Manganese is an important element of our diet, but is toxic in high amounts

We wanted to know if use of pesticides with manganese:

- Increases manganese levels in homes
- Increases manganese levels in children's teeth
- It is related to children's brain development
Manganese in home dust and teeth

- We measured manganese levels in home dust and children's teeth.
- We found higher levels of manganese when:
  - Pesticides with manganese were used in agricultural fields near home.
  - Farm workers clothes or shoes were stored inside home.
  - There was not a doormat at house entrance.

Like tree rings.
Manganese in teeth and brain development

- Children with highest manganese levels in their teeth had a small decrease in motor development at 6 months.
- These effects disappeared when children grew up.
- So far, we have not seen lasting effects of manganese exposure to levels we found in CHAMACOS' children.
Stress and children

- When stress was higher, children had slightly lower developmental scores at 7 years.
- For families with more stress, pesticides had a higher effect on the child's development.
- In families with less stress and a positive learning environment, pesticides had a minor impact on the child's development.
FIRE RETARDANTS
PBDE’s
PBDEs are added to household items to reduce flammability.
California Technical Bulletin 117

NOTICE
THIS ARTICLE MEETS ALL FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF HOME FURNISHINGS BULLETINS 116 AND 117. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

TB 116/117
NOTICE

THIS ARTICLE MEETS THE FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF ELECTRONIC AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION TECHNICAL BULLETIN 117-2013. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

The upholstery materials in this product:
- contain added flame retardant chemicals
- X contain NO added flame retardant chemicals

The State of California has updated the flammability standard and determined the fire safety requirements for this product can be met without adding flame retardant chemicals. The State has identified many flame retardant chemicals as being known to, or strongly suspected of, adversely impacting human health or development.

Furniture made after January 1, 2015 will have the “Technical Bulletin 117-2013” label AND the new flame retardant label.

Look for the labels marked “contain NO added flame retardant chemicals”
High PBDEs dust levels in California

PBDE 99 in home dust - several regions

Quiros-Alcala et al., 2011
Do PBDE levels increase over time in US MOTHERS?

![Graph showing trend](image)

- $P_{\text{trend}} < 0.001$
- Years of residence in US:
  - $\leq 1$
  - 2-5
  - 6-10
  - $\geq 11$
  - For life

Sum PBDEs (ng/g lipids)
It was found that Mexican children have much lower levels of flame retardants.

Levels in Mexican-American children in US were 7x higher than Mexican children.
Children in California have higher PBDE levels
Health Effects

Scientists and doctors still do not know if PBDEs can affect our health. Current research is examining whether PBDEs are related to:

- Infertility problems
- Learning delay in children
WHAT YOU CAN DO

- Repair or replace upholstered items with torn covers or exposed foam.
- Frequently clean dust with a wet rag and mop.
- Use a vacuum with HEPA filter.
- Open windows to let in fresh air.
- Choose baby products and furniture that contain polyester, wool or cotton, they are less likely to have flame retardants.
BISPHENOLA or BPA
BPA is used in hard plastics, some food cans, and receipts from stores.
# BPA FREE PLASTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="PETE" /></td>
<td>Clear tough plastic such as soft drink, juice and water bottles.</td>
</tr>
<tr>
<td><img src="image" alt="HDPE" /></td>
<td>Common white or coloured plastic such as milk containers and shampoo bottles.</td>
</tr>
<tr>
<td><img src="image" alt="LDPE" /></td>
<td>Hard rigid clear plastic such as cordial bottles.</td>
</tr>
<tr>
<td><img src="image" alt="PP" /></td>
<td>Soft flexible plastic e.g. squeezable bottles such as sauce bottles.</td>
</tr>
<tr>
<td><img src="image" alt="PS" /></td>
<td>Hard but flexible plastic such as microwave ware, takeaway containers, some yoghurt/ice cream/jam containers, hinged lunch boxes.</td>
</tr>
<tr>
<td><img src="image" alt="OTHER" /></td>
<td>Rigid, brittle plastic such as small tubs and margarine/butter containers.</td>
</tr>
<tr>
<td>All other plastics, including acrylic and nylon. Examples include some sports drink bottles, sunglasses, large water cooler bottles.</td>
<td></td>
</tr>
</tbody>
</table>

---

**Selezione productos plásticos más seguros.**

1. **PETE**
2. **HDPE**
4. **LDPE**
5. **PP**

**Plásticos que hay que evitar.**

- **PVC or vinyl**
  - Can contain phthalates
- **Polystyrene Foam**
- **Can contain Bisphenol A**

- **PVC o vinilo**
  - Pueden contener ftalatos
- **Espuma de Poliestireno**
- **Puede contener bisfenol A**
RECOMMENDATIONS

• Avoid heating food in plastic containers

• Avoid heating foods wrapped in plastic in the microwave

• Reduce the amount of food you eat from plastic-lined packages

• Do not wash plastic containers in dishwasher

• Use alternatives like glass, metal or plastic # 1 containers

• Buy products labeled BPA-Free, Bisphenol A Free or Phthalate Free
Endocrine Disruptors in Personal Care Products

**Phthalates** (fragrances)

**Parabens** (preservative)

**Triclosan** (antibacterial)

**Oxybenzone** (sunscreen)
Buy instead

**Phthalates (fragrances)**

**Use:** Make fragrances last longer and make nail polish smoother.

**Found in:** Perfumes, scented soaps, shampoos, lotions and other beauty products. Air fresheners and scented household cleansers. Nail polish.

**Health effects:** Linked to behavior problems and allergies in children. May effect reproductive development in males.

**How it’s listed on the label:** “Fragrance” or “perfume”

**Buy instead:** Unscented or naturally scented products.
Parabens

Use: A preservative to prevent growth of mold or bacteria

Found in: Foundation, mascara, eye liner, eye shadow, and other cosmetics

Health effects: Mimics estrogen. Has been linked to breast cancer, but little is known about how it affects our health

How it’s listed on the label: Methyl paraben, ethyl paraben, propyl paraben.

Buy instead: Mineral based make-up made without parabens
Buy instead

**Antibacterial**

**Triclosan**

**Use:** To kill bacteria

**Found in:** Antibacterial or antimicrobial soaps and cleansers. Colgate Total toothpaste

**Health effects:** Linked to changes in estrogen and thyroid hormone. Long term health effects not known

**How it’s listed on the label:** Triclosan, “antibacterial”

**Buy instead:** Regular soap or toothpaste eliminate germs just as well
Buy instead

Oxybenzone

**Use:** To block UV radiation

**Found in:** Sunscreens, foundation, blush, and other cosmetics

**Health effects:** Associated with decreases in sperm production in animal tests (rats) and with birth weight changes in humans

**How it’s listed on the label:** oxybenzone, BP-3

**Buy instead:** Zinc oxide or titanium dioxide base sunscreens
Future directions...

We want to learn more about how chemical exposures can affect health at older ages and find out what we can do to make sure our children grow up healthy. We hope to follow children passed 18 years of age, paying special attention to changes in neurodevelopment and behavior!
18-Year Visits

• We are starting an exciting new project that will allow us to see how a person's brain reacts as they perform different thinking tasks during the 18-year visit.

• They will use a cap with special sensors that show us which parts of the brain are being used to complete certain tasks.

• We will use this data to help determine if there is a relationship between altered brain function and chemical exposures.
Housing Quality
Household food insecurity 2005-2006

Rosas et al., JADA, 2009
Background

- Many youth in the United States are overweight.

- Healthy food and exercise are important for our health.

- It can be difficult to obtain healthy foods, cook fresh foods, or find the time or place to exercise.

- The scientists want to know if the chemicals in the environment increase the chances of becoming overweight.
Tips to stay healthy

There is a lot we can do to stay healthy:

- Eat healthy food
- Exercise
- Sleep well
- Read
- Do not smoke or abuse alcohol or drugs
- Talk to friends/family when you need help
- Spend time with family
Projects to Reduce Pesticide Exposure
Field Intervention

Farm workers received gloves.

Method developed to provide hot water in the field.

Workers left their work clothes at the fields to be washed.

Lightweight coverall developed and provided.

Trained crew leaders to use the system. The crew leaders filled tanks.

5 field-based education sessions.
Gloves reduced pesticides on hands and in the body.

Bradman et al., JESEE, 2009

* p<0.05 *** p<0.001
Farm Worker Education

- 42% had no pesticide safety training.
- 52% didn’t know when pesticides were applied.
- 92% didn’t know names of pesticides.
- 62% worry that pesticides could hurt their family’s health.

Over 30,000+ people reached!
Home Intervention

We also acted to reduce take-home pesticide exposures.
We developed a curriculum in home for families

- 3 sessions with farmworker households
- Developed action plan to reduce pesticide exposure
- Identified barriers to action

Salvatore et al., submitted.
CHAMACOS Advisory Structure

- Scientific Advisory Board
- Youth Community Council
- Farmworker Council
- Growers Council

Community Advisory Board

(40+ youth, 6+ years)
We work with the entire community
Reflections From Youth Council

**Belonging:**

- “I (now) feel like I fit into a whole other clique... a spark of hope for future generations... it's given me the power to believe I can change things...”

**Teamwork:**

- “I learned to collaborate with my team (on) amazing adventures, ones that I’ll never forget.”

**Capacity Building:**

- “My skills... were enhanced: team building, data collection, kit cleaning, data entry, team communication, public speaking, respect towards adults, (and) interviewing...”

- “I now won’t be afraid to speak out (loud) to my classmates or future bosses.”
Pilot and Collaboration with California Migrant Education

Training of Trainers Project (La Semilla):

- Trained volunteers
- Provided them with a curriculum, presentation, educational activities, handouts
- Each volunteer trained more parents to protect their families from pesticides
New Collaboration with Migrant Education

• Aim to reach 5 sites in 5 counties/regions across California
• Provide pesticide exposure prevention and Worker Protection Standards training
• Help attendees learn how to be strong presenters
• Provide community members with educational resources
• Hold a series of educational puppet shows for children of farmworkers
Stay informed...

For more information about the CHAMACOS study visit us online:

www.cerch.berkeley.edu

and sign up for our e-newsletter
CHAMACOS is on Facebook!

Give us a “Like” and a “follow” to know the latest news from CHAMACOS

www.facebook.com/CHAMACOSCERCH

(@CHAMACOSCERCH)
CHAMACOS Funders

United States Environmental Protection Agency

Agencia de Protección Ambiental de Estados Unidos

National Institute of Environmental Health Sciences

Instituto Nacional de Ciencias de la Salud Ambiental

Oficina de Educación Migrante de California

California Breast Cancer Research Program

Programa de Investigación del Cáncer de Mama
Thank You!