The Interplay Study: Examining the Effect of Flame Retardants and the Home Environment on Children's Neuro-Cognitive and Behavioral Development

Partnership for Environmental Public Health – Social Stress and Susceptibility

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Conflict of Interest Statement

Dr Kim Anderson invented the silicone passive sampler wristband.

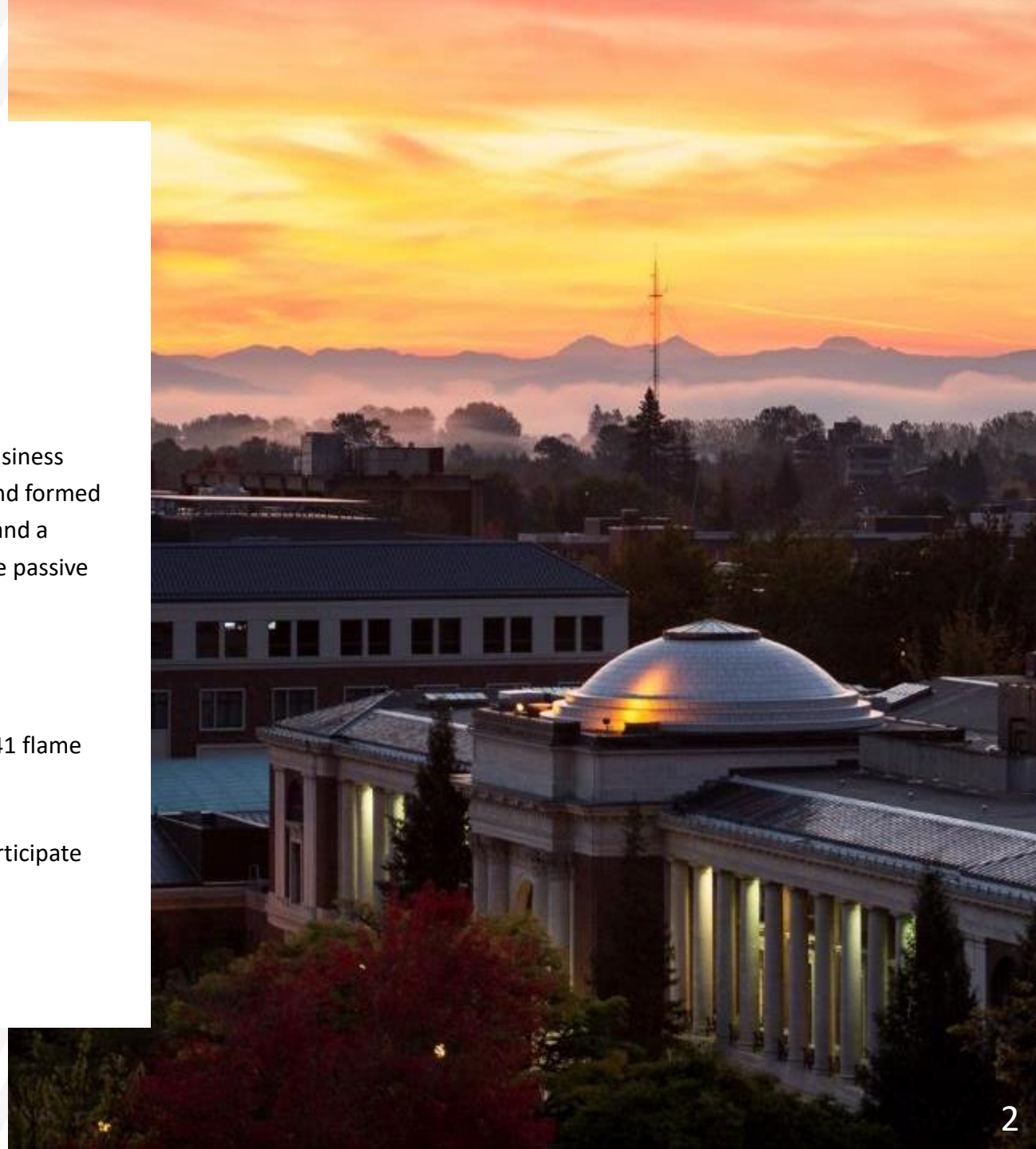
- Received NIH Small Business Innovation Research and Small Business Technology Transfer grants to commercialize this technology and formed MyExposome which is dedicated to creating an awareness of, and a market for, passive environmental monitors such as the silicone passive sampler wristband

- May financially benefit from the outcomes of this research

Dr Kim Anderson developed the analytical method for measuring 41 flame retardants and examining the analytical data quality.

- Blinded to all data collected on the participants and did not participate in any data analysis.

All other investigators declare no conflict of interest.



Outline

- Toxicological perspective of chemical-stress interaction on neurocognitive development
- Children's social stressors and resilience factors
- Results from a cross-sectional pilot study
- The Flame Retardant and Home Environment on Children's School Readiness Study

Chemical-Stress Interaction and Children's Neurocognitive Development

Environment – social interactions

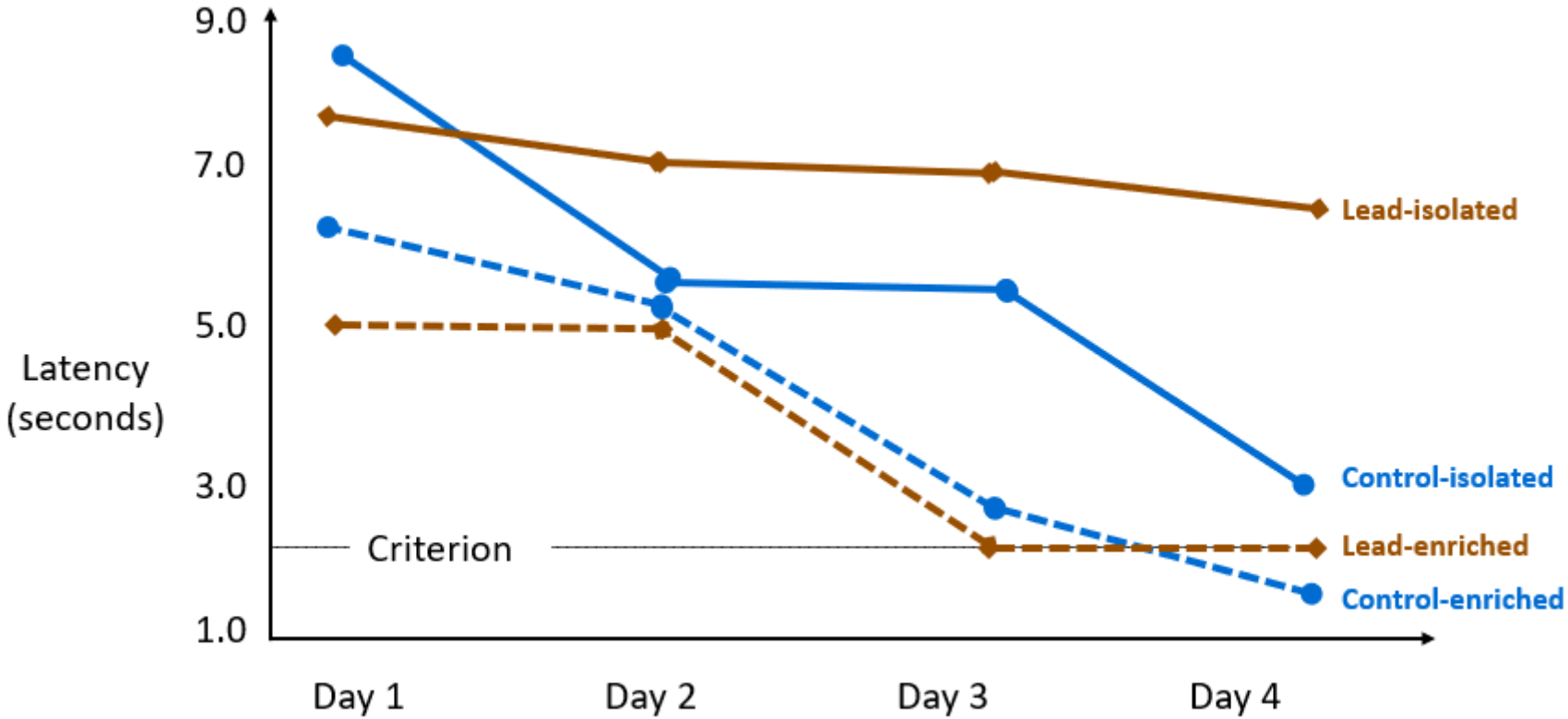
Traditional test conditions
(minimize interference)

Enriched test conditions
(provide stimulation)

Slater and Cao. A Protocol for Housing Mice in an Enriched Environment

Social enrichment modified lead neurotoxicity

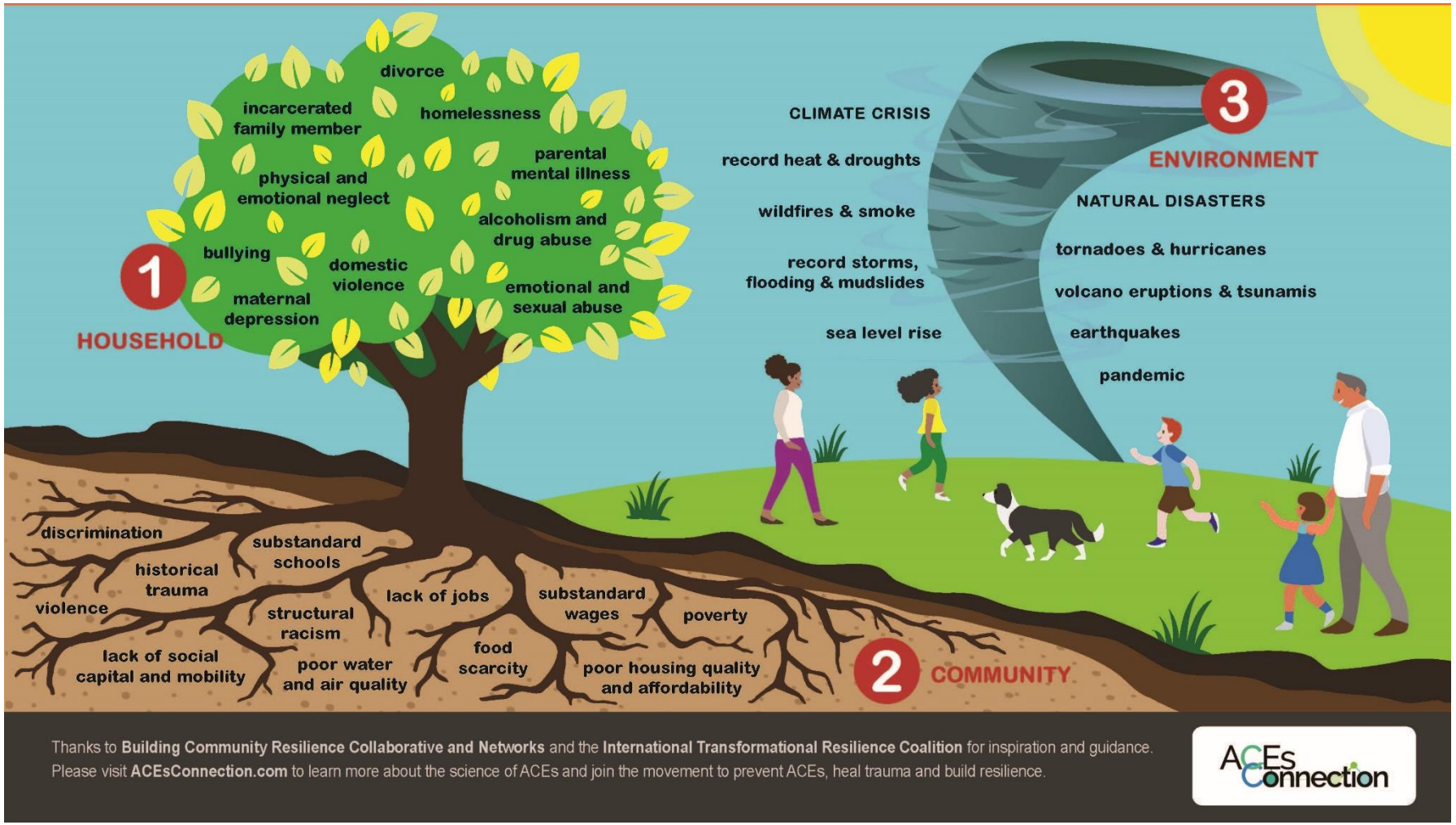
Animals exposed to Pb^{+} and reared in an enriched environment were able to learn the location of the platform in a water maze test at a significantly faster rate than Pb^{+} exposed littermates reared in an isolated environment.



Adapted from Guiarte et al. (2002) Environmental enrichment reverses cognitive and molecular deficits induced by developmental lead exposure. Annals of Neurology, 53(1): 50-56

Children's Social Stressor and Resilience Factors

Adverse Childhood Experiences



Resilience

Resilience: *Positive adaptation in the face of adversity*

Types of Protective Factors:
Individual, Relational, Community/Cultural
(Lui et al., 2017; Masten, 2018; Unger, 2011)

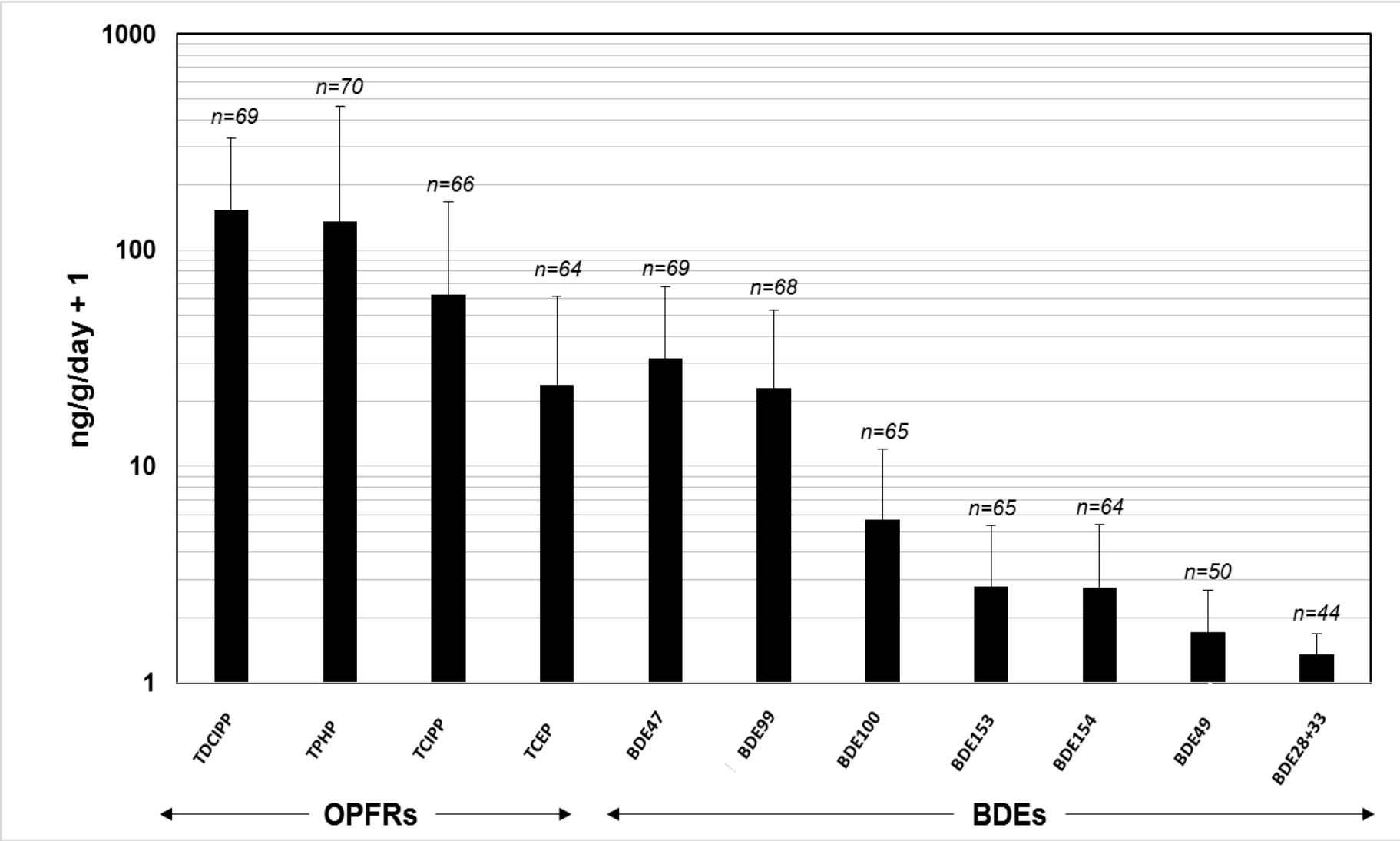
Cross-Sectional Pilot Study

Proof of Concept

Interplay Cross-Sectional Pilot Study

- Cross sectional study from Oct 2012 - Jan 2013
- Preschool children in two Oregon communities aged 3-5 years (N=92)
- Collected house dust, hand wipes, and child wore wristband for 7 days
- Parent completed socio-demographic questionnaires
- Preschool teacher completed Social Skills Improvement System Rating Scale to measure children's social behaviors in classroom settings
    - 7 subscales (Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, Self-Control, Externalizing, Bullying, Hyperactivity/Inattention, and Internalizing)

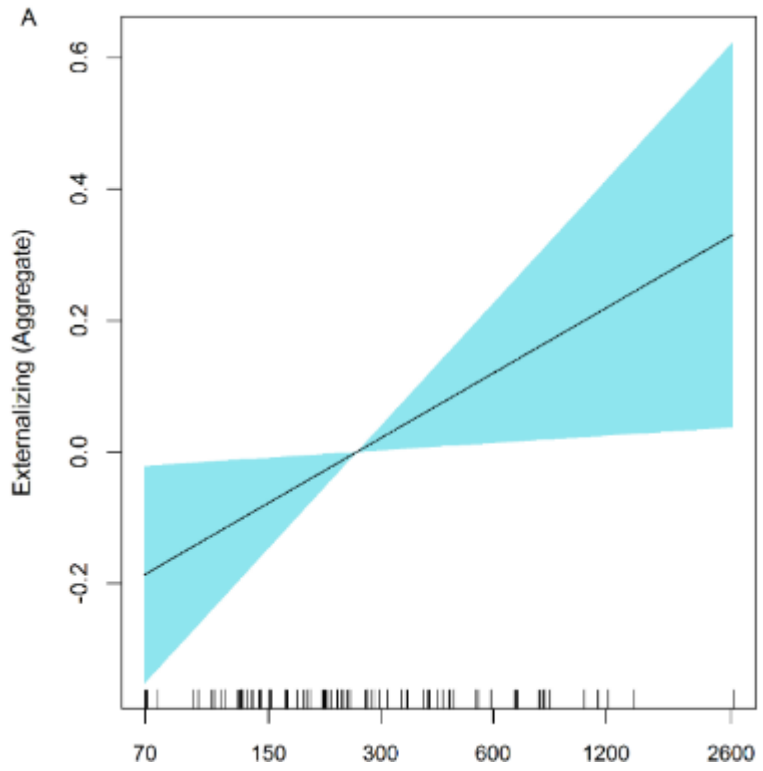
Most abundant flame retardants in wristbands (60% or more above detection limit)

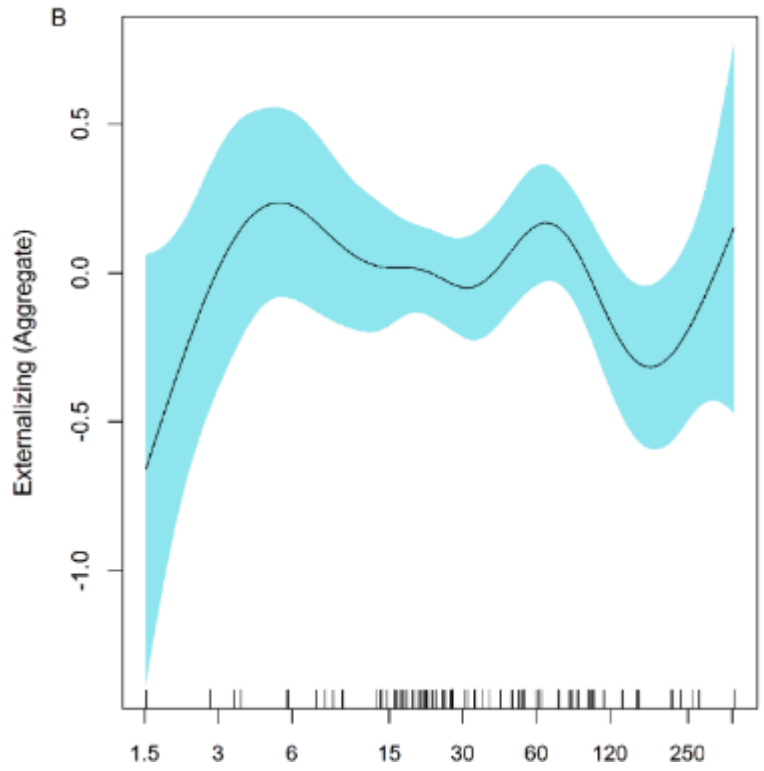


Kile et al, Env. Research 2016

Associations: LnΣOPFRs and LnΣBDE with Externalizing (Behavior Problems)

Adjusted for family context, age, sex, and child adverse experiences



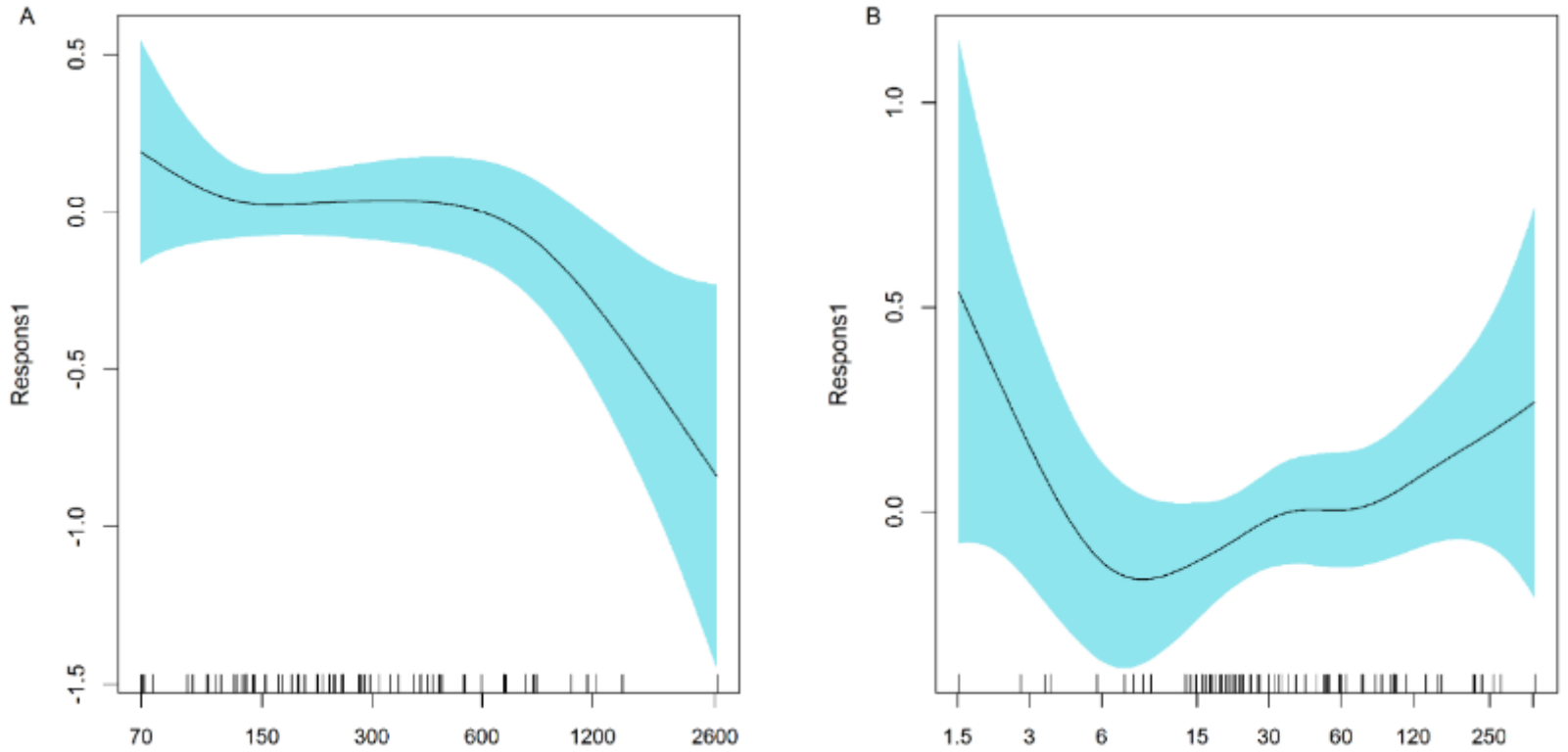


Curve	% of deviance explained	Sample size (n)	P-value
A) LnΣOPFRs (ng/g-day)	34.8%	69	0.027
B) LnΣBDEs (ng/g-day)	46.8%	69	0.303

Lipscomb et al, Env. Health 2017

Associations: LnΣOPFRs and LnΣBDE with Social Skills (Responsibility)

Adjusted for family context, age, sex, and child adverse experiences



LnΣOPFRs (ng/g-day)

LnΣBDE (ng/g-day)

Curve	% of deviance explained	Sample size (n)	P-value
A) LnΣOPFRs (ng/g-day)	47.8%	69	0.069
B) LnΣBDEs (ng/g-day)	48.8%	69	0.243

Lipscomb et al, Env. Health 2017

Ongoing Cohort Study

"Flame retardants and home environment on children's school readiness study"

Study Aims

1. Exposure

- Assess exposures to flame retardant mixtures among a diverse group of children over a three year time period from preschool to first grade.

2. Exposure-response

- Examine the exposure-response relationship between OPFRs and children's development.

3. Interactions

- Examine the interactions between social stressors, resilience factors, and OPFR exposures and children's development.

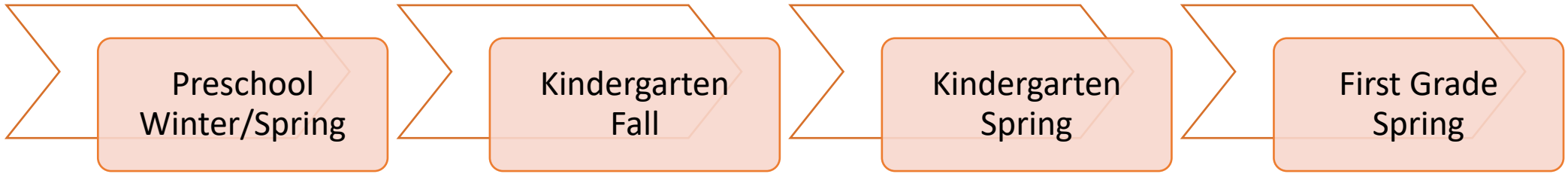
The Big Question

Do children's social experiences exacerbate or buffer the neuro-cognitive toxicity of chemical pollutants commonly found in their environment?

Longitudinal repeated measures cohort study

Sample

- Aim: 600 children from a wide range of socio-economic and racial/ethnic backgrounds
  - Current recruitment, n=441 parent-child and n=228 teachers at early education centers



Measurements

- Flame Retardant Exposures
- Home Environment: social stressors, resilience factors, demographics, etc.
- Child Assessments: executive function, social skills & behavior problems, early literacy & math skills

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