

# Food Insecurity and Child Outcomes

National Academies of Science  
Workshop on Research Gaps—  
Causes and Consequences of Child Food Insecurity and Hunger

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## Overview

- Food Insecurity during Pregnancy
- Food Insecurity and Children's Diet
- Food Insecurity and Children's Weight Status
- Influence of food insecurity among children with chronic diseases
- Next Steps

## Odds of Low Birth Weight among a Random Sample of Women from IL (n=294)

**Table 4. Multivariable Logistic Regression Models That Evaluated the Association of Each Psychosocial Variable After Controlling for Maternal Age**

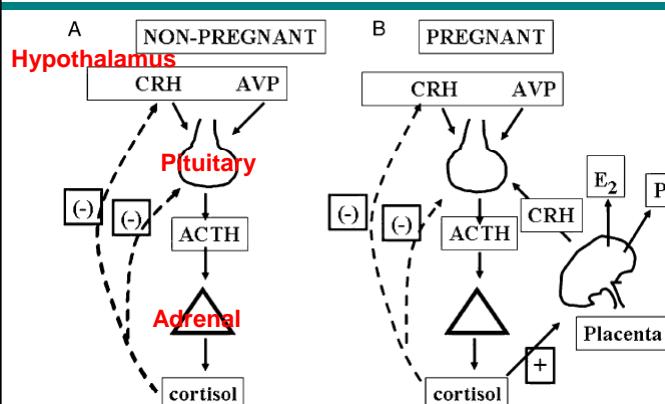
Variables	aOR*	95% CI
Food insecurity	2.6	1.7–3.5
Child with chronic illness	3.1	2.3–4.0
Home crowdedness	1.8	0.9–2.7
Unemployed	3.7	2.7–4.7
Poor coping skills	4.0	3.1–4.9

aOR, adjusted odds ratio; CI, confidence interval.

\* Adjusted for maternal age.

Borders et al. Chronic stress and low birth weight neonates in a low-income population of women. *Obstet Gynecol* 2007;109:331-8.

## Influence of Stress on Pregnancy

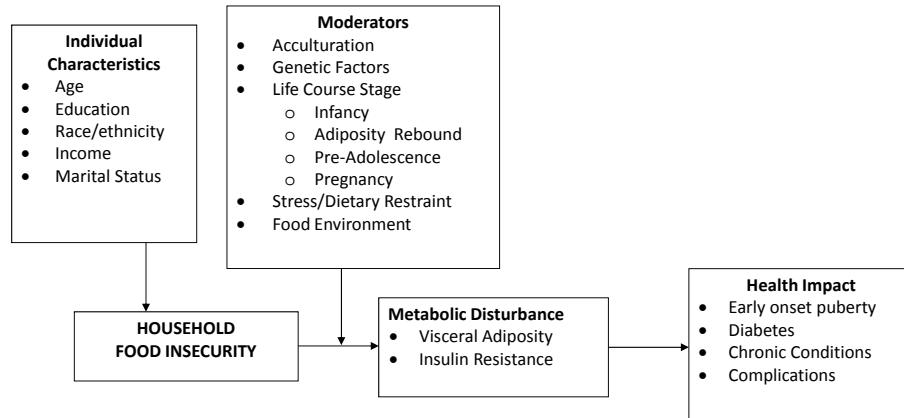


- Influence of stress can go from mother to child or child to mother

**FIGURE 1.** Major differences as to how cortisol effects CRH production between the nonpregnant state (hypothalamic-pituitary-adrenal axis) and the pregnant state (hypothalamic-pituitary-adrenal-placental axis).

Hobel et al. Psychosocial stress and pregnancy outcomes. *Clin Obstet Gynecol*. 2008;51:333-48.

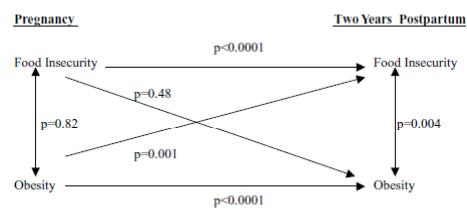
## Conceptual Framework of Household Food Insecurity on Adiposity and Health



Modified from Laraia, Ad Nutr 2013 (in press)

## Obesity associated with Food Insecurity at 2 years Post Partum

**Figure 2. The Associations Between Food Insecurity and Obesity Within and Across Early Pregnancy and 2 Years Postpartum (N = 311).**



- Significant interaction between prepregnancy food insecurity & obesity
- Linear combination of food insecurity & obesity was strongly and significantly associated with major weight gain ( $\geq 4.55$  kg) at 2 years PP.

Olson & Strawderman J Rural Health 2008

## Pregnancy, Infection and Nutrition Study

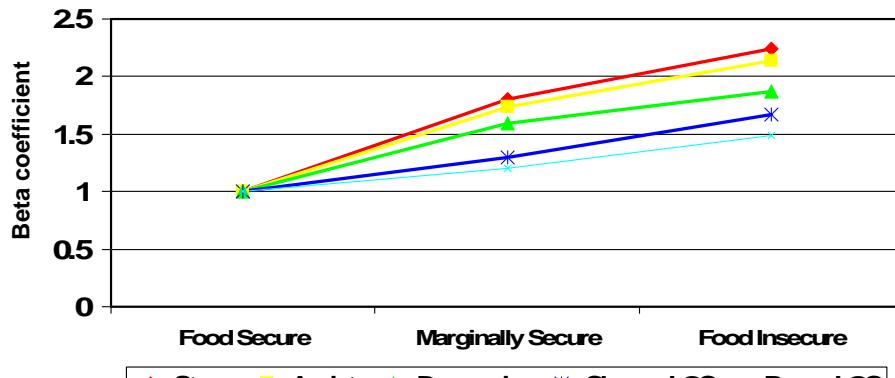
- Prospective cohort study pregnant women enrolled between 2001-2006 (n=2,006) assessed at 3 months (n=688) and 12 months postpartum (n=550)
- **Survey Assessment:**
  - Socioeconomic status, eating behaviors, dietary intake, physical activity, other health behaviors
- **Primary Exposure:** Household food insecurity status
  - USDA 18 Item Core Food Security Module assessed at 26-32 weeks' gestation
- **Psychosocial Factors:**
  - Perceived Stress; Trait Anxiety, Depression (CES-D); Locus of Control—Given to Chance, Powerful Others; Self Esteem and Mastery



## Prevalence of Food Insecurity in the PIN Study

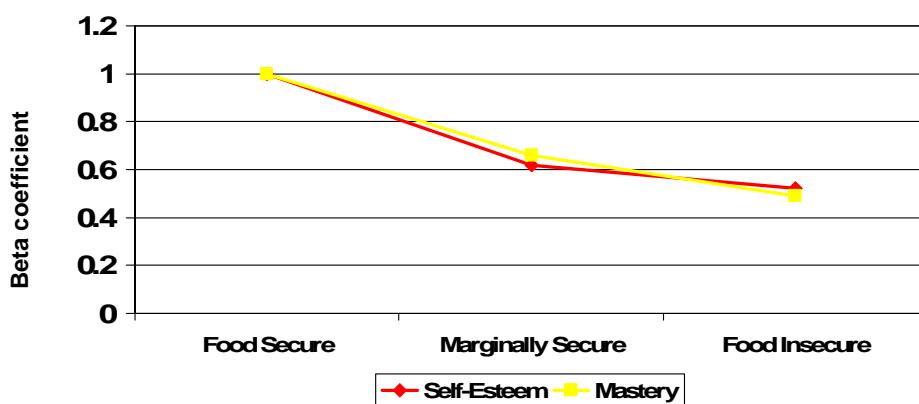
- Full sample (n=2006)
  - 87% Fully food secure
  - 8% Marginally food secure
  - 5% Food insecure
- Sample <400% income/poverty ratio (n=606)
  - 75% Fully food secure
  - 15% Marginally food secure
  - 10% Food Insecure

## Association of Psychosocial Factors and Food Security Status



\* Adjusted models controlling for age, children, education, income, race, and marital status  
 Laraia BA, et al. *J Nutr* 2006;136:177-182.

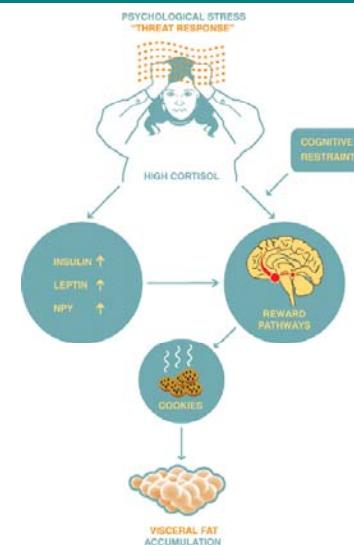
## Decreased Protective Traits with Increased Household Food Insecurity



\* Adjusted models controlling for age, children, education, income, race, and marital status

Laraia BA, et al. *J Nutr* 2006;136:177-182.

## Stress Induced Non-Homeostatic Eating

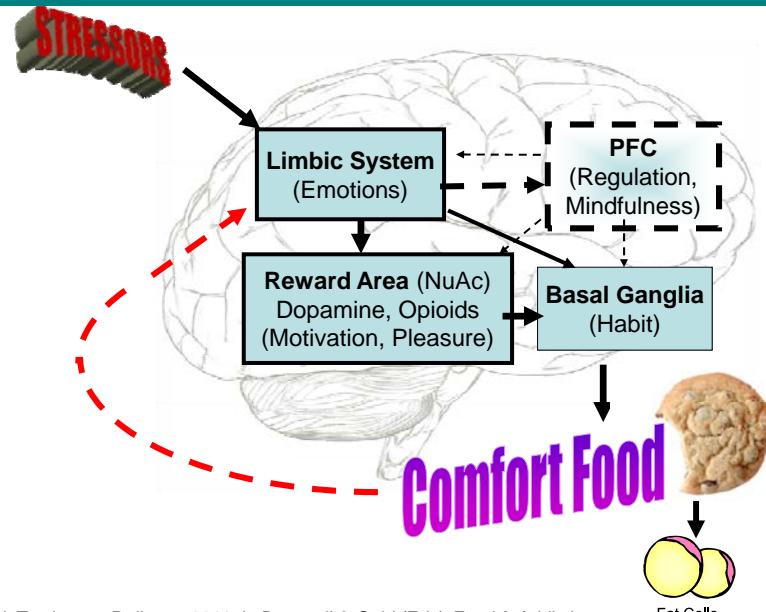


- 40% eat less, while 40% eat more under chronic stress conditions
- Stress increases the desire for palatable foods to dampen the stress response
- Eating in the presence of stress can lead to insulin resistance and visceral fat accumulation
- Food Insecurity is a **threat** that can stimulate HPA axis triggering hunger and increasing drive for feeding

Fig. 1. Theoretical model of reward based stress eating.

Adam &amp; Epel, 2007

## Stress, Reward & Habitual Eating Pathways

Epel, Tomiyama, Dallman, 2010, in Brownell & Gold (Eds) *Food & Addiction*

## Food Insecurity During Pregnancy

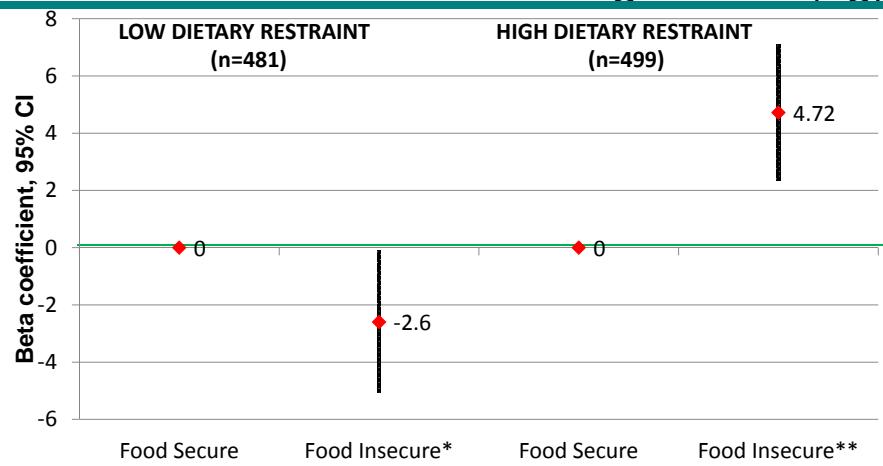
- Food insecurity was associated with:
  - Greater weight gain (kg) [ $\beta = 1.87$ , 95% CI: 0.13, 3.62]
  - Greater risk for GDM [OR = 2.38, 95% CI: 0.99, 5.73]

\* Adjusted models controlling for age, children, education, income, race, and marital status



Laraia BA, et al. *J Am Diet Assoc.* 2010;110:692-701.

## Significant Interaction: Food Insecurity & Dietary Restraint Associated with Differential Gestational Weight Gain (kg)



Adjusted models controlling for age, children, education, income, race, marital status, pre-pregnancy BMI, gestational age at last visit, physical activity, and smoking

Laraia BA, et al. *Appetite* 2013 (in press).



# Food Insecurity and Child Outcomes

## Food Insecurity & Childhood Anemia

Authors & Year	Study Design, Data Set, & Sample Size	Association with Iron Def. or Iron Def. Anemia?
Bhattacharya et al. 2004	Cross-sectional NHANESIII 1988-94 2-5, 6-11, 12-17 y N=9,582	<b>No</b> , no association found between microserum levels of iron and food insufficiency in any age group.
Skalicky et al. 2005	Cross-sectional C-SNAP at ED in Boston 6 – 36 mos. N=626	<b>Yes</b> , food insecure vs. food secure children: 2.4 greater odds of IDA (P=0.02), even when adjusting for possible confounders.
Eicher-Miller et al. 2009	Cross-sectional NHANES 1999-2004 3-5, 6-11, 12-15, 16-19 y N=11,247	<b>Yes</b> , food insecure vs. food secure children: 3-5 y: 10.71 greater odds of IDA (P=0.02) 6-11 y: 8.05 greater odds of IDA (P=0.003) 12-15 y: 2.95 greater odds of IDA (P=0.02)
Park et al. 2009	Cross-sectional C-SNAP in Minneapolis <36 mos. N=2,853	<b>Yes</b> , very low food secure vs. high/ marginally food secure children: 1.98 greater odds of IDA (95%CI: 1.11-3.53)

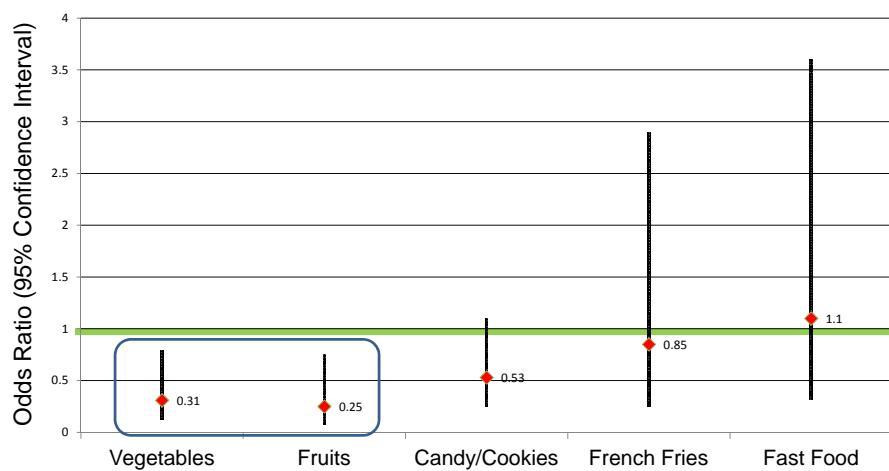
## Food Insecurity and Diet

Authors & Cohort	Sample Size	# Models	Results
Bhattacharya 2004, NHANES III	4,248 2-5 y, 3,103 6-11 y, 2,151 12-17 y	6	12-17 y: ↓ 3-point HEI score
Kirkpatrick, Tarasuk 2007 2004 Canadian Community Health Survey 2.2	891 1-3 y, 1,749 4-8 y, 1,926 9-13, 2,040 14-18 y by gender	186	4-8 y: ↓ energy: EER, protein 9-13 y males: ↓ vitamin C, B-6, B-12, energy density, % energy protein, grain products 9-13 y females: ↓ fruits and vegetables 14-18 y males: ↓ folate, potassium, 14-18 y females: ↓ potassium, energy density, % energy protein, milk products
Lorson, 2009, 1999-2002 NHANES	6,513 children 2-18 y	2	No association between HFS and meeting fruit or vegetable intake recommendations
Eicher-Miller 2009, 1999-2004 NHANES	11,247 children 3-5, 6-11, 12-15, 16-19 y	20	16-19 y: ↑ odds of iron intake <EAR and grain source iron intake <median of FS children
Eicher-Miller 2011, 2001-04 NHANES	5,270 children 8-11, 12-15, 16-19 y by gender	12	8-11 y males: ↑ odds of calcium intake <EAR and dairy servings below USDA guidelines
Cunningham 2012, 2006-08 Oregon PRAMS	1,522 mothers of 2-y children	11	↓ odds of vegetable and fruit intake ↑ odds of soda intake

## Food Insecurity and Diet in Hispanic children

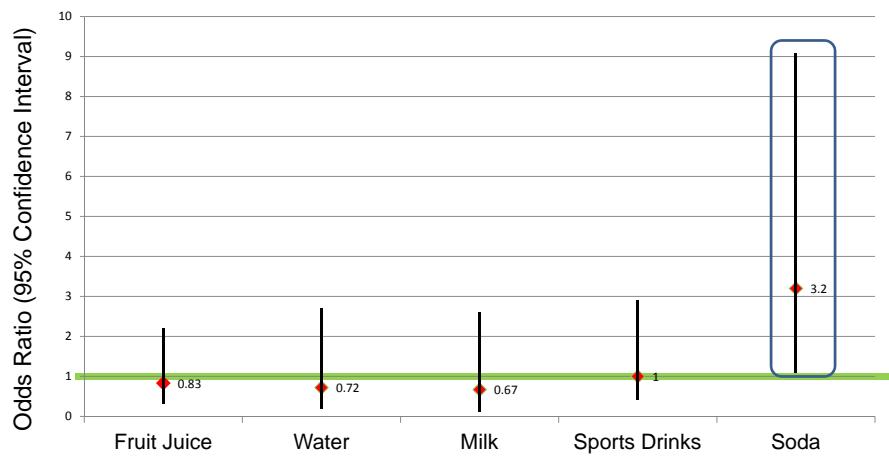
Ref	Sample Size	# Outcomes	Associations with food availability and diet
Matheson 2002	124 Hispanic 5 <sup>th</sup> grade children	7	↓ availability of meat, grains, fruits, vegetables, milk
Kaiser 2002	211 Mexican American families	6	↓ meeting FGP recommendation for milk and total FGP score
Kaiser 2003	274 low-income Latino families with preschool children	171 (11 shown)	↓ availability of nutrient-dense foods (e.g. fruits, vegetables, whole-wheat bread, meats) and non-nutrient dense foods (soda, pan dulce, gelatin, chocolate powder, alcohol)
Rosas 2009	301 children of CHAMACOS study	33	↑ total fat, saturated fat, sweets and fried snacks. Low FS children consumed most meat (0.9 times/d) compared to very low FS children (0.6 times/d) and FS children (0.7 times/d)
Dave 2009	184 parents low SES Hispanic children 5-12 y	8	↓ fruit (fresh, canned), vegetable juice
Sharkey 2012	50 Mexican-origin children 6-11 y in Texas border colonias	10	Very low FS associated with ↑ total energy, calcium and % calories from added sugar

## Maternal Food Insecurity and Toddler Food Intake 4-7 compared to 0-1 day/week



Cunningham et al. Is maternal food security a predictor of food and drink intake among toddlers in Oregon? Maternal Child Health J. 2012.

## Maternal Food Insecurity and Toddler Drink Intake 4-7 compared to 0-1 day/week



Cunningham et al. Is maternal food security a predictor of food and drink intake among toddlers in Oregon? Maternal Child Health J. 2012.

## Variable Foraging Demands



- Coplan 2006:
  - Early VFD: No change on maternal CRF
  - Late VFD: ↑ Maternal CRF
  - ↑ Infant CRF with both Early & Late VFD
- Kaufman 2007:
  - Late VFD: ↑ weight, ↑ BMI, ↑ abdominal circumference
  - “Our data suggest that early-life stress during a critical period of neurodevelopment can result in the peri-pubertal emergence of obesity and insulin resistance.”

## Food Insecurity and Coping Strategies

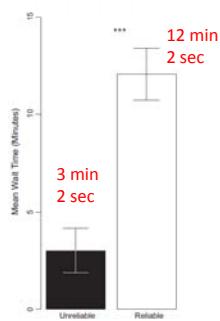
	Girls 9-13 y	Boys 9-13 y
“When I am hungry, I eat snacks like chips, candy and pop”	47%	65%
“I overeat at mealtimes so I will not be hungry later on”	36%	62%*
“If I am hungry, I will eat anything”	42%	51%
“If there is no food at home, I can find food somewhere else”	35%	51%
“If I am hungry, I will eat foods that I do not like”	24%	30%
“When there is not a lot of food in the home, we eat at a friend’s or family’s house”	34%	25%

P<0.001 for gender difference

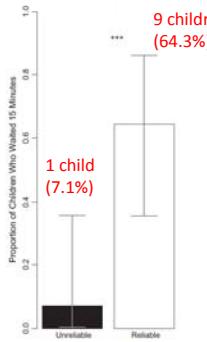
Smith C, Richards R. Dietary Intake, Overweight Status, and Perceptions of Food Insecurity among Homeless Minnesotan Youths. Am J Hum Biol. 2008.

## Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability

Celeste Kidd <sup>a,\*</sup>, Holly Palmeri <sup>a</sup>, Richard N. Aslin <sup>a,b</sup>



**Fig. 1.** Mean wait-times of children in each condition. Error bars show 95% confidence intervals. Children in the unreliable condition waited 9.55 minutes on average to eat the marshmallow for a mean duration of 3 min 2 sec ( $M = 181.2$  sec,  $SD = 100.4$  sec). Children in the reliable condition waited 12 min 2 sec ( $M = 722.4$  sec). A Wilcoxon signed-rank test found this difference to be highly significant ( $W = 22.5$ ,  $p < 0.0001$ ). Here, 15 min was used as the maximum wait time, as children were told to wait until the researcher returned, though these children may have actually waited longer if the experimental design had permitted.

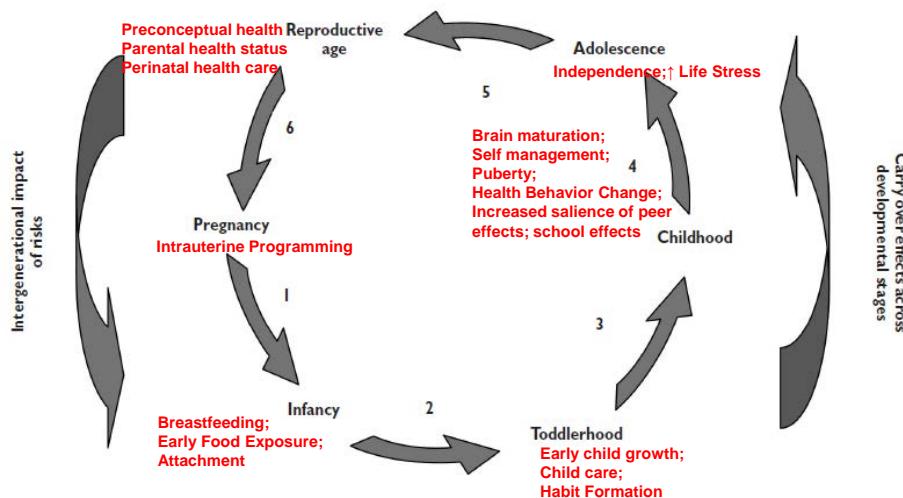


**Fig. 2.** Proportion of children who waited the full 15 min without eating the marshmallow by condition. Error bars show 95% confidence intervals. In the unreliable condition, only 1 out of the 14 children (7.1%) waited the full 15 min; in the reliable condition, however, 9 out of the 14 children (64.3%) waited the full 15 min. A Wilcoxon signed-rank test found this difference to be highly significant ( $W = 7.6222$ ,  $d = 1$ ,  $p < 0.0001$ ). The test found it to be highly significant ( $\chi^2 = 7.6222$ ,  $df = 1$ ,  $p < 0.0001$ ).

- Delayed gratification and self-control are associated with self-confidence, higher academic, social & emotional scores, & SAT score, decrease likelihood of substance abuse
- Poor delayed gratification associated with risk of being overweight at age 11
- But what determines delayed gratification?

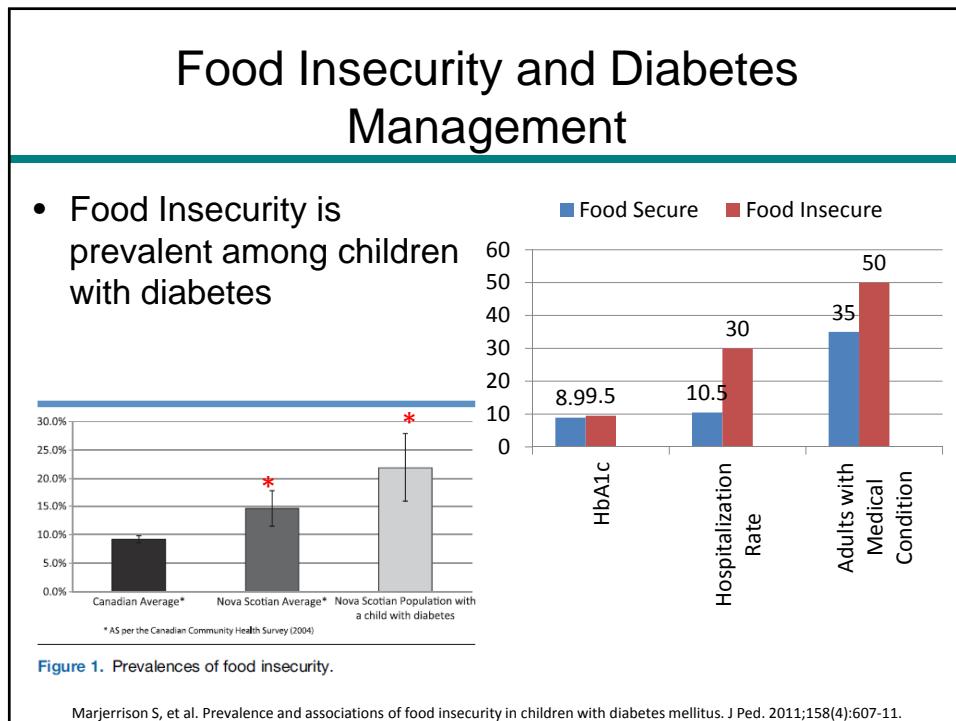
Kidd C, Palmeri H, Aslin RN. Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability. *Cognition* 2013;126:109-114.

## Developmental and Intergenerational Effects on Obesity



Nader et al. Next steps in obesity prevention: Altering early life systems to support healthy parents, infants, and toddlers. *Childhood Obesity* 2012;8(3): 195-204.

Food Insecurity & Child Wt. Status in Longitudinal Studies		
Authors & Cohort	Timeframe & Sample Size	Association with BMI & Weight Gain?
Bronte-Tinkew et al. 2007 ECLS-B	Δ 9 to 24 mos. N=8,693	<b>No</b> , however, overweight status linked through parenting practices and infant feeding practices.
Hernandez et al. 2009 ECLS-B	Δ 9 to 24 mos. N=7,900	<b>No</b> , weight-for-age BMI z-score were not significantly associated with food insecurity
Metallinos-Katsaras et al. 2012 WIC-Massachusetts	Δ infancy to 2-5 y N=28,353	<b>Yes</b> , in persistent food insecurity without hunger <b>Yes</b> , in food insecure children with mother that had pre-pregnancy BMI status as underweight or overweight/obese.
DuBois et al. 2006 LSCDQ	Δ 1.5 to 4.5 y N=1,514	<b>Yes</b> , food insufficiency at 1.5 y doubled odds for overweight at 4.5 y.
Winicki et al. 2006 ECLS-K	Δ K fall to K spring N=18,847	<b>No</b> , change in BMI & weight not significant <b>However</b> , as severity of food insecurity increases, proportion increases of children overweight & obese.
Jyoti et al. 2005 ECLS-K	Δ K to 3 <sup>rd</sup> grade N=11,180	<b>Yes</b> , in girls when persistently food <i>insecure</i> . <b>Yes</b> , in boys when transitioning to food <i>insecurity</i> .



## Food insecurity is associated with viral markers among 62 HIV infected children

### Multivariate model results

Linear regression for CD4 counts <sup>c</sup>	$\beta$	[95 % CI]	<i>p</i>
Food secure	Reference	Reference	Reference
Food insecure	-0.23	[-0.40, -0.01]	0.0453
Logistic regression for incomplete viral suppression <sup>d</sup>	Odds Ratio	[95 % CI]	<i>p</i>
Food secure	Reference	Reference	Reference
Food insecure	4.07	[1.02, 13.92]	0.025

Comparison of characteristics between food insecure and food secure participants were all *p* > 0.05. Comparisons were made using Student's *t* test for continuous variables and Pearson's Chi squared or Fisher's exact tests for categorical variables

<sup>a</sup> Data presented as mean (standard deviation)

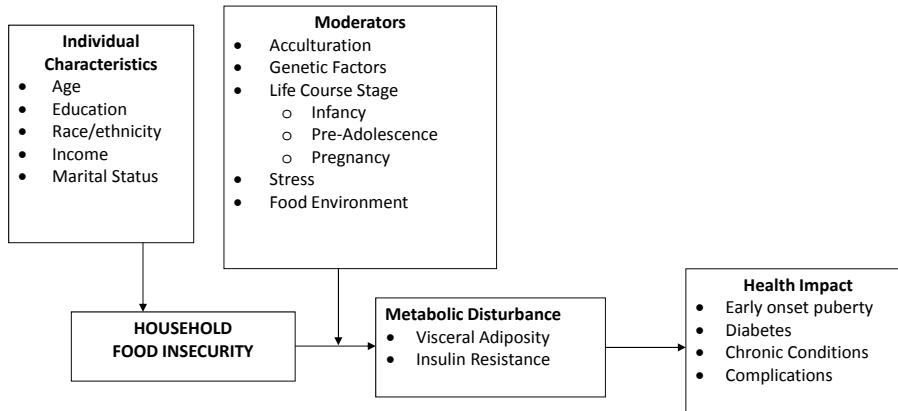
<sup>b</sup> Data presented as n (row % for food insecure versus secure, or column % for Total)

<sup>c</sup> Controlling for age and race/ethnicity

<sup>d</sup> Controlling for gender

Mendoza et al. Food insecurity, CD4 counts, and incomplete viral suppression among HIV+ patients from Texas Children's Hospital: A pilot study. AIDS Behav 2013.

## Conceptual Framework of Household Food Insecurity on Adiposity and Health



Modified from Laraia, Ad Nutr 2013 (in press)

## Question 1

- Is existing evidence sufficient to make causal claims, or merely associational?
  - No evidence exists to make a causal claim of the effect of food insecurity on:
    - Pregnancy outcomes, although there is temporality
    - Anemia, although very consistent findings
    - Diet, significant in the expected direction but little consistency for the food or nutrient studied
    - Weight gain, very inconsistent but longitudinal studies are more consistent
    - Disease Management

## Question 2

- Does how we measure food security, the unit (household vs. child hunger), and the severity/ threshold matter for our understanding of the topic?
  - Depends on the research question
  - Temporality of food insecurity and diet, e.g., food insecurity in past 30 days to be more consistent with dietary data
  - Duration of food insecurity, number of years—validated retrospective question or scale
  - Marginal food insecurity very important with regard to stress

## Question 3

- Are there important data gaps? **YES!**
  - No more cross sectional studies need to be funded with scarce research dollars, **however**,
  - Monitoring and surveillance beyond prevalence of food insecurity should be encouraged
  - Assess important modifiers of food insecurity
- Longitudinal, experimental, demonstrations, administrative, linked admin-survey data, qualitative? **YES!**
  - Basic science questions want to identify causality
  - Experiments can show mechanisms
  - Interventions can show impact
  - Efficient to link administrative data to monitor progress and show strong associations

## Question 4

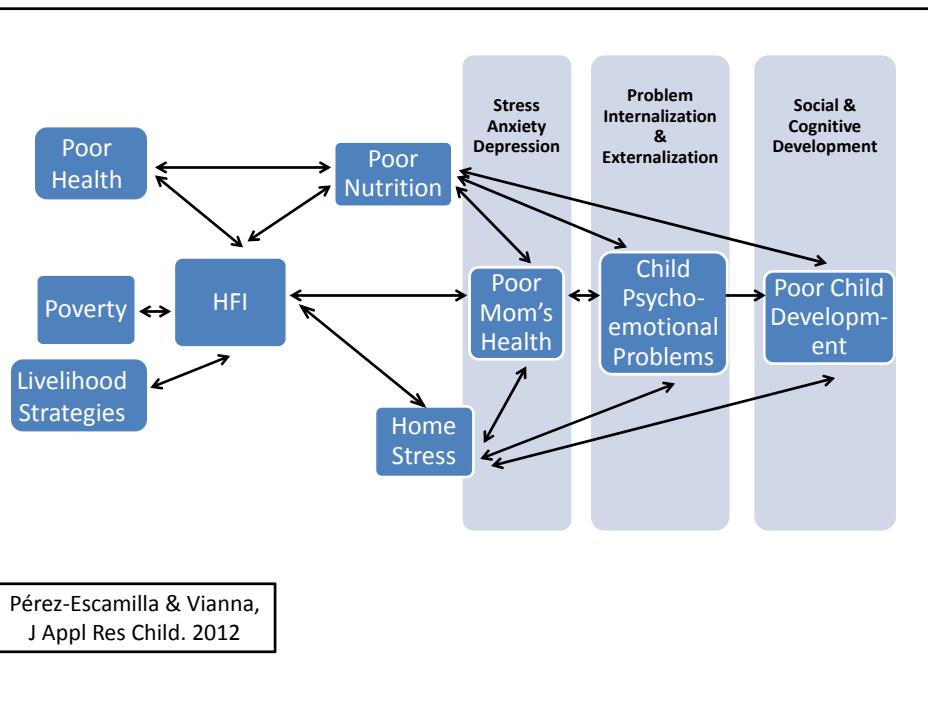
- How should USDA prioritize research efforts?  
What are the critical questions, and what kind of research could begin to answer them?
  - When in the life course is it most important to intervene and how? Earlier the better
  - Are more bad foods or a lack of nutritious foods most important (restrictions vs. incentives)
  - WIC Sentinel Sites for research data collection and monitoring
  - WIC Intervention Sites for demonstrations

# Household Food Insecurity and Child Psycho-emotional, Social, and Cognitive Development

Rafael Pérez-Escamilla, PhD  
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The Committee on National Statistics  
Causes and Consequences of Child Hunger Workshop  
Washington DC, April 8<sup>th</sup> and 9<sup>th</sup>, 2013



## Systematic Review

Pérez-Escamilla & Vianna, J Appl Res Child. 2012

- **Pubmed**
  - Key term “food insecurity children”
- **Hand and forward searches**
  - Articles’ reference lists
  - Papers citing article of interest
- **Authors’ archives**
- **Inclusion criteria:** 1) HFI experience-based scales, 2) peer reviewed scientific journals, y 3) measured child psycho-emotional, social and/or intellectual development
- **N=26** articles out of the 358 identified
  - Except where indicated all studies adjusted for socio-economic and demographic confounders

**HFI and Child Psycho-emotional, Social and Cognitive Development**

## Cross-Sectional

Rose-Jacobs (2008) USA, C-SNAP	4-36 month old	(-) child development
Whitaker (2006) USA, poor households	preschoolers	(+) aggressiveness (+) anxiety (+) depression (+) hiperactivity (-) concentration
Weinreb (2002) Massachusetts	pre-schoolers and schoolers	(+) internalization (+) anxiety
Kleinman (1998) Pittsburgh*	schoolers	(+) anxiety (+) agressiveness

\* Did not adjust for socio economic, demographic confounders

## Cross-Sectional

Murphy (1998) USA	schoolers	(+) hiperactivity (+) school absenteeism, tardiness
Alaimo (2001) USA, NHANES	schoolers	(-) academic performance (-) social interactions
Alaimo (2002) USA, NHANES	15-16 y old	(+) suicidal thoughts (+) suicide attempts
Casey (2005) Arkansas, Louisiana, Mississippi	12-17 y old	(-) psycho-social function

## Longitudinal

Zaslow (2009) USA, ECLS-B	9 mo → 2 y	(-)maternal attachment (-)parents attention
Jyoti (2005) USA, ECLS-K	kinder → 3 <sup>er</sup> y	(-) academic performance (-) social development
Slopen (2010) USA	4-14 y → 5-16 y	(+) internalization (+) externalization
Huang USA, PSID	7.5 y → 11.6 y	(+) internalización (+) externalización
Belsky (2010) UK	5 y → 12 y	(-) IQ (+) externalization (+) internalization

## HFI and Maternal Mental Health

## Maternal Mental Health Cross-Sectional

Laraia (2006) North Carolina	Pregnant women	(+) stress (+) anxiety (+) depression
Hromi-Fiedler (2011) Connecticut	Pregnant Latinas	(+) depresión
Whitaker (2006) USA, poor households	Low income mothers	(+) anxiety (+) depression
Casey (2004) USA, C-SNAP	Mothers	(+) internalization (+) externalization

## Maternal Mental Health Longitudinal

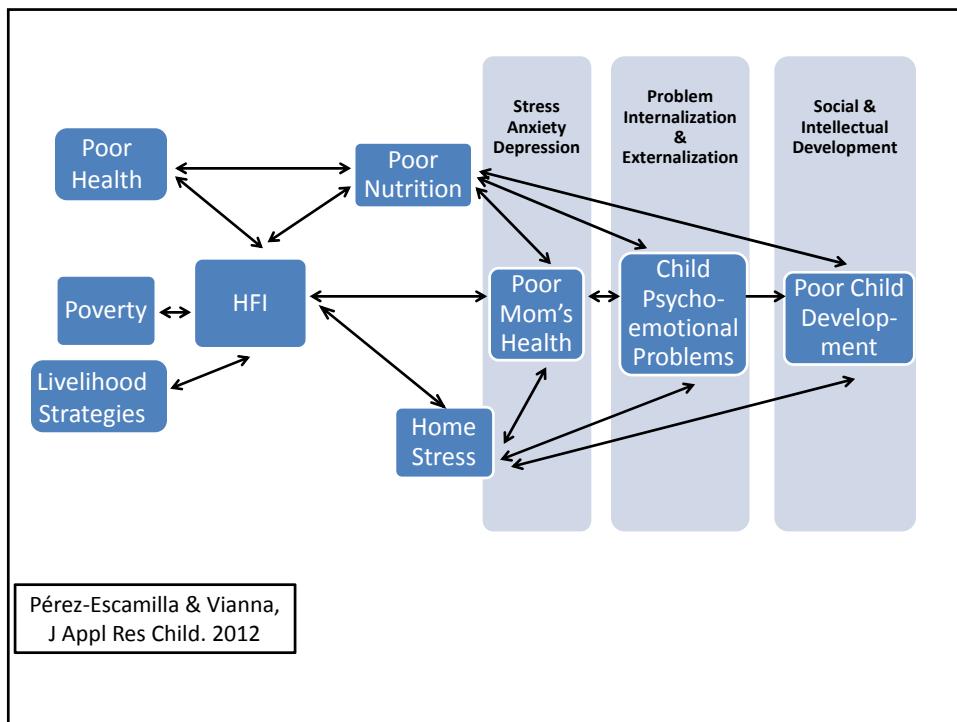
Huddleston-Casas (2009) USA, rural	Pregnant women	(+) stress (+) anxiety (+) depression
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## Parental Personality as Mediators of HFI- Child Development

### Parental Characteristics as Mediators of HFI- Child Development

Two longitudinal studies suggest that parental personality mediates the relationship between HFI and child development

- Panel Study of Income Dynamics (Huang 2010)
  - Maternal personality traits: stress, warmth, distress, self esteem
- E-Risk UK study (Belsky 2010)
  - Maternal personality traits: openness to experience, conscientiousness, extraversion, agreeableness, neuroticism

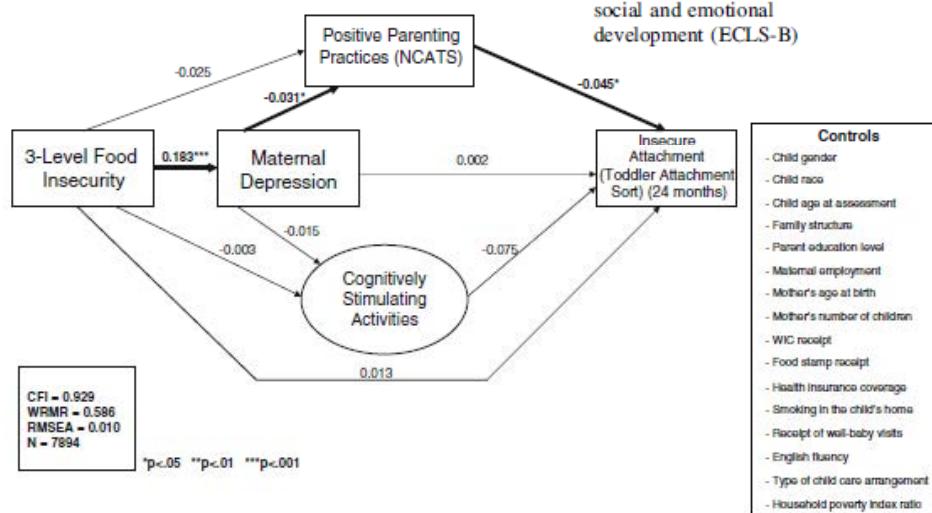


## Research Gaps

- Few studies have tested for factors mediating or moderating the relationship between HFI and child development
  - Theory based designs
  - Improved analytical frameworks

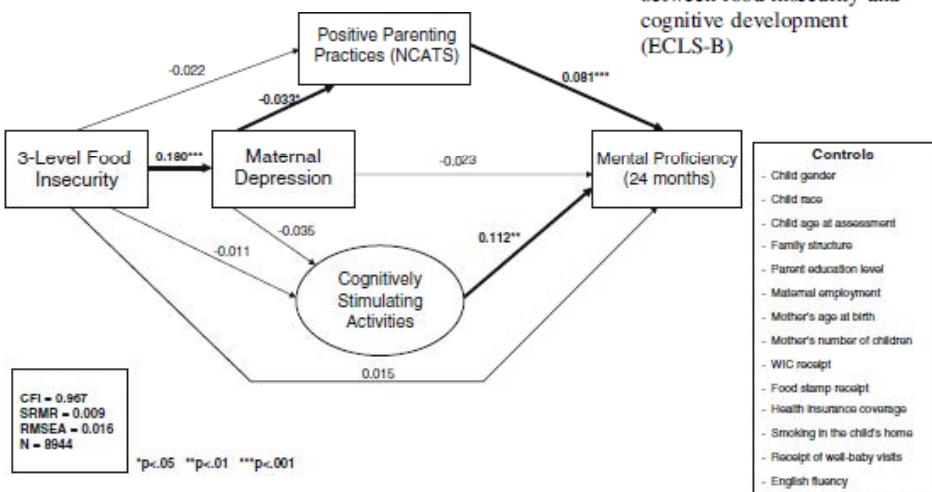
Zaslow et al. (Matern Child Health J (2008))

**Fig. 1** Structural equation model of the associations between food insecurity and social and emotional development (ECLS-B)



Zaslow et al. (Matern Child Health J (2008))

**Fig. 2** Structural equation model of the associations between food insecurity and cognitive development (ECLS-B)



## Research Gaps

- No studies examining if and how child dietary intake mediates relationship between HFI and child developmental outcomes
- Is there a critical period of initial exposure to HFI with regards to its influence on child development?
  - Is the negative influence of HFI on child development reversible?

## Policy Questions

- Food assistance programs
  - Should they link better with parental mental health services?
  - Should they link better with child development remedial programs?
- Maternal-Child health care services
  - Should they screen routinely for HFI and provide referrals for food assistance & child development evaluations?

# **Improving our Understanding of the Relationship Between Food Insecurity and Children's Well-Being**

Workshop on Research Gaps -- Causes and Consequences of Child Food Insecurity and Hunger

Alison Jacknowitz

April 9, 2013

## **Outline of Discussion**

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- What are the gaps in knowledge?
  - Differential effects
  - Duration
  - Transitions
  - Pathways
  - Causal relationships
- Could current data sources address these gaps?

## What are the Gaps in Knowledge? Differential Effects

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How does the effect of food insecurity on children's well-being vary by child and household characteristics? Variables in addition to gender to consider:

- Age of the child
- Language spoken at home
- Urban versus rural status

## What are the Gaps in Knowledge? Duration of Food Insecurity

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Does the effect of food insecurity on children's well-being vary by length of spell?

- Address this question within one year as well as over multiple years
- Hypothesize that cumulative effects of food insecurity exist
- Hernandez and Jacknowitz (2009) suggest this may not be the case

## Hernandez and Jacknowitz (2009) Summary

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Question: What is the influence of persistent and transitional food insecurity on the development of toddlers?

Data: 9-month and 2-year data from the ECLS-B

Food insecurity variables:

- Food insecure in both waves (Persistent)
- Food insecure in 9-month only (Transitional)
- Food insecure in 2-year only (Transitional)
- Never food insecure

Outcomes: Cognitive and motor development, Weight-for-age z-scores, and health status

## Hernandez and Jacknowitz (2009) Results

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- Experiencing temporary food insecurity at 2 years is related to lower cognitive scores and health status
- It is possible that those who experience persistent food insecurity have developed coping strategies to address the situation

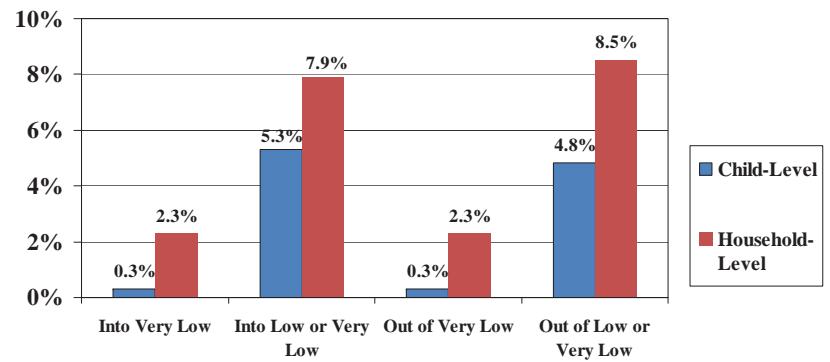
## What are the Gaps in Knowledge? Transitions in Food Insecurity

Does the effect of food insecurity on children's well-being vary by number of spells experienced?

- Sizeable movement in and out of food security among children (see next slide)
- Address this question within one year as well as over multiple years
- Hypothesize that constant food insecurity is worse than transitioning in and out

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## Percentage of Transitions Entering and Exiting Food Insecurity



Note: Sample size is 18,950 transitions using the ECLS-B.  
Source: Jacknowitz, Morrissey, and Brannegan (2012).

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## What are the Gaps in Knowledge? Identifying the Pathway

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Understanding the pathway through which food insecurity affects the outcome of interest provides policy relevant information. Pathways can vary by:

- Who is experiencing the insecurity in the household member? Is the child directly affected by food insecurity or indirectly affected through adults or other children?
- The age of the child
- The outcome of interest

## What are the Gaps in Knowledge? Causal Relationships

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- Large literature on the negative consequences of food insecurity on children exists though few studies establish causal relationships
- Establishing the causal effects of food insecurity on children's well-being is a current gap

## These Questions Can Not be Answered with Existing Data

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- Panel data
  - ECLS-B
  - ECLS-K
- Cross-sectional data
  - NHANES
  - CPS

## Early Childhood Longitudinal Study-Birth Cohort (ECLS-B)

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- Nationally representative sample of approximately 10,700 children born in 2001
- Data collected when children were 9 months, 2 years, 4 years (preschool), and at kindergarten entry in 2006 and 2007
- Data include the 18-item Core Food Security Module (CFSM) in each wave
- Data include a rich set of variables capturing children's well-being including: birth weight, weight in each wave, height/length in each wave, cognitive test scores, and socio-emotional outcomes

Note: Unweighted sample sizes are rounded to the nearest 50 per NCES regulations.

## These Questions Can Not Be Addressed with the ECLS-B

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- Long intervals between waves
- Timing of food insecurity does not match that of outcomes of interest or possible mechanisms
- Does not include 30-day food insecurity questions or ask about past food insecurity
- Does not identify if the survey child is experiencing food insecurity
- Few children experience very low food insecurity among this age group

## What Data Do We Need?

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- More longitudinal data
  - With more frequent data collection
  - That follow children from birth over a longer period of time
  - That allow the timing of food insecurity and other key events to be established
- More questions that capture the duration and transitions into and out of food insecurity
- More questions that provide information on which child experiences food insecurity
- More data sets with larger sample sizes for infants and toddlers



## Impacts of Child Food Insecurity and Hunger

*John T. Cook, PhD, MAEd*

Children's HealthWatch

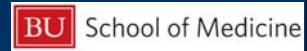
Department of Pediatrics

Boston University School of Medicine

*National Academy of Science/CNSTAT*

Workshop on Childhood Hunger; April 8-9, 2013

Sponsored by USDA Economic Research Service and  
Food and Nutrition Service



## Children's HealthWatch

- Non-partisan, pediatric research & public policy center based at Boston Medical Center
- We have studied impacts of economic conditions and public policy on young children's health & well-being since 1998, focusing on:

- Food insecurity
- Housing insecurity
- Energy insecurity



- Provide policy makers with evidence to develop policies that protect young children's health and development

## Children's HealthWatch Mission

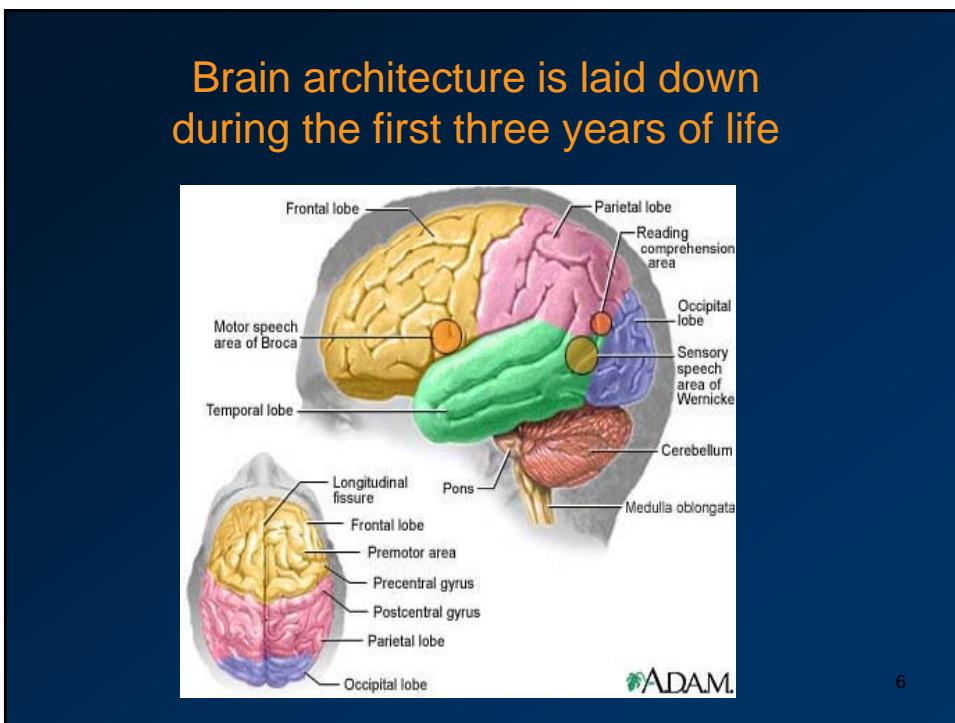
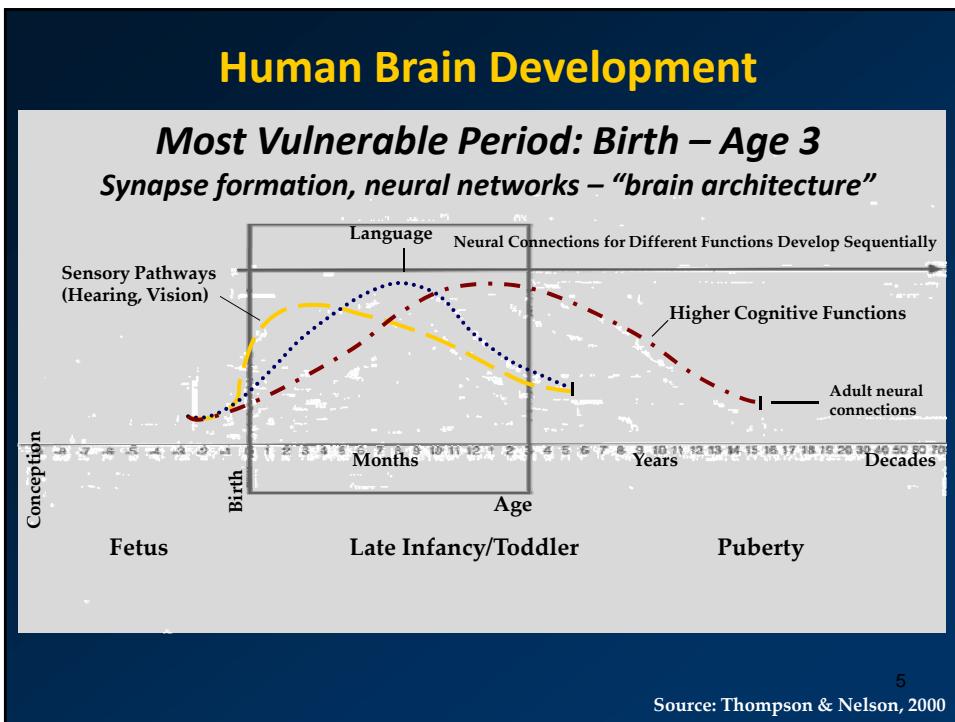
**Our interest in measuring and studying child food insecurity and hunger, and their causes and consequences, derives from an urgent sense of the need to treat and eliminate what we see as a totally unnecessary, and imminently solvable threat to public health, the public good, and our future prosperity.**

**Our priority is to do and encourage research that can inform and motivate policies that prevent, reduce and eliminate child food insecurity and hunger, and support child health.**

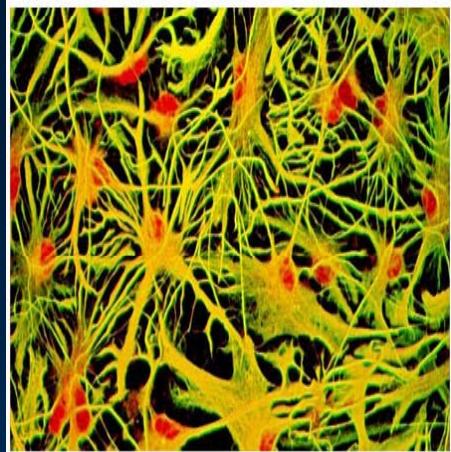
3

## Background/Motivation

4



## Brain architecture is physical structure, interconnections, & neural networks



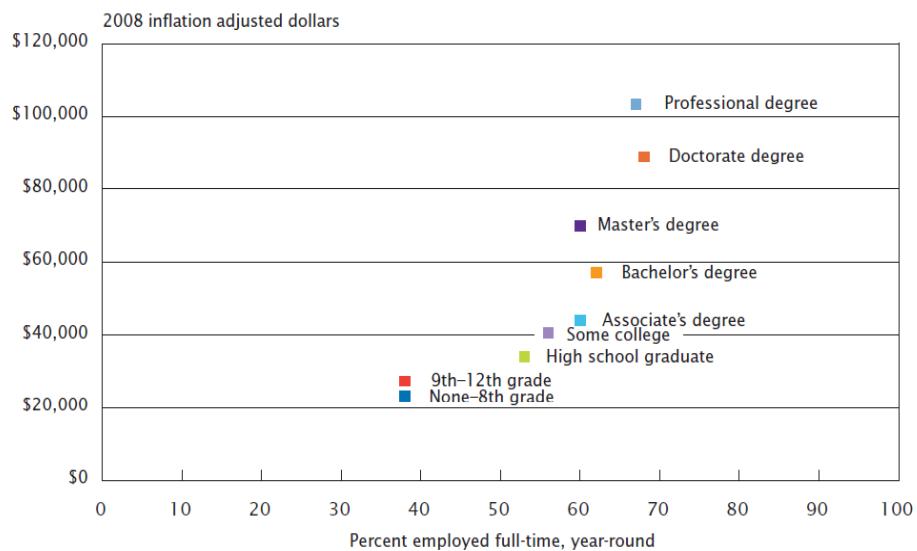
Brain “architecture” is physical structure, and interconnections. There are about 100 billion cells in the brain.

It is influenced by many factors, including those associated with stress related to poverty, and food insecurity.

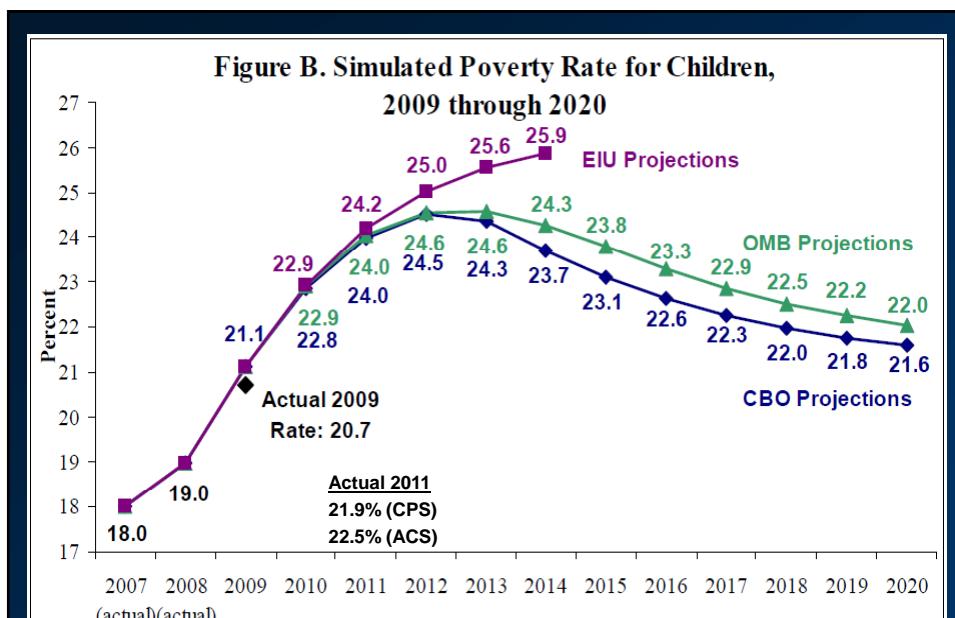
The first 3 years of life largely set the trajectory of cognitive development, school readiness, academic achievement, and educational attainment .

7

Figure 2.  
**Education, Work Status, and Median Annual Earnings**

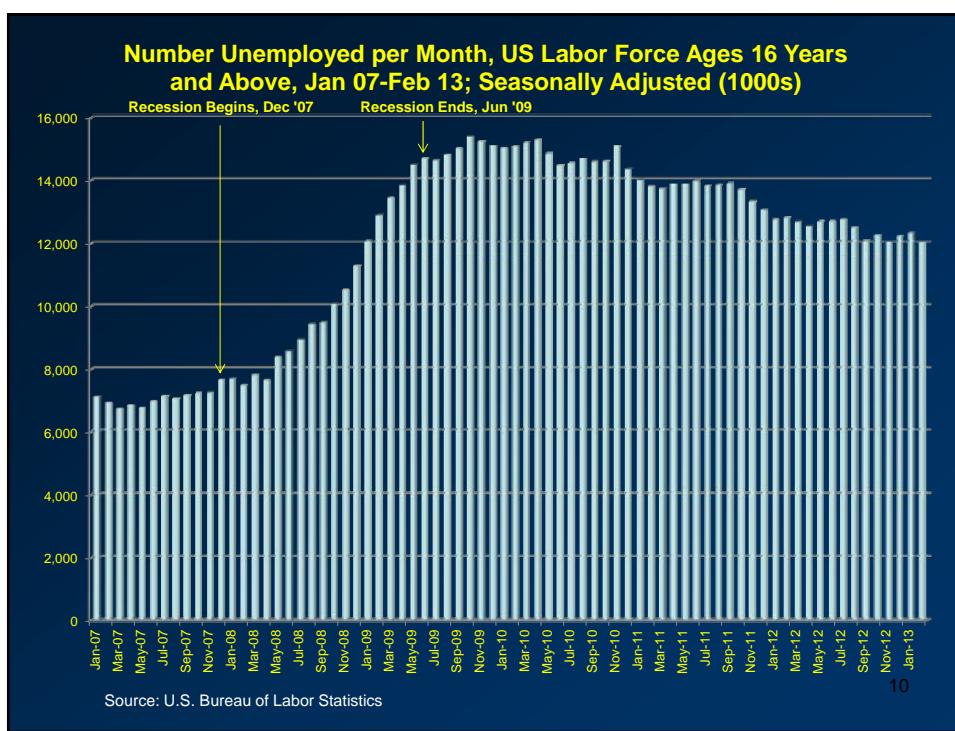


Source: U.S. Census Bureau, American Community Survey, 2006–2008.



Source: Monea E, Sawhill I. An update to "Simulating the Effect of the 'Great Recession' on poverty". Brookings Institution, September 16, 2010.

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## Overview

- **Issues of measurement; thresholds and food in/security categories,**
- **Use of the scale's child only items, and reduced scales, as they relate to:**
  - The impacts of childhood food insecurity and hunger on:
    - ✓ Health, obesity, cognitive, academic, and emotional/behavioral outcomes,
- **Address mechanisms/pathways of influence, including:**
  - Biological, psycho-emotional, via caregivers,
  - Nutritional and non-nutritional
    - ✓ With reference to prenatal influences and other windows of vulnerability.

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### The USFSS was Developed by the Food Security Measurement Project (1995-1997)

- Mandated by law; the National Nutrition Monitoring and Related Research Act of 1990.
- A multi-objective activity to develop “scientifically valid and reliable measures of food security, food insecurity and hunger” for the US population (*consistent with the goals and policies of the US government*).
- Reports released in 1997; some revisions & refinements by USDA ERS & FNS since then.

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## Food Security Thresholds and Categories

- US Food Security Survey Module, and its associated scales were developed using Item Response Theory (IRT) methods.
- IRT methods can also be used to score responses to the scale items based on each item's psychometric and statistical characteristics, and the pattern of responses.
- IRT methods can guide and inform decisions about thresholds and categories, but they cannot make those decisions.
- Decisions where to set thresholds have to be made by people, and require knowledge of the phenomenon or condition being measured, and human judgment.
- Food Security categories are human constructs and can only be created based on human understanding, and judgment.

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Alternative Standard Metrics for 1998 Scale Values

Number of "yes" responses		1998 Scale Value		Food Security Status Category
Household with child	Household with no child	Standard Computational Metric	Standard 0-10 Metric	
0	0	0.0*	0.0*	
1	1	1.4	1.0	
2	2	1.7 2.6 3.1	1.2 1.8 2.2	Food secure (Marginal Food Security)
3		3.4	2.4	
4	3	4.1	3.0	
5	4	4.2 4.8 5.2	3.0 3.4 3.7	
6		5.4	3.9	
7	5	6.0	4.3	
8	6	6.2 6.6 7.1	4.4 4.7 5.0	
9		7.2	5.1	
10	7	7.7	5.5	
11		8.0	5.7	
12	8	8.3 8.8 9.0	5.9 6.3 6.4	Food insecure with hunger, moderate
13		9.3	6.6	
14		9.8	7.0	
15	9	10.1 10.4 11.1*	7.2 7.4 7.9*	
16		12.2	8.0	
17		13.0*	8.7	
18			9.3*	Food insecure with hunger, severe

\* Note on next page.

Source: Calculated by ERS based on U.S. Census Bureau data from the Food Security Supplement to the August 1998 Current Population Survey.

## The Food Security Scales

- (The USDA Food Sufficiency Question)
- The 18-item household food security scale;
  - A 12-month reference period version
  - A 30-day reference period version
- The 6-item abbreviated household scale
- The 10-item adult food security scale
- **The 8-item child food security scale**
- Self-administered survey module for children ages  $\geq 12$  yrs.
- Spanish translation of the USFSSM

(<http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/survey-tools.aspx#.UWCLmVdlaWM>)

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HH2. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?

HH3. "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

HH4. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

AD1. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)

AD1a. (If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

AD2. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)

AD3. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)

AD4. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)

AD5. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

AD5a. (If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

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CH1. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?

CH2. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?

CH3. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?

CH4. In the last 12 months, did you ever cut the size of your children's meals because there wasn't enough money for food? (Yes/No)

CH6. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)

CH5. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)

CH5a. (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

CH7. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Questions HH2 through CH7 comprise the U.S. Household Food Security Scale (questions HH2 through AD5a for households with no child present). Specification of food security status depends on raw score and whether there are children in the household (i.e., whether responses to child-referenced questions are included in the raw score).

Categories for households with one or more children:

- Raw score zero—High food security
- Raw score 1-2—Marginal food security
- Raw score 3-7—Low food security
- Raw score 8-18—Very low food security



Categories for households with no child present (the adult scale):

- Raw score zero—High food security
- Raw score 1-2—Marginal food security
- Raw score 3-5—Low food security
- Raw score 6-10—Very low food security



• Households with high or marginal food security are classified as food secure. Those with low or very low food security are classified as food insecure.

Questions CH1 through CH7 comprise the U.S. Children's Food Security Scale.

- Raw score 0-1—High or marginal food security among children (*raw score 1 may be considered marginal food security, but it is not certain that all households with raw score zero have high food security among children because the scale does not include an assessment of the anxiety component of food insecurity*)
- Raw score 2-4—Low food security among children
- Raw score 5-8—Very low food security among children

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CH1. “We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food.” Was that often, sometimes, or never true for you in the last 12 months?

CH2. “We couldn’t feed our children a balanced meal, because we couldn’t afford that.” Was that often, sometimes, or never true for you in the last 12 months?

CH3. “The children were not eating enough because we just couldn’t afford enough food.” Was that often, sometimes, or never true for you in the last 12 months?

CH4. In the last 12 months, did you ever cut the size of your children’s meals because there wasn’t enough money for food? (Yes/No)

CH6. In the last 12 months, were the children ever hungry but you just couldn’t afford more food? (Yes/No)

CH5. In the last 12 months, did any of the children ever skip a meal because there wasn’t enough money for food? (Yes/No)

CH5a. (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

CH7. In the last 12 months did any of the children ever not eat for a whole day because there wasn’t enough money for food? (Yes/No)

## What Have we Learned in over 15 Years About Food Insecurity's Impacts on Child Health & Development?

Recommended reviews:

- ❖ Gunderson C, Kreider B, Pepper J. The Economics of Food Insecurity in the United States. *Applied Economic Perspectives and Policy* (2011) volume 33, number 3, pp. 281–303. doi:10.1093/aep/ppr022.
- ❖ Nord M. *Food Insecurity in Households with Children: Prevalence, Severity, and Household Characteristics*. EIB-56. U.S. Dept. of Agriculture, Econ. Res. Serv. September 2009. <http://www.ers.usda.gov/Publications/EIB56/>
- ❖ Cook JT, Frank DA. Food Security, Poverty and Development in the United States. *Ann. N. Y. Acad. Sci.* xxxx: 1–16 (2008). 2008 New York Academy of Sciences. doi: 10.1196/annals.1425.001 <http://www.childrenshealthwatch.org/page/Publications>

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## Reviews (Cont'd.)

- Reviews from ASN EB Symposium 2012 (Food Security and Health Across the Lifespan)
  - ❖ Laraia BA. Food Insecurity and Chronic Disease. *Adv. Nutr.* 4: 203–212, 2013. <http://advances.nutrition.org/content/4/2/203.full.pdf+html>
  - ❖ Cook, JT, et al. Are Food Insecurity's Health Impacts Underestimated in the U.S. Population? Marginal Food Security Also Predicts Adverse Health Outcomes in Young U.S. Children and Mothers. *Adv. Nutr.* 4: 51–61, 2013. <http://advances.nutrition.org/content/4/2/51.full.pdf+html>
  - ❖ Gundersen C. Food Insecurity Is an Ongoing National Concern. *Adv. Nutr.* 4: 36–41, 2013. <http://advances.nutrition.org/content/4/2/36.full.pdf+html>
  - ❖ In addition, all Children's HealthWatch publications can be found at <http://www.childrenshealthwatch.org/page/Publications>

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## Pathways Through Which Food Insecurity Influences Child Health & Development

- **Food Insecurity Influences Children's Health and Development Through:**
  - **➔ Nutritional and**
  - **➔ Non-nutritional Pathways**

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### Examples of Nutritional Pathways

- Perinatal nutrition of mother and child, including internatal period
- Brain and cognitive development in the child (sensitive and vulnerable periods)
- Growth impacts (stunting, wasting, structural and system anomalies, endocrine system, obesity, oral health issues)
- Compromise of immune system functions (risks for infection-malnutrition cycle)
- Energy deficits
  - Compromised body temperature regulation
  - Reduced environmental exploration & learning

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## Examples of Non-nutritional Pathways

- Adverse impacts on the child's and mother's mental health (depression) and adult-child interactions (impaired responsiveness, serve and return)
- Impoverished home environment and lack of appropriate stimulation and nurturing support
- "Toxic stress" (repetitive, persistent or inescapable acute or chronic stress; e.g., child abuse, domestic violence, recurrent or persistent hunger, poverty & food insecurity(?)
- Delays in and/or deterrence of needed medical care
- Non-compliance with treatment, including Rx

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## Food Insecurity's Impacts on Child Health & Development (Perinatal Period)

Borders *et al.* (2007): *Chronic stress and low birth weight* neonates in a low-income population of women.

- FI is positively associated with low-birthweight births.

Laraia *et al.* (2006): *Psychosocial factors and socioeconomic indicators are associated with HFI among pregnant women.*

- FI positively associated with psychosocial indicators of perceived stress, trait anxiety, and depressive symptoms in pregnant women; indication of dose-response relationship with greater effects at more severe levels of FI.

Zubietta *et al.* (2006): *Breastfeeding practices in U.S. households by food security status.*

- FI is negatively associated with initiation of breastfeeding and with duration if initiated.

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## Food Insecurity's Impacts on Child Health & Development (Early Childhood)

Kaiser *et al.* (2002): Food Security and Nutritional Outcomes of Preschool-Age Mexican-American Children.

- Using data from the Radimer/Cornell food security scale, found limited education, lack of English proficiency, and low income negatively correlated with food security. Controlling for acculturation, children in severely food-insecure households were less likely to meet Food Guide Pyramid guidelines than other children, and percent overweight tended to peak among children from household level food insecure families; no significant differences were found in weight or height status of children by level of food insecurity.

Cook *et al.* (2004): *FI is associated with adverse health outcomes among human infants and toddlers.*

- FI is positively associated with “fair/poor” health and having been hospitalized since birth. A dose-response relationship was found between severity of FI and likelihood of fair/poor health. Food stamps attenuated effect of FI on health status but did not eliminate it. 27

## Food Insecurity's Impacts on Child Health & Development (Early Childhood)

Casey *et al.* (2004): *Maternal depression, changing public assistance, food security, and child health status.*

- Maternal PDS are positively associated with HFI, fair/poor child health status, and child hospitalization. PDS also positively associated with reductions or loss of welfare and FSP benefits.

Black *et al.* (2004): *WIC participation and infants' growth and health: a multisite surveillance study.*

- Infants (aged ≤ 12 months) that did not receive WIC benefits because of access problems were more likely to be underweight, short, and perceived as having fair/poor health than were WIC recipients. Both infants receiving WIC and those eligible but not receiving benefits because of access problems were more likely to be FI than infants whose caregiver perceived no need for WIC.

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## **Food Insecurity's Impacts on Child Health & Development (Early Childhood)**

Skalicky *et al.* (2006): *CFI and IDA* in low-income infants and toddlers in the United States.

- CFI positively associated with IDA in children aged 6–36 months.

Neault *et al.* (2007): Breastfeeding and health outcomes among citizen children of immigrant mothers.

- Although families of US-born breastfed infants of immigrant mothers had greater odds of being food insecure than those of nonbreastfed infants of immigrant mothers, breastfed infants had lower odds of having fair/poor health (versus excellent/good), of having a chronic health condition, and of having previously been hospitalized than nonbreastfed infants of immigrant mothers.

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## **Food Insecurity's Impacts on Child Health & Development (Early Childhood)**

Whitaker *et al.* (2006). Food Insecurity and the Risks of Depression and Anxiety in Mothers and Behavioral Problems in the Preschool-Aged Children.  
*Pediatrics*, 118(3):859-68.

- Significant behavioral problems (aggressive, anxious/depressed, inattention/hyperactivity) 1.6 times more likely in hh with marginal food security among adults and 2.1 times more likely in hh with food-insecure adults. Similar and statistically significant associations with each problem domain individually.

Rose-Jacobs *et al.* (2007): *HFI*: associations with at-risk infant and toddler development.

- FI positively associated with parental reports of developmental issues on the PEDS after controlling for confounders.

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## Food Insecurity's Impacts on Child Health & Development (School Age)

Kleinman *et al.* (1998): *Hunger in children* in the United States: potential behavioral and emotional correlates.

- Children categorized as hungry by the CCHIP scale more likely to have clinical levels of psychosocial dysfunction on the PSC than either at-risk or non-hungry children. Analysis of individual PSC items found that most behavioral, emotional, and academic problems were more prevalent in hungry children, that aggression and anxiety had the strongest degree of association with hunger.

Murphy *et al.* (1998): *Relationship between hunger and psychosocial functioning in low-income American children.*

- Found children aged < 12 years categorized as hungry or at risk of hunger twice as likely as non-hungry children to be reported as having impaired functioning by either a parent or the child her/himself. Teachers reported statistically significantly higher levels of hyperactivity, absenteeism, and tardiness among hungry/at-risk children.

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## Food Insecurity's Impacts on Child Health & Development (School Age)

Weinreb *et al.* (2002): *Hunger: its impact on children's health and mental health.*

- Severe hunger was a statistically significant predictor of chronic illness among both preschool-aged and school-aged children and was statistically significantly associated with internalizing behavior problems, whereas moderate hunger was a statistically significant predictor of health conditions in preschool-aged children. Severe hunger was also associated with higher reported anxiety/depression among school-aged children.

Alaimo *et al.* (2001a): *Food insufficiency, family income, and health in U.S. preschool and school-aged children.*

- Food insufficiency associated with higher prevalence of fair/poor health and iron deficiency, and with greater likelihood of experiencing stomachaches, headaches, and colds in children aged 1–5 years.

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## Food Insecurity's Impacts on Child Health & Development (School Age)

Alaimo *et al.* (2001b): *Food insufficiency* and American school-aged children's cognitive, academic, and psychosocial development.

- Children aged 6–11 years in food-insufficient families had lower arithmetic scores, were more likely to have repeated a grade, to have seen a psychologist, and to have had difficulty getting along with other children, than similar children whose families were food sufficient. Teenagers from food insufficient families more likely than food-sufficient peers to have seen a psychologist, to have been suspended from school, and to have had difficulty getting along with other children.

Alaimo *et al.* (2002): *Family food insufficiency*, but not low family income, is positively associated with dysthymia and suicide symptoms in adolescents.

- Children aged 15–16 years from food-insufficient households were statistically significantly more likely to have had dysthymia, to have had thoughts of death, to have had a desire to die, and to have attempted suicide than food-sufficient peers.

## Food Insecurity's Impacts on Child Health & Development (School Age)

- Jyoti *et al.* (2005): *FI affects school* children's academic performance, weight gain, and social skills.
  - In lagged models, found FI in kindergarten associated with lower math scores, increased BMI and weight gain, and lower social skills in girls at third grade, but not for boys, after controlling for time-varying and time-invariant covariates.
  - Using difference scores and dynamic models based on changes in predictors and outcomes from kindergarten to third grade, found that children from persistently FI households (FI at both kindergarten and third grade years) had greater gains in BMI and weight than those of children in persistently food-secure households, though effects were statistically significant only for girls. Also among girls, but not boys, persistent FI was associated with smaller increases in reading scores over the period than for persistently food-secure girls.

## **Food Insecurity's Impacts on Child Health & Development (School Age)**

- **Jyoti et al. (2005):**
  - In dynamic models, for households that transitioned from food security to FI over kindergarten to third grade (i.e., became FI), the transition was associated with statistically significantly smaller increases in reading scores for girls and boys than for children in households remaining food secure. For children transitioning from FI to food security (i.e., becoming food secure), the transition was associated with larger increases in social skills scores for girls but not for boys. Becoming FI was associated with statistically significantly greater weight and BMI gains for boys but not for girls and with greater declines in social skills scores for girls but not boys.

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## **Children's Awareness and Experience of Food Insecurity? (School Age)**

- Connel, et al. (2005) found that children (ages 11-16 Yrs) described food insecurity in terms of quantity (eating less than usual, or eating more or fast when food is available), quality (having only a few, low-cost foods), affective states (worry/anxiety/sadness about the family's food, shame/fear of being labeled "poor", feelings of having no choice, adults trying to shield children from food insecurity), and social dynamics (using social networks to get food, or being socially excluded).
- Fram, et al. (2011) found that children (9-16 Yrs) experience food insecurity distinct from parents experience and reports of the condition, and have cognitive, emotional and physical awareness of food insecurity; adults are not always aware of children's experience of food insecurity.

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## Children's Awareness and Experience of Food Insecurity? (School Age)

- Bernal, et al. (2012) found children (10-17 Yrs) in peri-urban areas of Miranda State, Venezuela were cognitively aware (of food insecurity, their parents' worries about it, and causes both internal and external to their households), emotionally aware (feelings of concern, anguish, sadness; episodes of crying), physically aware (of hunger, reduced quantity and quality of intake, eating smaller meals, and thinness and fainting as consequences).
  - Children's responses included reducing quantity and quality of intake, child labor, food from waste, sacrifice in food consumption, seeking food from extended family, strategies for obtaining, preparing and cooking food
  - Children were not always protected from hunger by adults

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## Children's Awareness and Experience of Food Insecurity (School Age)

- Fairbrother, et al. (2012) explored children's (9-10 Yrs) understanding of family finances and how they related to "eating healthily" in two contrasting SES schools in the North of England. The authors found:
  - Children incorporated a variety of media information into their understanding, and sought explanations from personal experience.
  - Children had sophisticated ideas about interrelationships between diet, cost and health, and were keenly aware of how family finances influenced food purchases.
  - Children proposed a variety of strategies for eating healthily on a budget, ***but prioritized state and corporate responsibility in ensuring that eating healthily is affordable.***
  - Children consistently conflated eating fruits and vegetables with eating healthily.

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## Levels of Severity of Food Insecurity

Categories for households with one or more children (the 18-item scale):

- Raw score zero—High food security
- Raw score 1-2—Marginal food security
- Raw score 3-7—Low food security
- Raw score 8-18—Very low food security

Categories for households with no child present (the 10-item adult scale):

- Raw score zero—High food security
- Raw score 1-2—Marginal food security
- Raw score 3-5—Low food security
- Raw score 6-10—Very low food security
- *Households with high or marginal food security are classified as food secure. Those with low or very low food security are classified as food insecure.*

Categories for children (the 8-item child scale):

- Raw score 0-1—High or marginal food security in children
- Raw score 2-4—Low food security among children
- Raw score 5-8—Very low food security among children

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## Levels of Severity of Food Insecurity

- Most Children's Healthwatch studies have used a dichotomous household food security status variable as predictor.
- We have found that variable to be a strong predictor of adverse health outcomes in children and caregivers in our sentinel sample of over 40,000 mother-child dyads.
- In one study we found that including child food insecurity as another category led to greater odds of adverse health outcomes in children, but their magnitude (odds ratios) were only marginally statistically significantly different.
- We are currently engaged in a study (funded by the UKCPR/USDA) testing how mothers' foreign-born status, together with risk and protective factors, are related to very low food security (VLFS) in children. (Preliminary results to be presented at ASN/EB 2013)
- 1.4% of children in Children's HealthWatch data have VLFS compared to 1.1% (845,000) of children in the CPS living in households with VLFS in at least one child in 2011.

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## Levels of Severity of Food Insecurity

- Marginal Food Security
- Cook, JT, et al. Are Food Insecurity's Health Impacts Underestimated in the U.S. Population? Marginal Food Security Also Predicts Adverse Health Outcomes in Young U.S. Children and Mothers. *Adv. Nutr.* 4: 51–61, 2013. <http://advances.nutrition.org/content/4/2/51.full.pdf+html>
  - Reviews several studies presenting evidence that marginal food security is more like food insecurity than food security.
  - All studies find that marginal food security is a significant predictor of adverse health outcomes in children or their mothers, compared to food security.
  - Present results of new research showing that marginal food security is associated with the same negative health outcomes as food insecurity, but magnitude of associations are intermediate between food security and food insecurity (dose response).
  - Conclude that marginal food security should be a separate adverse category and not combined with either food security or food insecurity; marginal food insecurity.

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## Levels of Severity of Food Insecurity

- Marginal Food Security
- Hager ER, et al. Development and Validity of a 2-Item Screen to Identify Families at Risk for Food Insecurity. *Pediatrics*, Volume 126, Number 1, July 2010.
  - Develops and validates a 2-item clinical screen for food insecurity using the first 2 items in the 18-item household scale.
  - Using the 18-item HFSS as a “gold standard”,
    - ❖ Endorsement of either of the first two HFSS items provided:
      - ✓ Q1 only: Sensitivity of 93% and specificity of 85%
      - ✓ Q2 only: Sensitivity of 82% and specificity of 95%
    - ❖ Endorsement of both questions 1 and 2 provided:
      - ✓ Sensitivity of 78% and specificity of 96%.
    - ❖ Endorsement of question 1 and/or question 2 provided:
      - ✓ **Sensitivity of 97% and specificity of 83%**.

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## How Does Living in Households Where Adults, but Not Children, Have VLFS Affect Children?

- In 2011, there were 6.8 million households with very low food security on the household scale
  - 16.9 million people lived in those households
    - **12.1 million adults & 4.8 million children**
  - There were 3.9 million households with 8.6 million children with low food security on the child scale
    - **845,000 children had VLFS on the child scale**
  - **This implies that nearly 4 million children lived in households where adults had VLFS, but the children did not. What does that mean for those children? How do they experience the adults' hunger? How does it affect them?**

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## What Do We Still Need to Learn?

- Multiple Hardships in families:
  - How do other hardships (e.g., housing insecurity, energy insecurity, health care needs) influence food insecurity and its impacts on health and development, and family resilience?
  - How do other hardships affect results of policies aimed at preventing and reducing food insecurity?
- Children with Special Health Care Needs
  - 15% of US children have special health care needs
  - In many cases their care prevents at least one parent/caretaker from working, and it can involve extraordinary costs
  - What nutrition policy adaptations are needed for CSHCN?
- Children of Immigrants
  - Dual-status households; citizen children, non-citizen parent(s)
  - Immigration self-selects people who have many qualities we value in our culture, but they face many obstacles
  - Many mothers and children are “healthier” in first 5 years of stay, but become less healthy the longer their stay

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## What Do We Still Need to Learn?

- Non-nutritional pathways of food insecurity's impacts on child health and development;
  - We know more about nutritional pathways, though there is more to learn,
  - Can we clarify non-nutritional pathways of influence?
  - Depression and other mental health issues
  - Can food insecurity and hunger become "Toxic stress"
  - Would it help our understanding of food insecurity and its impacts on child health and development to clarify that?
- Policy solutions to address non-nutritional pathways of food insecurity's influence often are not available.
  - Often medication is considered as part of addressing mental health issues (e.g., depression), but policy solutions are often not available, and seeking solutions can lead to victim blaming.
  - How will the ACA combine or interact with nutrition assistance policies? What will be its affects on child food insecurity?

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## What Do We Still Need to Learn?

- Clarify "dynamics" of food insecurity and hunger;
  - Do people/families move from one category to another, and what does that mean? Is the "cliff effect" part of that picture?
  - How does that affect effectiveness of assistance programs?
- Diego Rose convened a symposium on access to food in communities at 2010 EB meetings.
  - How do geographic locations, size and other characteristics of food stores impact household food security?
  - Is it possible to clarify the relationships and connections between household and community food security?
- Can there ever be a census of household members in the CPS implementation of the USFSSM?
- **How can we clarify SNAP EBT procedures to respond to efforts to use it to "police" consumption of "bad foods" (e.g., SSBs)?**

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## On Causality and Standards of Evidence

- Establishing causation is correctly the ideal, but . . .
- Many of the relationships of interest do not lend themselves to randomization, so creative (quasi-experimental) approaches are needed.
- The numerous contingent relationships involved in families' efforts to juggle food insecurity, housing insecurity, energy insecurity, health care and other needs can make determining causality impracticable.
- There is great heterogeneity in people's abilities to make those tradeoffs rationally and effectively.
- Humans are fallible, and often unpredictable.
- Thus inferences are always probabilistic.
- Effects are usually the result of multiple causes.
- Some causes are also effects; causation can be bidirectional.
- Yet, we have to try to identify manipulable "causes" that precede manipulable effects.
- And always be prepared for our very best evidence to be ignored because it conflicts with deeply held moral beliefs.

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Thank You!

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## LONG-RUN IMPACTS OF CHILDHOOD ACCESS TO THE SAFETY NET

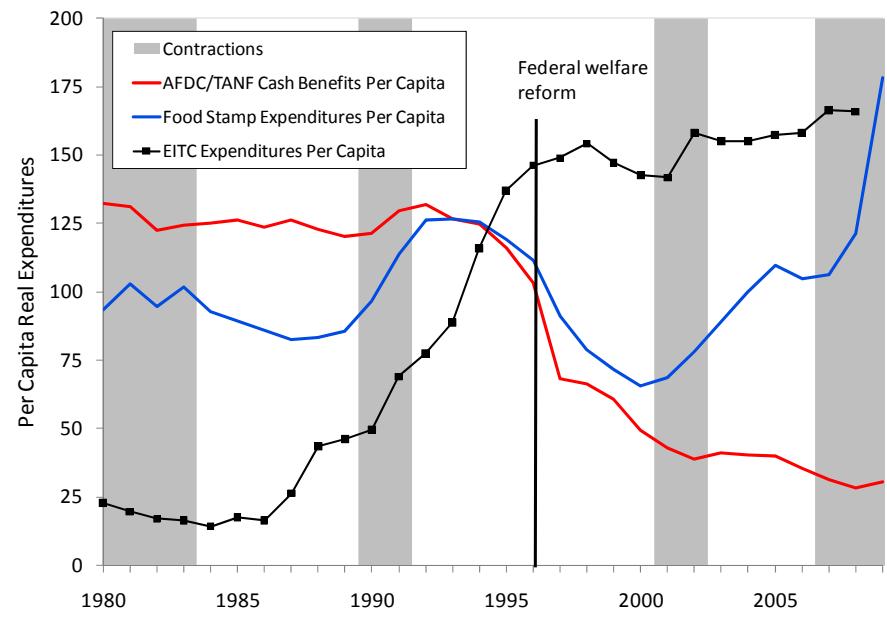
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Diane Whitmore Schanzenbach  
Northwestern University and NBER

### Why study Food Stamps?

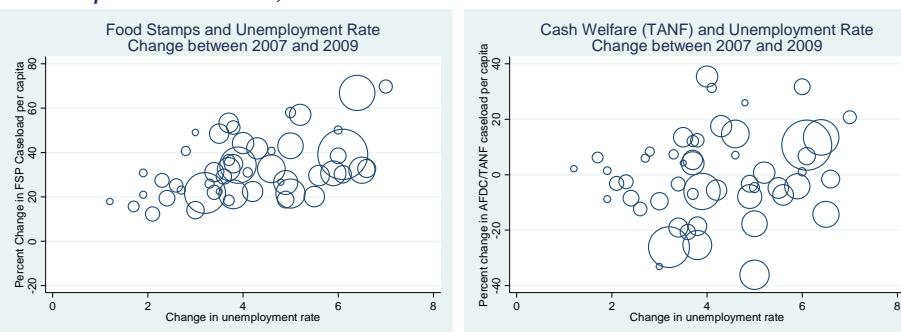
- The food stamp program is currently the largest cash or near-cash anti-poverty program in the U.S.:
  - In 2011 almost 1 in 7 persons received food stamps
  - Only U.S. universal safety net program – eligible based only on economic need.
- Food stamps has been a big part of the safety net in Great Recession (rising in places with greatest need)
- New supplementary poverty measure shows that food stamps raises about 5 million persons out of poverty.

## The landscape providing assistance to poor families with children has changed substantially

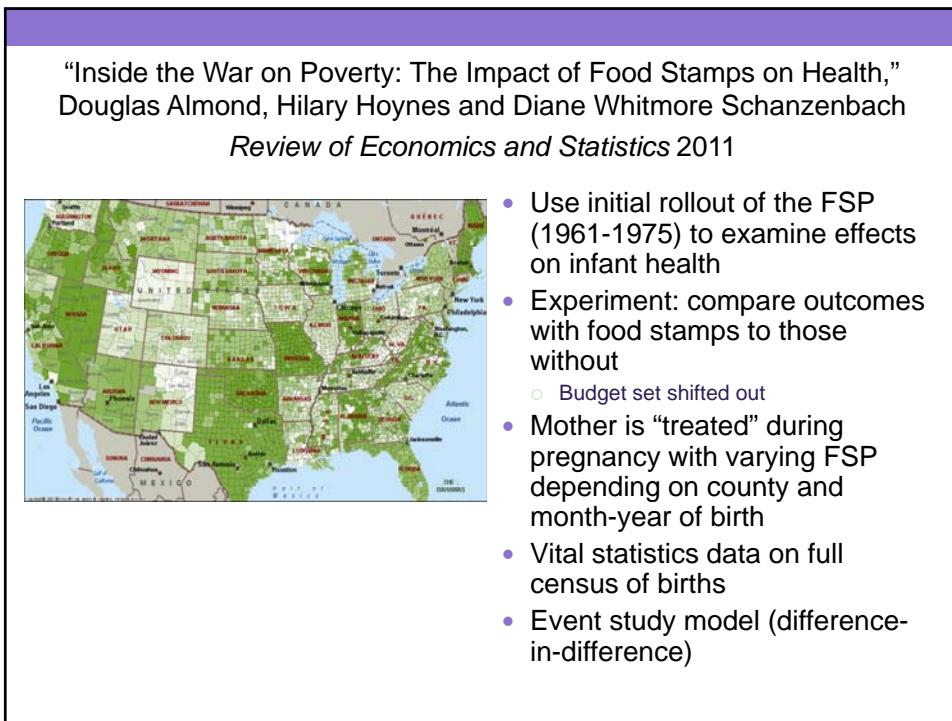
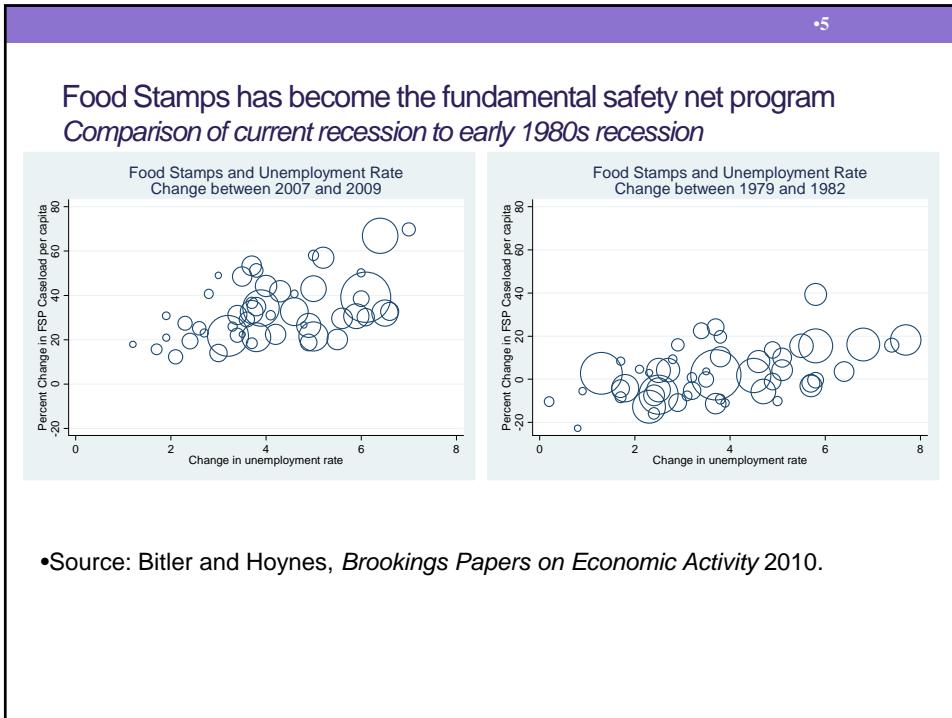


•4

### Food Stamps has become the fundamental safety net program Comparison to TANF; current recession

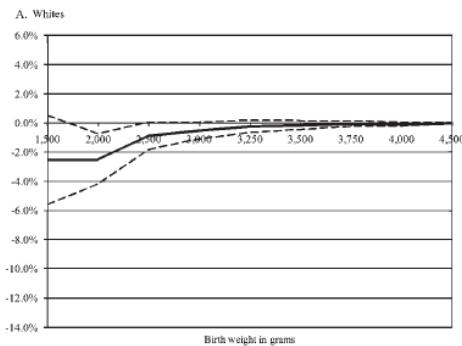


•Source: Bitler and Hoynes, *Brookings Papers on Economic Activity 2010*.



## Results: Food Stamps and Infant Health

FIGURE 3.—EFFECTS OF FSP IMPLEMENTATION ON DISTRIBUTION OF BIRTH WEIGHT, PERCENTAGE IMPACTS (COEFFICIENT/MEAN)



Availability of food stamps in the county

- Increases birth weight
- Reduces incidence of low birth weight

Effects concentrated at the bottom of the birth weight distribution

- Graph: 2% reduction in births <1500 grams
- 2% reduction in births <2000 grams
- No change in births <4000 grams

## Timing of health effects

- Food stamps have important, quantifiable effects on health outcomes
- Impacts on infant health is a *contemporaneous* health effect
- Extension: whether access to the safety net *in utero* in early life can lead to longer term impacts; outcomes in adulthood

## Theory: Early life “shocks” and later life outcomes

- Economic outcomes: Heckman and others argue that *investment* in early childhood leads to higher returns to human capital than investments later in life
  - Prediction: food stamps improve acquisition of human capital, better economic outcomes in adulthood
- Health outcomes: “Fetal origins” hypothesis, from developmental biology and Barker (1990) argues that there is a connection between fetal development and early “critical” periods (nutrition in particular) and chronic conditions in adulthood.
  - Prediction: food stamps improve adult health, reduce metabolic syndrome/obesity

## Our contribution to the literature

- Literature based on *extreme, negative shocks*
  - War, famine, pandemic flu
- How generalizable are these linkages between early life and long run outcomes?
- There is little evidence that uses convincing research designs allowing for causal identification to analyze more commonplace treatments
- We are the first to look at the long term effects of a *positive* and *policy-driven* change in resources
  - i.e. the provision of food stamp benefits
- Further, we can explore when treatment matters; our policy affects resources *in utero* and through childhood

## What we do

- Use variation in childhood exposure to FSP based on county and year of birth during the FSP rollout period
  - Note that our treatment never “turns off” once it starts
- Use Panel Study of Income Dynamics
  - Data on economic outcomes, health conditions, general health status, and disability. Allows for measurement of metabolic syndrome.
  - Restricted use data allows for measurement of county of birth for cohorts affected by introduction of FSP.
- Explore when in childhood the intervention is most beneficial.

## Outcome measures: Index

Metabolic Syndrome	<ul style="list-style-type: none"> <li>Obese (=1)</li> <li>High blood pressure (=1)</li> <li>Diabetes (=1)</li> <li>Heart disease (=1)</li> <li>Heart attack (=1)</li> </ul>
Economic self-sufficiency	<ul style="list-style-type: none"> <li>High school graduate (=1)</li> <li>Employed (=1)</li> <li>Not poor (=1)</li> <li>Not on TANF (=1)</li> <li>Not on food stamps (=1)</li> <li>Earnings</li> <li>Family income</li> </ul>

## Metabolic Syndrome for High Impact Sample

Metabolic syndrome (index)	
FS share IU-5	-0.294*** (0.107)
Mean of dep va	0.01
Observations	8,246
R-squared	0.26

Includes fixed effects for birth year, county, interview year, state linear trends, 1960 county characteristics by linear time, individual demographics and family background. Clustered by county and weighted using PSID weights.

## Metabolic Syndrome for High Impact Sample

Metabolic syndrome (index)	
FS share IU-5	-0.294*** (0.107)
Mean of dep va	0.01
Observations	8,246
R-squared	0.26

Change from no exposure to full exposure (in utero to age 5) reduces metabolic syndrome by 0.3 standard deviations; significant at 1% level.

## Metabolic Syndrome for High Impact Sample

Metabolic syndrome (index)	Components of metabolic syndrome index					
	Diabetes	High blood pressure	Obesity	Heart disease	Heart attack	
FS share IU-5	-0.294*** (0.107)	-0.032 (0.048)	-0.13 (0.086)	-0.159* (0.086)	-0.053 (0.027)	-0.031 (0.019)
Mean of dep va	0.01	0.05	0.19	0.33	0.03	0.01
Observations	8,246	8,431	8,430	9,217	8,430	8,432
R-squared	0.26	0.19	0.22	0.26	0.13	0.08

While only obesity reaches statistical significance, all the individual components indicate an improvement in adult health. (Component regressions use 0/1 not z-scores.)

## Other Health Outcomes, High Impact Sample

	Other health outcomes			Health behaviors	
	In good health	Disabled	Height below 5th perc.	Ever smoked	Drink any
FS share IU-5	0.110 (0.074)	-0.004 (0.039)	-0.060** (0.026)	-0.056 (0.064)	-0.023 (0.049)
Y-mean	0.59	0.12	0.02	0.44	0.70
Observations	25,738	25,731	9,398	20,946	20,896
R-squared	0.16	0.13	0.22	0.19	0.18

All outcomes show improvement, only “stunting” measure is significant. (Note variation in sample size due to how frequently the questions are included in the survey.)

## Economic Self Sufficiency Index, High Impact Sample

Economic self sufficiency (index)	
FS share IU-5	0.182 (0.124)
Y-mean	-0.25
Observations	20,115
R-squared	0.38

Access to food stamps leads to an insignificant 0.2 standard deviation increase in economic self-sufficiency.

## Economic Self Sufficiency Index, High Impact Sample

Economic self sufficiency (index)	Components of economic self sufficiency index							
	High school plus	Poor	Food stamp receipt	TANF receipt	Employed	Earnings	log(family income)	
FS share IU-5	0.182 (0.124)	0.184* (0.108)	-0.052 (0.067)	-0.032 (0.052)	-0.023 (0.026)	-0.008 (0.056)	3610 (5,064)	0.247 (0.165)
Y-mean	-0.25	0.80	0.30	0.14	0.05	0.76	24495	10.52
Observations	20,115	21,197	21,209	20,115	21,347	21,348	20,529	21,160
R-squared	0.38	0.29	0.30	0.38	0.16	0.18	0.34	0.37

Each component (except employment) shows an improvement with food stamp access. [Note in the self-sufficiency index each component is converted to a “positive” outcome.]

## Economic Self Sufficiency Index, High Impact Sample

	Economic self sufficiency (index)	Components of economic self sufficiency index						
		High school plus	Poor	Food stamp receipt	TANF receipt	Employed	Earnings	log(family income)
FS share IU-5	0.182 (0.124)	0.184* (0.108)	-0.052 (0.067)	-0.032 (0.052)	-0.023 (0.026)	-0.008 (0.056)	3610 (5,064)	0.247 (0.165)
Y-mean	-0.25	0.80	0.30	0.14	0.05	0.76	24495	10.52
Observations	20,115	21,197	21,209	20,115	21,347	21,348	20,529	21,160
R-squared	0.38	0.29	0.30	0.38	0.16	0.18	0.34	0.37

Adult food stamp receipt – theoretically ambiguous due to possible (positive) effect of intergenerational transmission of “welfare” receipt.

## Main Results for High Impact Sample, by Gender

	Women			Men		
	Metabolic syndrome (index)	Good Health	Economic self sufficiency (index)	Metabolic syndrome (index)	Good Health	Economic self sufficiency (index)
FS Share IU-5	-0.312** (0.130)	0.336*** (0.100)	0.306* (0.164)	-0.526** (0.251)	-0.077 (0.112)	0.005 (0.168)
Mean of Dependent <sup>1</sup>	0.03	0.53	-0.37	-0.01	0.66	-0.11
Observations	5,062	15,702	12,208	3,184	10,036	7,907
R-squared	0.37	0.22	0.43	0.32	0.18	0.46

Economic impacts strong for women, nonexistent for men. Consistent with other studies finding stronger impacts for girls (Anderson 2008, Bleakley 2007, Dahl/Lochner 2012, Milligan/Stabile 2009, MTO; less evidence from fetal origins/nutritional studies)

## Conclusions

- “Childhood Exposure to the Food Stamp Program: Long-run Health and Economic Outcomes”
  - Hilary Hoynes, Diane Schanzenbach and Douglas Almond
  - NBER Working Paper #18535
- Exogenous shock to resources available during early life improves adult health and (for women) economic outcomes
  - Consistent with predicted improvement in “metabolic syndrome”
- New evidence concerning role of early life conditions:
  - A *positive, policy-driven* shock
  - Extend our investigation beyond in utero exposure and find evidence that critical period for health is through age 5, entire childhood for economic outcomes
- Show that benefits of safety net are broader than previously thought. Positive external benefits to taxpayers.
  - If fail to account for externalities, will under-invest in provision of safety net
  - SNAP is investment in children, not just charity

## Overview Recommendations

- Caution against focusing too narrowly
  - Broader literature gives important insights
  - Insights into relationship between consumption and shocks in population of interest
- Measurement
  - Underreporting of benefits
  - Dramatically different prevalence of food insecurity in CPS, PSID, ECLS-K
  - Takeup is not an outcome
- Policy relevance (broadly)
- Dept of Education’s Institute for Education Sciences as case study
  - Including funding of graduate students

# Food Insecurity and Cardiometabolic Risk Factors among Adolescents

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April 9, 2013

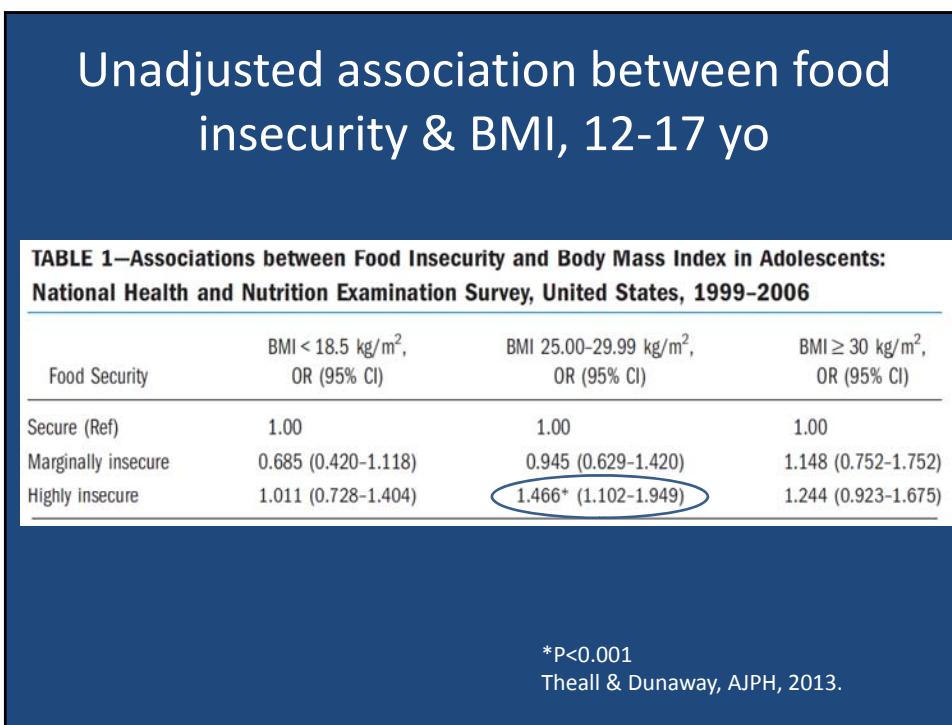
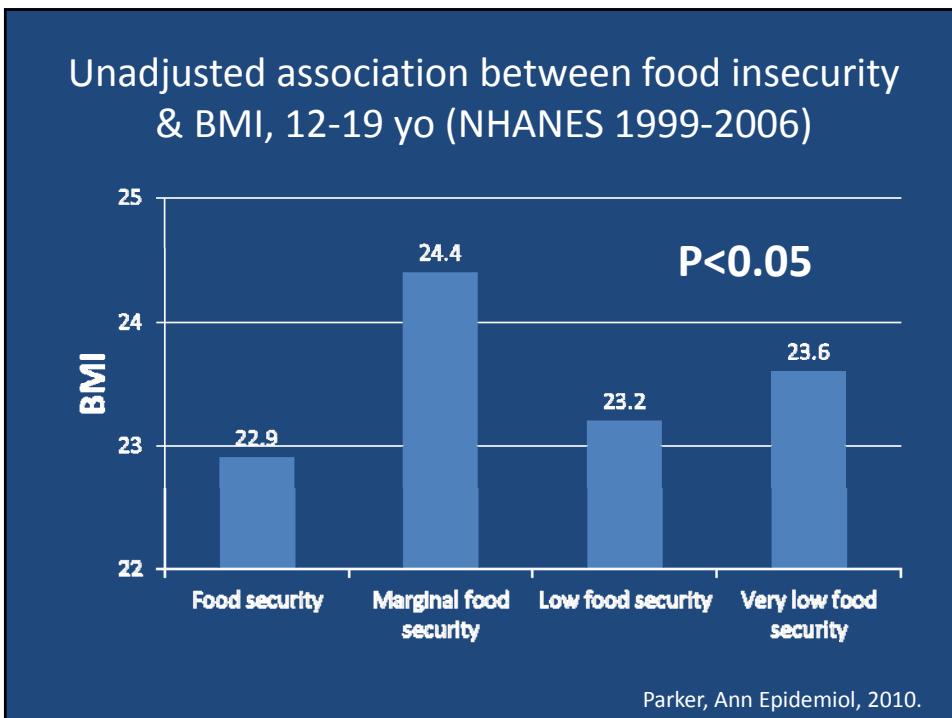


Center for Vulnerable Populations at  
San Francisco General Hospital & Trauma Center



## Food Insecurity & Obesity: Hypotheses

- Food affordability → changes in dietary intake
- Disordered eating practices: hoarding, binging, preferences for calorically dense foods
- Stress
- Inflammation
- Genetic programming & fetal environment



## Food Insecurity & BMI: NHANES (Cross-Sectional)

Alaimo, 2001	NHANES-III	Girls & boys 8-16 yo	Food insuff (1-item) BMI measured	No difference
Bhattacharya, 2004	NHANES-III	Girls & boys 12-17 yo	CFSM BMI measured	No difference
Casey, 2006	NHANES 1999-2002	Girls & boys 12-17 yo	CFSM BMI measured	Overweight AOR 1.50 (1.17-1.93)
Gundersen, 2008	NHANES 1999-2003; <u>&lt;200%FPL</u>	Girls & boys 11-17 yo	CFSM BMI measured	No difference, even with maternal stress
Gundersen, 2009	NHANES 2001-2004; <u>&lt;200% FPL</u>	Girls & boys 8-17 yo	CFSM BMI measured	No difference in BMI or other anthropometric measures

Note: Many of these studies included other age ranges; this slide summarizes data only for adolescents.

## Food Insecurity & BMI: Other Data Sets (Cross-sectional)

Casey, 2001	CSFII 1994-96	Girls & boys <u>1-17 yo</u>	Food insuff (1-item) BMI self-report	No diff when limited to low-income hh's
Gundersen, 2008	Three City Study (low income pop)	Girls & boys 10-15 yo	CFSM (3 items) BMI measured	No diff
Lohman, 2009	Three City Study (low income pop)	Girls & boys 10-15 yo	CFSM (3 items) BMI measured	No diff, except FI + maternal stress → higher BMI
Smith, 2008	Homeless youth, Minnesota	Girls & boys 14-18 yo	CFSM (4 items) BMI measured	No diff in this age group

## Weaknesses of Existing Data

- Lack of longitudinal data in this age group
- Food insecurity generally defined at the household level (Three City Study used individual child's food security status)

## Reasonable Conclusions

- Food insecurity & obesity may be associated among adolescents
  - Probable that food insecurity is a marker for *something* that increases obesity risk
    - Poverty, stress, eating behaviors/coping strategies, sedentary behaviors, etc....

## Research Needed

- *If there is a food insecurity-obesity relationship among adolescents:*
  - Mechanisms
  - Longitudinal studies to clarify the direction of any food insecurity—obesity associations among adolescents

*But is this looking at the wrong problem?*

## Research Agenda

- Obesity, diabetes, high blood pressure, high cholesterol, metabolic syndrome
  - *Develop over the course of decades*
- *\*\*Is food insecurity during adolescence (childhood) associated with cardiometabolic risk factors later in life?*
  - Coping strategies laid down in childhood
  - Eating patterns established during childhood

*I have this phobia about food... And, remembering that [experience of having no food] now I constantly have to have food in the house. We start getting low and I start freaking.*

Olson CM, Bove CF, Miller EO. Growing up poor: long-term implications for eating patterns and body weight. *Appetite*. 2007 Jul;49(1):198-207.

## Review of FI and Adult Cardiometabolic Risk Factors

- Obesity (women only)
- Diabetes
- High blood pressure
- Tobacco\*\*\*
- *Probably not high c..*
- Increased risk of meeting metabolic syndrome criteria
- Increased risk of some inflammatory markers: CRP, WBC count

No data in  
adolescents...  
but silly to look

- Disability  
COPD health  
snacks

## Other Cardiometabolic Risk Factors in Adolescents

- Parker, Ann Epidemiol, 2010
- NHANES, 1999-2006; adolescents 12-17 yo
- CFSM, household level; measured BMI
- Components of metabolic syndrome
  - Higher waist circumference in the marginal FS group
  - No differences in glucose, HTN, TG, HDL, HTN
  - No difference in meeting 3+ criteria for metabolic syndrome

## Food insecurity & inflammatory markers among adolescents, 12-17y0

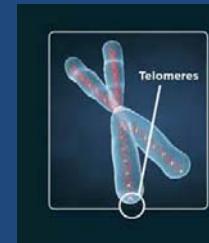
- Theall & Dunaway, AJPH, 2013
- NHANES 1999-2006
- No association between food insecurity and CRP among adolescents

## Research Gap

- **What are the long-term health implications of childhood food insecurity?**
  - Longitudinal studies with follow-up into adulthood
  - Primary focus to be on understanding the health implications of FI
  - Repeated measures of food insecurity
    - A way to quantify “dose” of food insecurity over time
    - Most profound depth? Total duration?

## Research Gap

- **What are the long-term health implications of childhood food insecurity?**
  - Robust measurement of health data
    - Self-reported isn't good enough
    - I want BLOOD
      - (...and urine, blood pressure, bone mineral density, *telomeres*?)
  - Robust measurement issues relevant to the experience of FI
    - Coping strategies, public program participation, tobacco/drug use, dietary intake, geographic food access, parental feeding behaviors



Thank you



## Systematic Reviews

- Eisenmann & Gundersen, Is food insecurity related to overweight and obesity in children and adolescents? A summary of studies, 1995-2009. *Obesity Reviews*. 2011.
- Franklin & Jones, Exploring mediators of food insecurity and obesity: a review of recent literature. *J Community Health*. 2012.