Does an Evidence-Based Early Childhood Program Reduce Adult Obesity? Results from the Chicago Longitudinal Study

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Key Trends

1. Obesity is a world-wide health problem.
2. Adult prevalence doubled in 3 decades.
3. Lower-income status and black women have shown larger increases.
4. High priority on goals and broad health promotion.
5. Innovative, scalable prevention approaches are needed.

Adult Prevalence, 2015-16

Total: 39.6%

Males: 37.9%

Females: 41.1%

20-39y: 35.7%

Source: Hales et al. (2018). JAMA. Trends in obesity from National Health and Nutrition Examination Survey (NHANES).

Child Prevalence, 2015-16

Total:	18.5%	
2-5y:	13.9%	>38% from 07
6-11y:	18.4%	<6%
12-19y:	20.6%	>14%

Source: Hales et al. (2018). JAMA. NHANES data.

Select Adult Rates, 2013-16

	Women	Men
White:	38.1%	36.2%
Black:	55.9%	37.4%
Hs grad	47.3%	30.0%
College grad	29.3%	36.2%

Source: Hales et al. (2018). JAMA; NHANES data, age adjusted.

2020 Goals

"Improve the cardiovascular health of all Americans by 20% while reducing deaths from cardiovascular diseases by 20%." (AHA)

"Reduce the proportion of adults [and children] who are obese." Goal: 10 percent improvement. (HP 2020).

AHA Ideal Health Metrics 2016

	12-19	*20-49*
No smoking	91%	73%
BMI < 25	63%	33%
Cholesterol < 170	80%	64%
BP < 120/80	89%	61%
B Glucose < 100	88%	74%

Notes and Source: Physical activity (27% and 42%) and Healthy diet score (<1% and <1%) are not shown. AHA Statistical Fact Sheet and Benjamin et al. (2017), Circulation.

CVD Prevention

"…such efforts must be targeted at youths and young adults because by middle age, most Americans already have poor cardiovascular health."

Source: Folsom et al. (2011). JACC. Prevalence of ideal cardiovascular health (p. 1696).

Why Early Childhood?

True Prevention

High Dosage of Educational Enrichment

Multi-Component Programs (family services, nutrition, health, readiness)

Growing Public Investment

Existing Service Systems

Classifications

Parenting and home visitation

Early education and care

State PreK (Publicly funded)

Comprehensive Programs

Transition and School-age Programs

GROW Study, 2018

610 parents and 3-5yo children assigned to tiered behavior change over 36 months

Setting: Low-income Nashville areas

Results: No change in BMI trajectories at 3-yr follow up; significant improve. for food insecure group

Source: Barkin et al. (2018), JAMA; Growing Right unto Wellness Trial

INSIGHT Trial, 2018

279 mother-child dyads received 4 home visits focused on play, sleep, and feeding over 3 years plus annual center visits.

Setting: Hershey, PA

Results: Sig. lower BMI at age 3 (d = -.28); trend for overweight and obesity.

Source: Paul et al. (2018), JAMA; Responsive parenting intervention.

Head Start Study, 2015

19,023 3-to-5yo were compared to 5,405 age-matched Medicaid children using program admin data & e-health records.

Setting: 12 programs in MI over 8 years

Results: Obese & overweight HS children showed greater 2-year declines in BMI.

Source: Lumeng et al. (2015), Pediatrics; Changes in BMI and Head Start participation.

Abecedarian Project, 2014

40 low-income children in a 5-year early ed center were compared to 28 controls at age 35 follow up based on exams.

Setting: Chapel Hill, NC (1972-1977)

Results: No overall differences but trend for females (abdominal; 56% vs. 76%).

Source: Campbell et al. (2014), Science; Early ed and adult health.

Role of Education

Several recent studies confirm negative correlation of years of ed & BMI/obesity.

Wisconsin Longitudinal Study

--reduction of .15 BMI for each year.

Young Finns Study

--reduction of .22 BMI for each year.

Sources: Kim (2016). Economics & human biology; Bockerman et al. (2017). Preventive Medicine.

Child-Parent Education Centers

Goal

"The Child-Parent Education Centers are designed to reach the child and parent early, develop language skills and self-confidence, and to demonstrate that these children, if given a chance, can meet successfully all the demands of today's technological, urban society." (Sullivan, 1968)

Age 35 Ed Attainment, PreK

	Prog	Comp	Diff
AA and above	15.7%	10.7%	5.0*
BA and above	11.0%	7.8%	6.1t
Masters+	4.2%	1.5%	2.7*
Years of ed	12.81	12.32	0.49*

Source. Reynolds, Ou, & Temple (2018). JAMA Pediatrics. 1 or 2 years of CPC vs. comparison adjusted for school-age, selection and attrition by IPW. t < .10; *p<.05

Questions

1. Is CPC preschool participation associated with BMI and obesity in early midlife?
2. Are there differences by child, family, and neighborhood characteristics?
3. Does educational success and related child, family, and school experiences mediate the relationship?

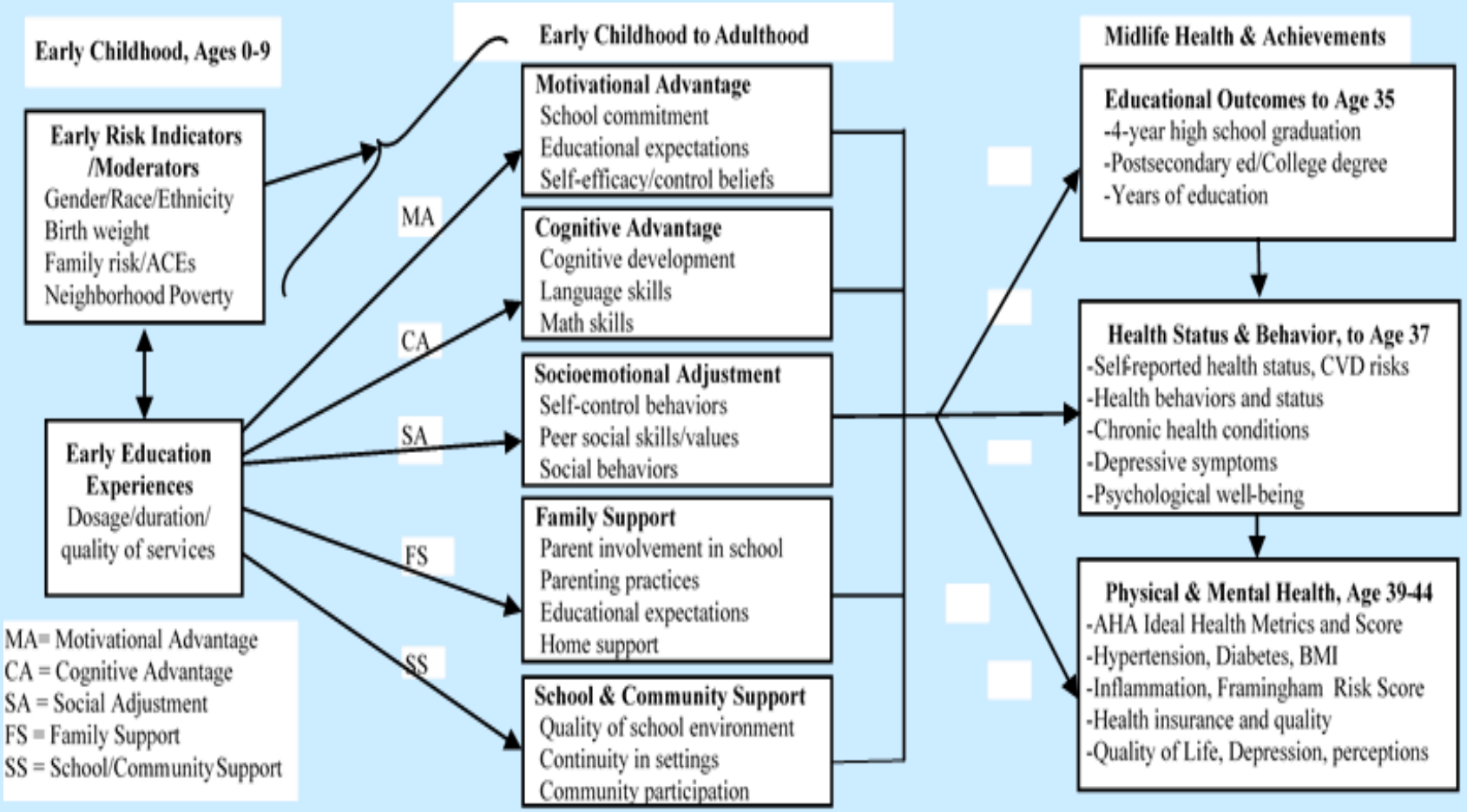
Theoretical Frameworks

Developmental Origins of Health/Disease

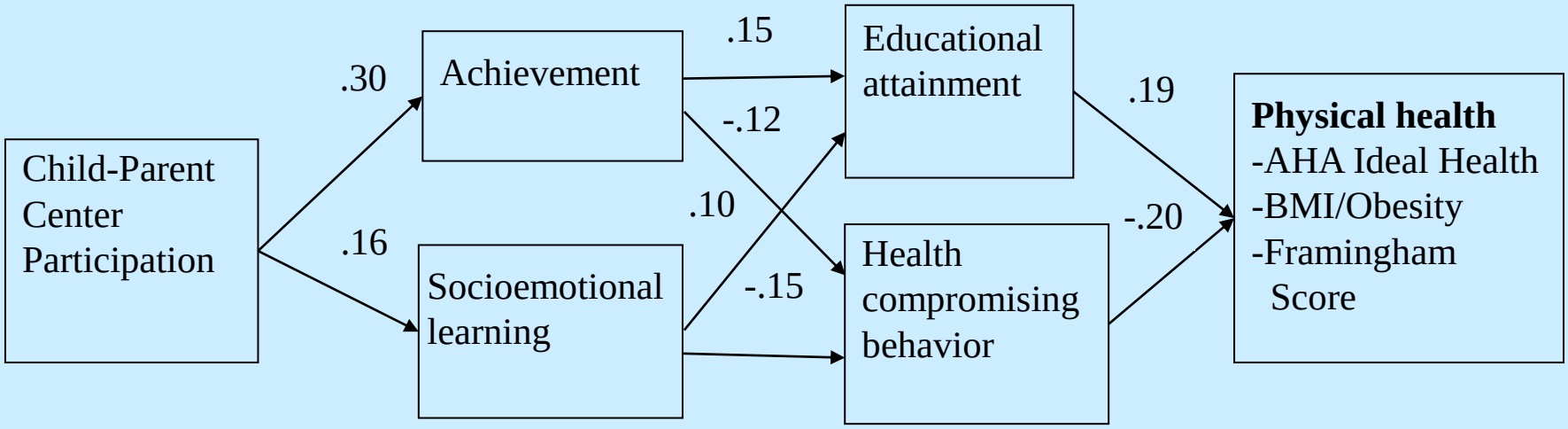
Ecological Systems Theory

Risk and Protection

Five-Hypothesis Model Paths to Education and Health Outcomes in the CLS from early life to education and health outcomes. Paths among mediators not shown.

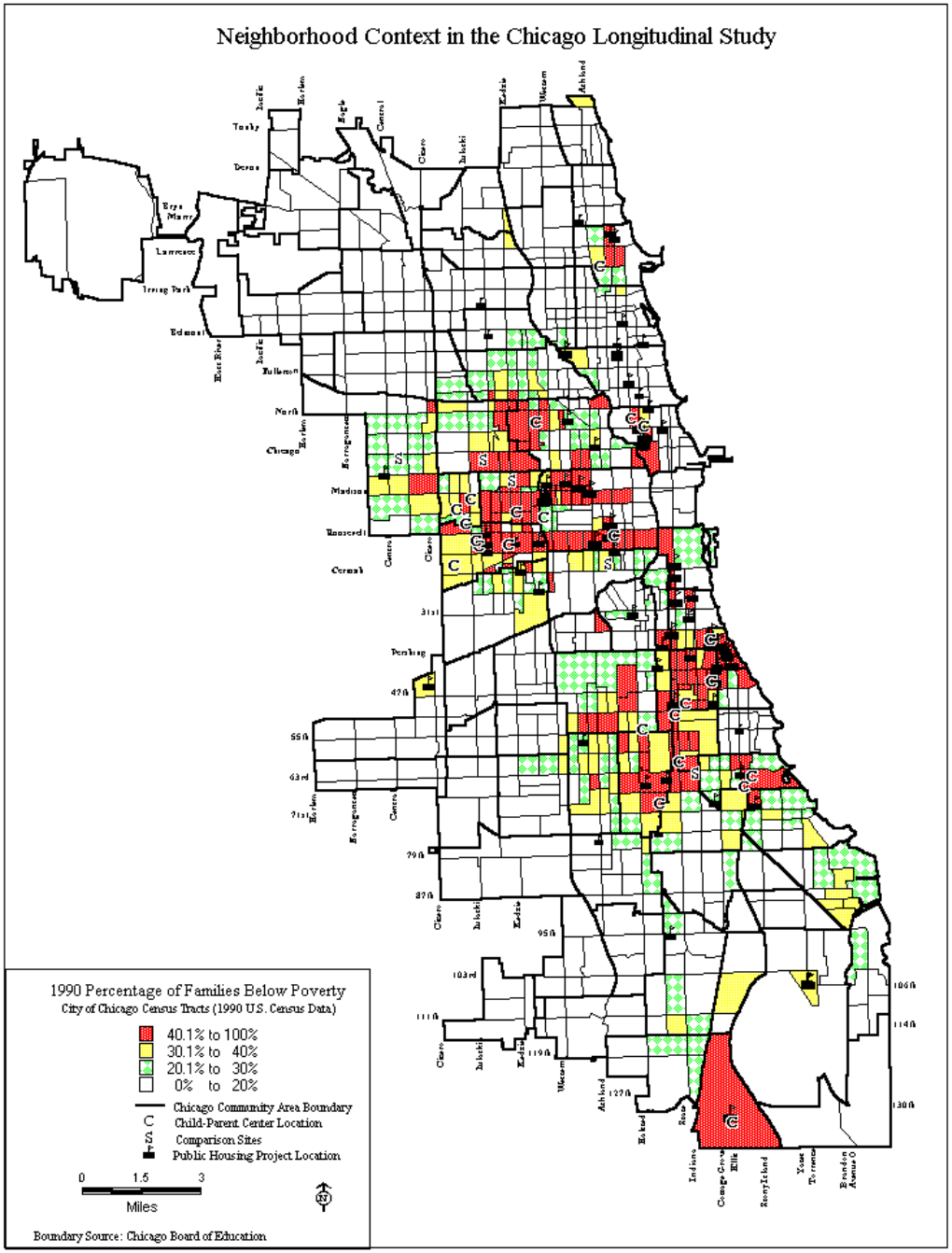


CLS Paths of Influence from CPC to Adult Health



Note. Pathways of CPC Impacts from prior CLS Findings Leading to Physical Health in Midlife. The path coefficients to physical health are from self-reported AHA index scores from the age 35-37 survey. Initial CPC impacts on cognitive skills (b = .36) and parent involvement (b = .15) are not shown.

Neighborhood Context in the Chicago Longitudinal Study



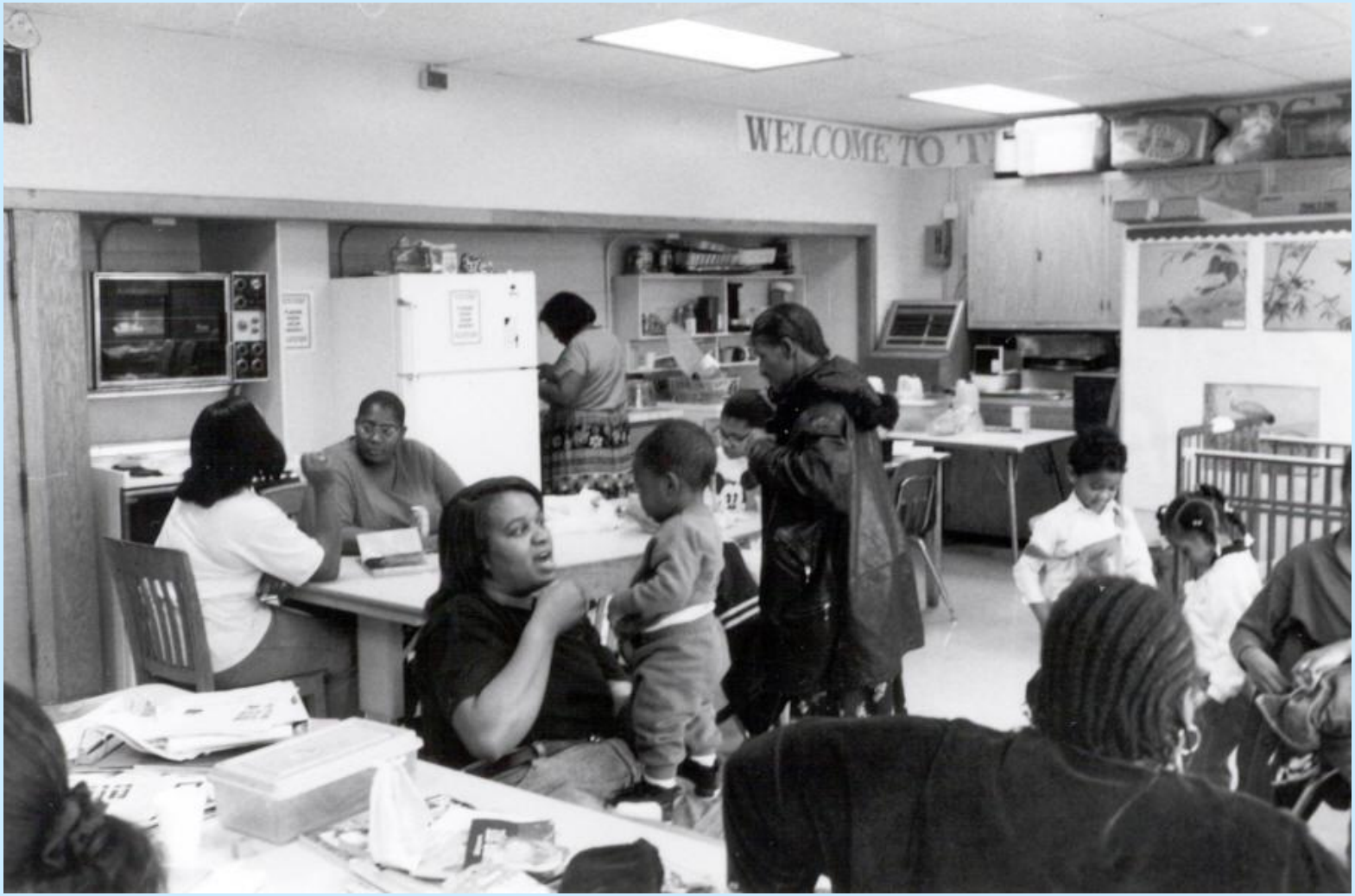
CPC History

First preschool program funded by Title I (1967)

Original P-3 program, providing integrative services

District 8 Supt. Lorraine Sullivan developed program with much local collaboration

Parent Resource Room



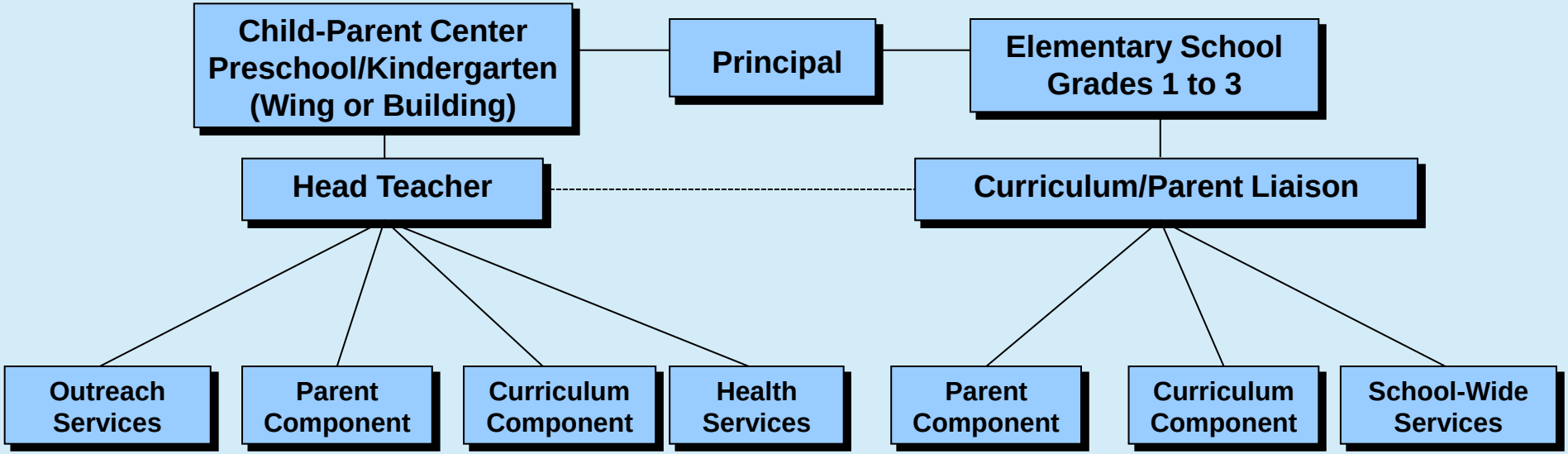
CPC Core Features

1. School-based and P-3 continuity
2. Whole-child approach to readiness
3. Free meals and nutrition ed
4. Health screening and services
5. Parent Resource Room workshops
6. Community outreach.

CPC Staffing

- Head Teacher
- Parent Resource Teacher
- School-Community Representative
- Teachers and assistants
- School nurse, psychologist, social worker
- Preschool class size was 17 to 2
- School-age services K to 3

Child-Parent Center Structure



School-Community Representative
Resource Mobilization
Home Visitation

Parent Resource Teacher
Parent Room Activities
Classroom Volunteering
Home Support

Language Focus
Class Sizes 17/2
Balance of Activ.
Whole-Child Prof. Develop.

Health Screening
Nursing Services
Free + Reduced-Price meals

Parent Room Activities
Classroom Volunteering
School Activities
Home Support

Class Sizes 25/2
Teacher Aides
Instructional Materials
Individualized Instruction
Inservice Training

Health Services
School-Community Representative
Free + Reduced-Price meals
Resource Mobilization

Age 3 → To → Age 9

Chicago Longitudinal Study

1. Effects of CPC program for a complete cohort born in 1979-80

2. Assess timing and duration of impacts

3. Early influences across the life course

4. Identify mechanisms and processes of change to midlife.

CLS Sample Description

- Cohort of 1,539 young children who attended publicly funded PreK programs in 1983-85 for children at risk in Chicago public schools and completed K in 1986.

- Data collected annually from many sources with 90% or higher recovery into adulthood. Mobility measured starting in K from school records and supplemented with parent/student reports.

Program Groups

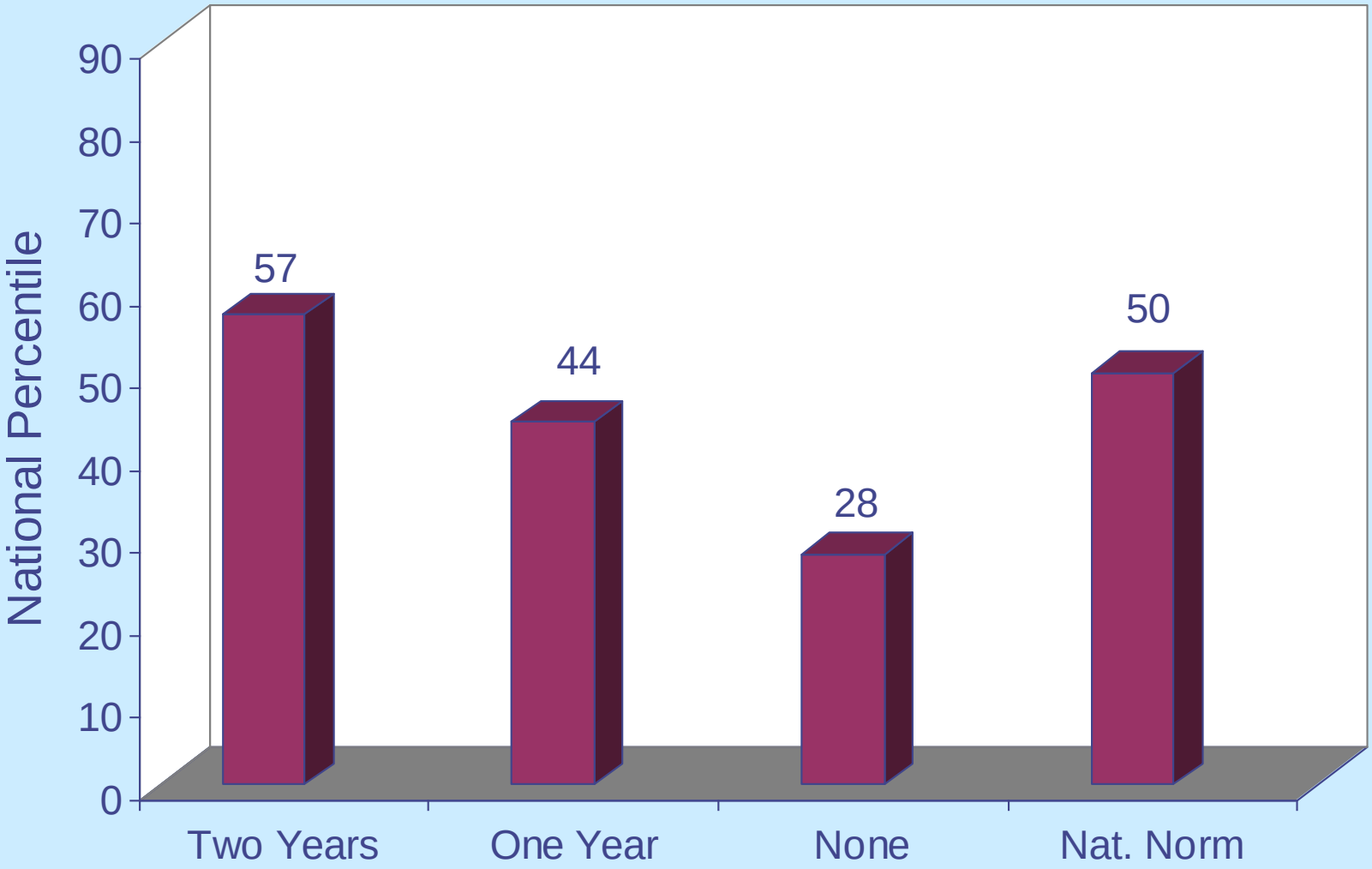
- 989 complete cohort of CPC participants in 20 sites; they participated from 2 to 6 beginning at age 3. Centers are located in the highest poverty areas of Chicago.

- 550 children enrolled in an alternative early childhood program in kindergarten in five randomly selected schools serving low-income families and in six CPC sites. They matched on socioeconomic status.

Characteristics of CPC Groups

	CPC Intervention	Comparison
Sample	Complete cohort	Random sample of K sites + 6 CPC areas
Recovery, by age 35	904 of 989 (91%)	494 of 550 (90%)
Key attributes	Reside in highest poverty areas Over 80% of children enroll Mean no. of risks = 4.5; 73% with 4 or more risks Parent ed > than compar.	Reside in high poverty areas Had school-based enrichment Mean no. of risks = 4.5; 71% with 4 or more risks Area poverty > than prog.
Intervention levels		
Preschool	100% 1 or 2 years	15% in Head Start
Kindergarten	60% full day	100% full day
School age	69% 1 year 56% 2-3 years	7% 1 year 23% 2-3 years

CPC Preschool and Readiness



Impacts into Adulthood: PreK

	Prog	Comp	Diff
Juvenile arrest	16.9%	25.1%	-8.2%*
Child maltreat.	6.9%	14.2%	-7.3%*
HS completion	79.4%	70.7%	8.7%*
Felony arrest	16.3%	21.2%	-4.9%*
Depression	12.8%	17.4%	-4.6%*
Health Insur.	76.7%	66.6%	10.1%*

Age 35 Data Collection

1,104 completed interviews by phone (n=885) and other modes (20 partials)

Collected over 5 years (2012-2017)

2 hours and 130 questions

Effective completion rate of 79%

Collaborators, BMI and Health Studies

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Organizations

- Public Opinion Lab, Northern Illinois University
- Chicago Public School District
- Illinois Department of Corrections
- COFI
- University of Minnesota Survey Center

BMI Questions

Q89: What is height with your shoes off?
(___feet __inches)

Q90: How much do you currently weight with your shoes off?
(___lbs)

BMI = weight (kg) / height (m*m).

R, BMI Self Report & Physical Exam

Sample	*Corr.*
Total	.85
Males	.90
Females	.81
Bottom 50%	.70
Top 50%	.66

BMI metrics, CLS (N=1,042)

	BMI	30+
Total	30.4 (6.8)	44.9%
Female	31.5	50.6%
Male	29.1	38.9%

Ns=543, 499; U.S. rate =36%; 56%(BF), 37%(BM).

CPC Descriptives for Obesity

	CPC	Comp.
N (% ret.)	689 (70)	353 (64)
Total	44%	46.7%
Female	46.8%	59.2%
Male	40.6%	35.3%

Covariates

Birthweight (B)	Birth records
SES/family risk eg. parent ed (D)	Birth/admin parent report
Home env, 0-5 e.g., adversity (H)	Retros. report/ child welfare
Program	School-age CPC
School/neigh. (SN)	Poverty context, sites (S)

Estimated Models

1. Baseline:

   $BMI = \mathbf{C} + \mathbf{B}CPC\text{-}P + \mathbf{B}CPC\text{-}SA + e$

2. Full Regression:

   $..+ \mathbf{B}BD + \mathbf{B}Home + \mathbf{B}SN + e$

3. School fixed effects:

   $..+ \mathbf{B}S + e$

4. IPW for attrition (all models)

   $W = 1/P$

   $P_{i\,(SR)} = \mathbf{C} + \mathbf{B}_j BD + B_j Home + \mathbf{B}_j P + \mathbf{B}_j SN + e$

Selective attrition by CPC?

Variable	P-value
Birthweight	0.47
Family Risk	0.17
Neigh. Poverty	0.76
Neigh. Advantage	0.85
Word analysis skills, K	0.16

Note. N=1531; Prog x retention interaction term.

Predictors, Sample Retention (OR)

Black participants	1.7
Home env. adversity	1.2
Parent involvement	1.1
PreK by sch poverty	1.03
Sch-age by sch poverty	0.97

Note. 31 predictors in full logit regression model.

CPC Differences for BMI

	BMI	SD units
1 Baseline	-0.62	.09
2 Covariates	-0.99*	.15
3 Fixed effects	-1.19*	.18
4 W covariates	-0.96*	.14

*p < .05; **p < .01; t=p < .10

CPC Marginal Effects for Obesity

	Diff.	%reduction
1 Baseline	-2.7p	.09
2 Covariates	-4.6p	.15
3 Fixed effects	-0.8p	.18
4 W covariates	-4.1p	.14

*p < .05; **p < .01; t=p < .10

CPC and BMI, Women

	BMI	SD units
1 Baseline	-2.01	.30
2 Covariates	-2.28	.34
3 Fixed effects	-2.79	.42
4 W covariates	-2.33	.35

Note. All values $p<.01$.

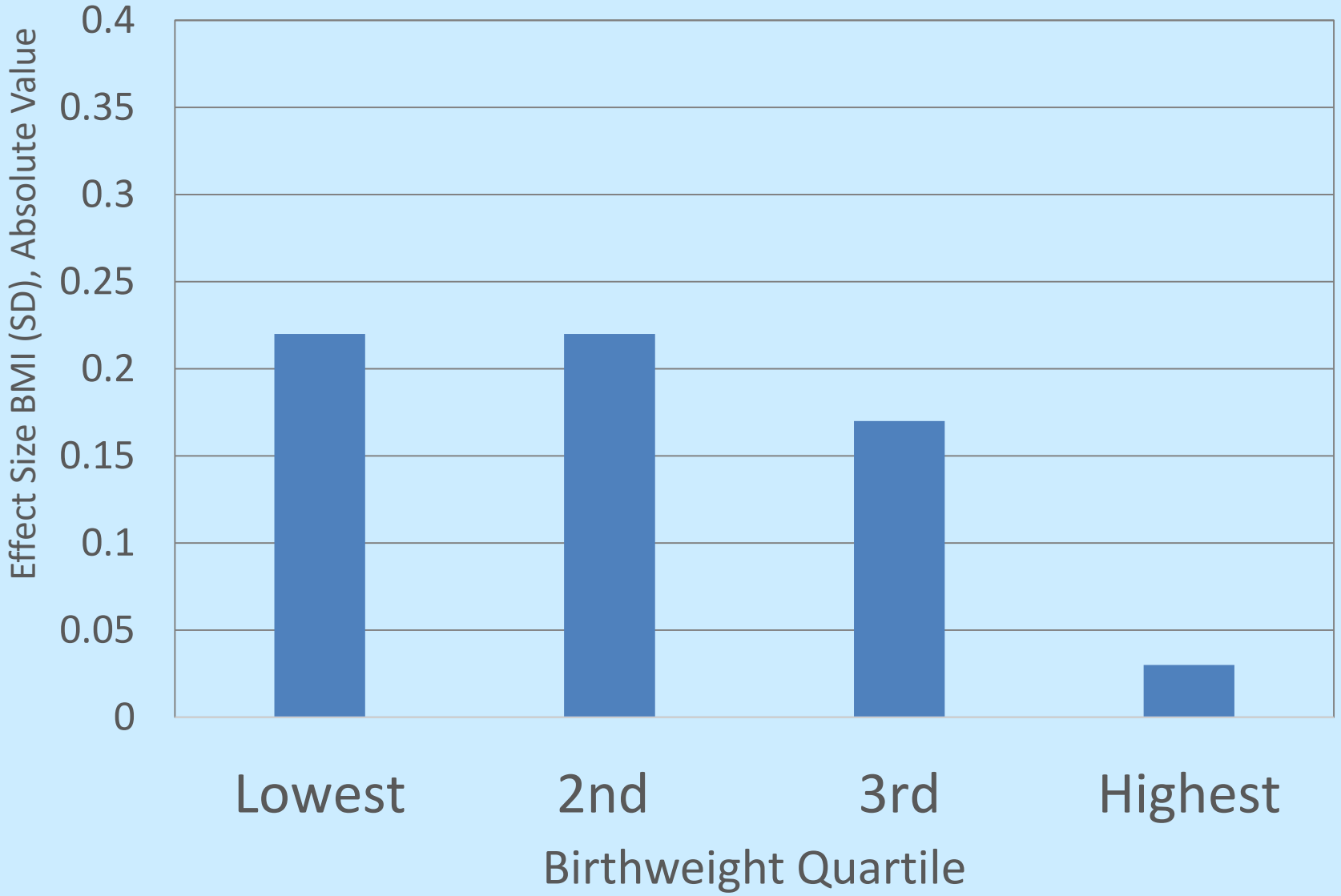
CPC and Obesity, Women

	Diff.	%reduction
1 Baseline	-14.2p	24%
2 Covariates	-15.2p	26%
3 Fixed effects	-13.6p	22%
4 W covariates	-15.2p	26%

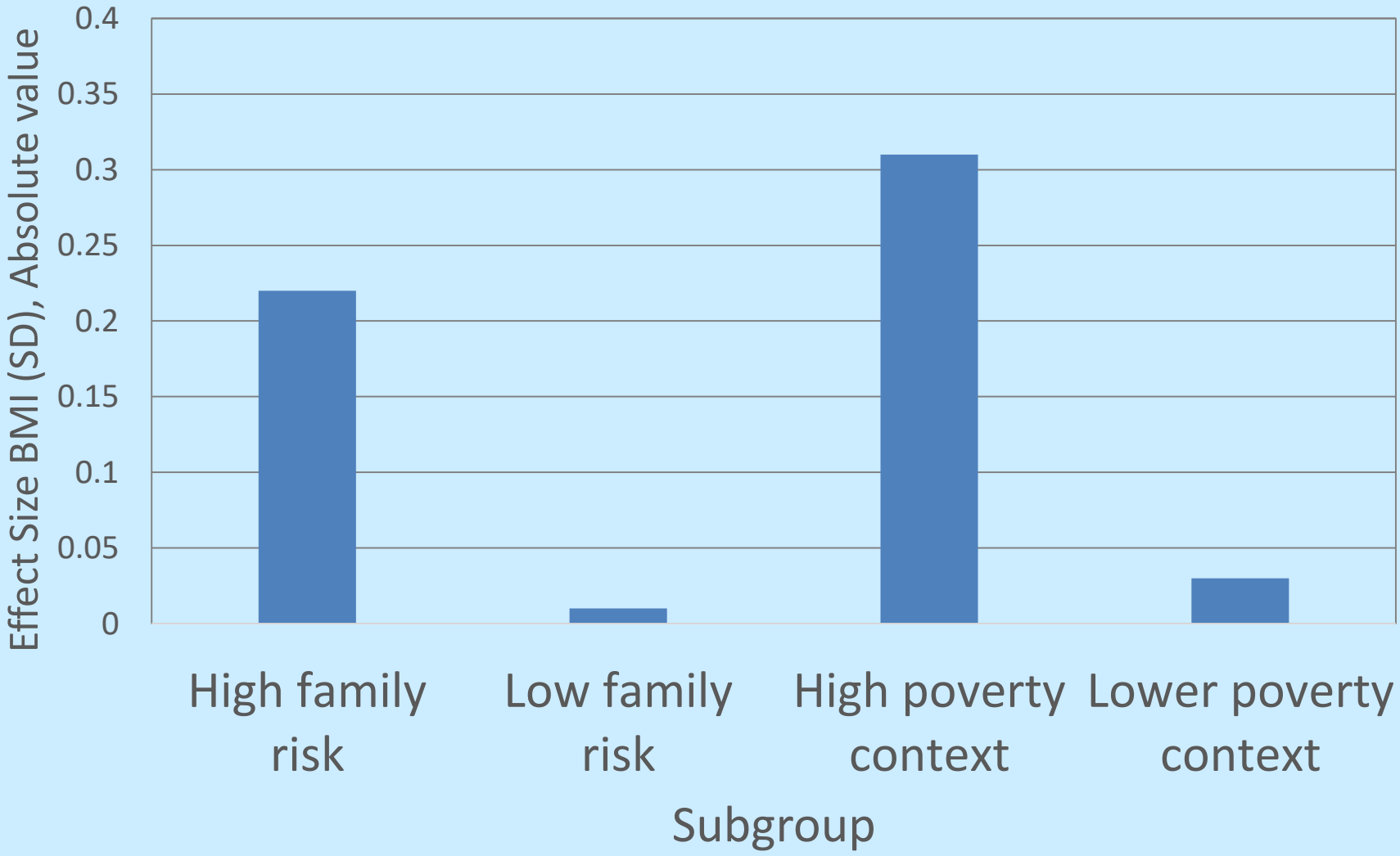
Model 3 (P, C): 40% vs. 59.2%

Note. All values $p < .01$, except Model 3 ($p<.05$).

CPC PreK and Age 35 BMI by Birthweight



CPC PreK and Age 35 BMI by Family Risk



Mediation Findings

1. Educational attainment and 5HM factors accounted for 10 to 15 percent of main effects (overall and women).
2. Contributors were years of education, magnet high school attendance, and socio-emotional skills.
3. Modeling complex processes and indirect effects is a next step.

PreK Instruction Differences

1. Prior study found that CPC children with instruction high in child-initiated learning had highest rates of HS graduation.
2. IPW results found a similar pattern. Relative to the high teacher-directed group, the high child-initiated/low teacher-directed group had lower mean BMIs (d = -0.17, total; d = -0.20, women). Weaker obesity findings.

Source: Graue, Reynolds, et al. (2004). Ed Policy Analysis Archives. Prek instruction and achievement.

CLS Health Exam Study

With Preventive Medicine at Northwestern U, health exams are conducted in Chicago

Exams assess all AHA metrics, mental health, health history, and blood storage

Modeled after CARDIA and MESA

257 completed exams to date

CPC P-3 Program Manual

Child-Parent Center Preschool–3rd Grade Program

HCRC
www.humancapitalrc.org

Human Capital Research Collaborative
University of Minnesota
Humphrey School of Public Affairs
301 19th Ave. South
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CPC
P-3
CHILD-PARENT CENTERS

Child-Parent Centers

The Child-Parent Center preschool to 3rd grade (CPC P-3) model is a school reform effort currently in three Midwestern states. The program aims to strengthen overall well-being and achievement of preschool through elementary school-aged children from low-income families.

Who's involved in running a CPC P-3 site? Learn more here.

CPC P-3 ROLES & RESPONSIBILITIES

New Book on Early Childhood

Sustaining Early Childhood Learning Gains: Program, School, and Family Influences. New York: Cambridge.

Edited by Arthur Reynolds and Judy Temple.

Next Steps

1. Further examine mediators of CPC impacts and by subgroups.
2. Dosage analysis across ages 3-9.
3. Compare different approaches to incorporating missing data.
4. Generalize to AHA and other domains of well-being.

Summary

1. CPC preschool shows evidence of benefits on BMI in midlife, especially women.
2. Stronger benefits for those in the highest poverty contexts.
3. Limited evidence of mediation.
4. Routine, comprehensive programs have promise for obesity prevention.
5. Program scaling is feasible.

Funding Support from:

National Institute of Child Health and Human Development

Bill & Melinda Gates Foundation

Web: hcrc.umn.edu; cpcp3.org
icd.umn.edu/cls; clstudy.org

Key Impacts of Obesity

Although AHA metrics show sizeable correlations, causal impact reviews show obesity most linked to:

Type 2 Diabetes: 1.67 OR

Coronary Artery Disease: 1.20 OR

Sources: Riaz et al. (2018). JAMA Network Open. Systematic review of Mendelian randomization studies.