

### Introduction

Although high quality early childhood programs have been found to reduce achievement and health gaps, effects on adult physical health are understudied. Two previous cost-benefit analyses of the Chicago Child-Parent Centers (CPC) Program at age 21 (Reynolds et al., 2002) and age 26 (Reynolds et al., 2011) reported benefit-cost ratios ranging from \$7 to \$11 of benefits per \$1 of costs.

While health benefits due to reduced substance abuse and depression treatment were included, cardiovascular risks were not considered. Many of these benefits occur in mid-life, which was beyond the scope of prior studies.

In this study we examine a larger set of measures of physical health including obesity, diabetes, hypertension, smoking, and substance abuse obtained from a survey of participants from age 35 to 37. We also present a comparison of health benefits versus intervention costs as a partial **cost-benefit analyses**.

### Data

This study makes use of data from the **Chicago Longitudinal Study (CLS)**, which follows a same-age cohort born between 1979 to 1980. The **quasi-experimental study design** was created by including all students who were enrolled in each CPC school sites that included kindergarten as well as entire kindergarten classrooms in a matched set of similar high-poverty schools.

### Sample Size

| Age 3           | Age 37          |
|-----------------|-----------------|
| Total: 1539     | Total: 1125     |
| Program: 989    | Program: 741    |
| Comparison: 550 | Comparison: 384 |

### Estimation Methodology

We used **Inverse Probability Weighting (IPW)** to adjust for each individual's propensity to enroll in the CPC program and for attrition from the sample at age 37. The estimates for program impact were obtained using **linear regression with IPW weights**, adjusting for eight indicators of pre-program risk status, a dummy-coded variable for missing data on risk status, home environment problems at ages 0-5, race/ethnicity, gender, and participation in the school-age program.

The economic benefit is estimated by multiplying the marginal effect of CPC effectiveness by the respective monetary estimate of the outcome. To adjust for inflation, estimates are converted to 2019 dollars using the Bureau of Labor Statistics' Consumer Price Index for All Urban Consumers. We use an annual discount rate of 3%. Benefits are projected through age 65 to account for lifetime estimates.

**Table 1: Impact on Health Outcomes**

| Health Outcome (Self-Reported) | Sample Mean (Sample Size) | Unadjusted group difference (SE) | IPW adjusted Regression estimate (Robust SE) |
|--------------------------------|---------------------------|----------------------------------|--|
| Smoking (Current)              | 0.215 (n=1100)            | -0.052** (0.026)                 | -0.058* (0.031)                              |
| Hypertension                   | 0.169 (n=1096)            | -0.004 (0.024)                   | -0.0001 (0.027)                              |
| Body Mass Index                | 30.37 (n=1042)            | -0.575 (0.444)                   | -1.071** (0.533)                             |
| Obesity                        | 0.449 (n=1042)            | -0.028 (0.033)                   | -0.044 (0.036)                               |
| Diabetes                       | 0.054 (n=1097)            | -0.036** (0.014)                 | -0.037** (0.017)                             |
| Drug Use                       | 0.058 (n=1097)            | -0.025* (0.015)                  | -0.025 (0.018)                               |
| Depression                     | 0.067 (n=1098)            | 0.001 (0.016)                    | 0.002 (0.020)                                |

\*Significant at 10% level; \*\*Significant at 5% level

### Estimation of Program Cost

Based on the cost estimates presented in two previous cost-benefit analyses (Reynolds et al., 2002, 2011) The present-value average cost per child of the CPC preschool program was estimated to be **\$10,585** for an average of 1.5 years of program.

### Estimation of Program Benefits

#### **Benefits from reduced diabetes:**

Using the estimates from American Diabetes Association (2018) of direct medical costs and lost productivity, the estimated benefit from 3.7 percentage point reduction in diabetes is expected to be \$5,618 per participant.

#### **Benefits from reduced smoking:**

Using the estimates from Centers for Disease Control and Prevention (2008) of direct medical costs and lost productivity, the estimated benefit from a 5.8 percentage point reduction in smoking is expected to be \$5,895 per participant.

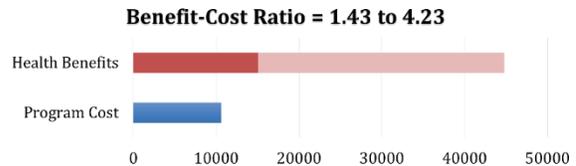
Additionally, we accounted for the range of benefits from smoking costs due to premature death using two methods. Using the value of statistical life estimates from Viscusi & Hersch (2007) we estimate the mortality costs of smoking to be \$33,272. Using a more conservative estimate of lost earnings due to premature death, we estimate the costs to be \$3,580 per participant.

### **References**

- American Diabetes Association. (2018). Economic Costs of Diabetes in the U.S. in 2017. *Diabetes Care*, 41(5), 917–928.
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### Results

We estimate the total physical health benefits from the CPC program in the range of **\$15,093 to \$44,785** per participant as opposed to a program cost of \$10,585, showing a benefit-cost ratio in the range of 1.4 to 4.2.



### Conclusions

In this partial benefit-cost analysis, we focused solely on the physical health outcomes at age 37. The results suggest that the health impacts of early educational intervention are significant and may by themselves offset the costs of the intervention, even if no other benefits were observed.

Our analysis also suggests that the impact of preschool on smoking outcome could be mediated through educational attainment, and thus should not be double counted while including benefits from higher educational attainment.

Most studies of the benefits of early intervention do not utilize data on health outcomes presented in this study. The existence of these additional benefits serves to emphasize the importance of high-quality early interventions and are likely to further amplify the rationale for government investments in early education.