The Long-Term Effects of Childhood Exposure to the Earned Income Tax Credit on Health Outcomes

Breno Braga[1]
URBAN INSTITUTE AND IZA

Fredric Blavin
URBAN INSTITUTE

Anuj Gangopadhyaya
URBAN INSTITUTE

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ABSTRACT

The EITC is a central component of the U.S. safety net, benefiting about 27 million families. Using variation in the federal and state EITC, this paper evaluates the long-term impact of EITC exposure during childhood on the health of young adults. We find that an additional $100 in the average EITC exposure between ages 0 to 18 increases the likelihood of reporting very good or excellent health by 2.7 percentage points and decreases the likelihood of being obese 1.0 percentage point between ages 22 and 27. Direct program transfers, increases in pre-tax family earnings, and increase in health insurance coverage are channels through which the EITC improves health.

[1] Corresponding author, email: bbraga@urban.org.We would like to thank Jason Gates and participants in the Urban Institute seminar and the 2018 IAPHS Conference seminar participants for their helpful comments. This work was supported by the Robert Wood Johnson Foundation.

1. Introduction

The Earned Income Tax Credit (EITC) is one of the largest safety net programs in the United States, providing a refundable tax credit to lower-income working families through the tax system. In 2017, the EITC reached 27 million tax filers at a total cost of $65 billion (IRS 2018). The primary goals of the program are to provide extra resources to low- and moderate-income workers through tax refunds and to encourage labor force participation through the program's structure. By incentivizing work and providing eligible working families with refundable tax credits, the EITC substantially increases family income for children in low- and moderate-income families, which in turn can affect their long-term well-being. While previous research has shown that EITC is effective at reducing poverty (Hoynes and Patel 2015), improving education outcomes of participant families (Dahl and Lochner 2012, Manoli and Turner 2014, Bastian and Michelmore 2018), increasing labor force participation of mothers (Meyer and Rosenbaum 2001, Bastian 2017), improving maternal and infant health (Evans and Garthwaite 2014, Hoynes, et. al 2015, Gangopadhyaya et al. 2019), and promoting asset building (Jones and Michelmore 2018), this is the first study to identify the long-term health benefits of EITC.

We estimate the effects of EITC exposure in childhood on health outcomes in early adulthood and assess three main mechanisms through which EITC can affect long-term health outcomes. First, the EITC provides additional resources to low- and moderate-income households through the direct transfer and potential increases in pre-tax family earnings. The strong relationship between socioeconomic status and current and future health outcomes over the life course is well documented (Case et al. 2002; Currie 2009; Smith 2007). Second, in contrast, mothers, especially those who are single, increase their labor supply in response to more generous EITC policies and consequently spend more time working and less time with their children at home. There is evidence of reduction in breastfeeding, immunization and worst health outcomes of children when mothers work and are absent

from the household (Berger et al. 2005, Rossin 2011). Finally, the EITC program may have long term effects on health through the program's impact on health insurance coverage (Baughman, 2005; Hoynes et al., 2015). The effect of EITC on health insurance coverage is ambiguous: EITC families may obtain employer-sponsored insurance (ESI) by gaining parental employment but could also lose Medicaid eligibility if their earnings rise above program eligibility thresholds specified in their state of residence (Gangopadhyaya et al. 2019). Consequently, EITC expansions could increase insurance coverage of children, if those who were previously uninsured gain ESI coverage, or decrease coverage, if low-income individuals gain employment at firms that do not offer ESI and lose Medicaid eligibility due to increased earnings. Considering all three potential mechanisms, the overall effect of the EITC on children's long-term health is theoretically ambiguous.

Using data from the 1968 to 2015 waves of the Panel Study of Income Dynamics, we estimate the causal effect of exposure to EITC on later-life health outcomes, including self-reported health status, emotional problems, obesity, functional limitations, and high blood pressure. Consistent with the literature, we define "EITC exposure" in childhood as the maximum federal and state EITC benefits that a child's family could potentially receive from the child's birth to age 18, similar to the measure used in Bastian and Michelmore 2018.[2] Variation in EITC exposure comes from three sources: the year the individual was born, the state of residence the individual lives in each childhood year, and the number of children in the household in each year.

We estimate that EITC exposure during childhood is associated with better self-reported health status and lower likelihood of obesity in early adulthood. An additional $100 in the average EITC exposure between ages 0 to 18 increases the likelihood of reporting good or excellent health by 2.7 percentage points (4.1 percent) and decreases the likelihood of being obese by 1.0 percentage points

[2] Bastian and Michelmore (2018) define EITC exposure as at the cumulative maximum federal and state EITC a child's household could receive from ages 0 to 18. We estimate separate models using average and cumulative measures of EITC exposure between ages 0 to 18, but use the former in the main text for ease of interpretation.

(5.1 percent) between ages 22 and 27. We also estimate that EITC exposure is associated with a lower likelihood of having a functional limitation at later ages, although this finding is only marginally significant. We find no significant association between EITC exposure in childhood and emotional problems or high blood pressure at later ages, although the direction of our estimates is consistent with EITC improving these outcomes as well.

We also investigate which children benefit the most from EITC exposure. Children who grew up in single-parent households are most affected by EITC exposure; among this group, an additional $100 in average EITC exposure during ages 0 to 18 increases the likelihood of reporting good or excellent health by 8.1 percent and decreases the likelihood of being obese by 7.7 percent at ages 22 to 27. Similarly, we find stronger effects of EITC exposure on children of lower-educated parents, as those families are more likely to receive the tax credit.

To investigate the potential mechanisms driving the better health outcomes of children exposed to EITC, we look at the effect of EITC exposure at different intermediate outcomes during the childhood years of the individuals in our sample. EITC exposure is associated with increases in direct EITC transfers, pretax family earnings, and children's health insurance coverage, all of which are likely to improve later life health outcomes. EITC exposure is also associated with less parental time spent with their children, however these findings are not statistically significant. Overall, our study provides important findings for evaluating the long-terms benefits of the EITC as well as the more general question of how income in childhood affects long-term health.

2. Literature Review and Contribution

A large and growing literature has shown that access to safety net programs in the prenatal period and in childhood could systematically affect health, education, and work productivity of individuals as they enter adulthood. Hoynes et. al (2016) find that children gaining access to the Food Stamps Program had lower incidence of diabetes, hypertension, and obesity in adulthood. Miller and

Wherry (2018) find that Medicaid expansions to pregnant women and infants resulted in lower rates of chronic illnesses and fewer hospital visits for diabetes and obesity during adulthood among cohorts who gained access to coverage in utero and during the first year of life. They also find that those exposed to prenatal Medicaid expansions had higher high school graduation rates in adulthood, indicating that the improvements associated with the prenatal eligibility expansions extend beyond health by improving human capital. Bastian and Michelmore (2018) find that EITC exposure when a child is 13–18 years old increases earnings and the likelihood of completing high school and college and being employed as a young adult. This study expands upon this literature by estimating the long-term health effects associated with childhood exposure to the EITC.

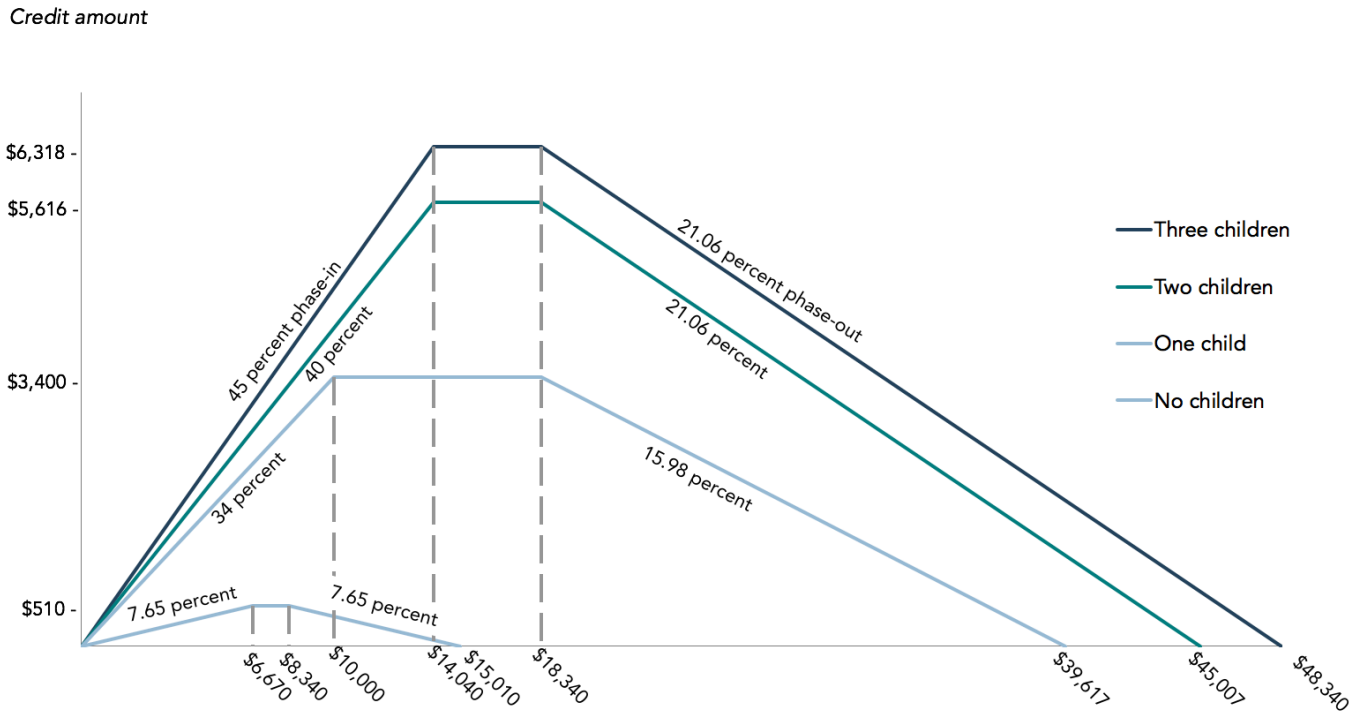
There is also a growing literature investigating the effects of EITC on health outcomes. Hoynes, et. al (2015) find that the EITC reduced the incidence of low birthweight and increased mean birth weight. Evans and Garthwaite (2014) estimate that higher EITC payments improved self-reported health and reduced the number of poor mental health days reported by mothers. Similarly, Boyd-Swan et al (2016) and Gangopadhyaya et al. (2019) find that the EITC expansion generated sizeable improvements in mental health. While these papers all find positive contemporaneous effects of the EITC on health outcomes, little is known about the long-run effects of being exposed to EITC during childhood on health in subsequent years of young adulthood. This paper aims to fill this gap.

3. Background on EITC program

The EITC program was established in 1975 and has grown to be the primary poverty-reducing means-tested transfer program in the country. While the benefits of the program have increased substantially since its introduction, the main structure of the program has remained the same. The EITC is a tax credit program targeting low-wage earners. Eligibility is based on family structure, income, and state of residence. The tax credit increases for the lowest section of the wage distribution (referred to as the “phase-in” section), holds steady for a subsequent section of the

wage distribution, then decreases for a section of the wage until it reaches zero (a "phase-out" section). This creates a trapezoidal benefit structure along the wage distribution (Figure 1). The shape of this trapezoid (i.e. the height and the slopes of the phase-in/phase-out regions) varies by year, marital status, family size, and, in the case of states that augment the federal EITC with their own state program, by state of residence. Since 1975, the size of the credit has generally grown for working-poor population, although some subgroups experienced greater growth differentials.

Figure 1. Structure of the EITC, 2017

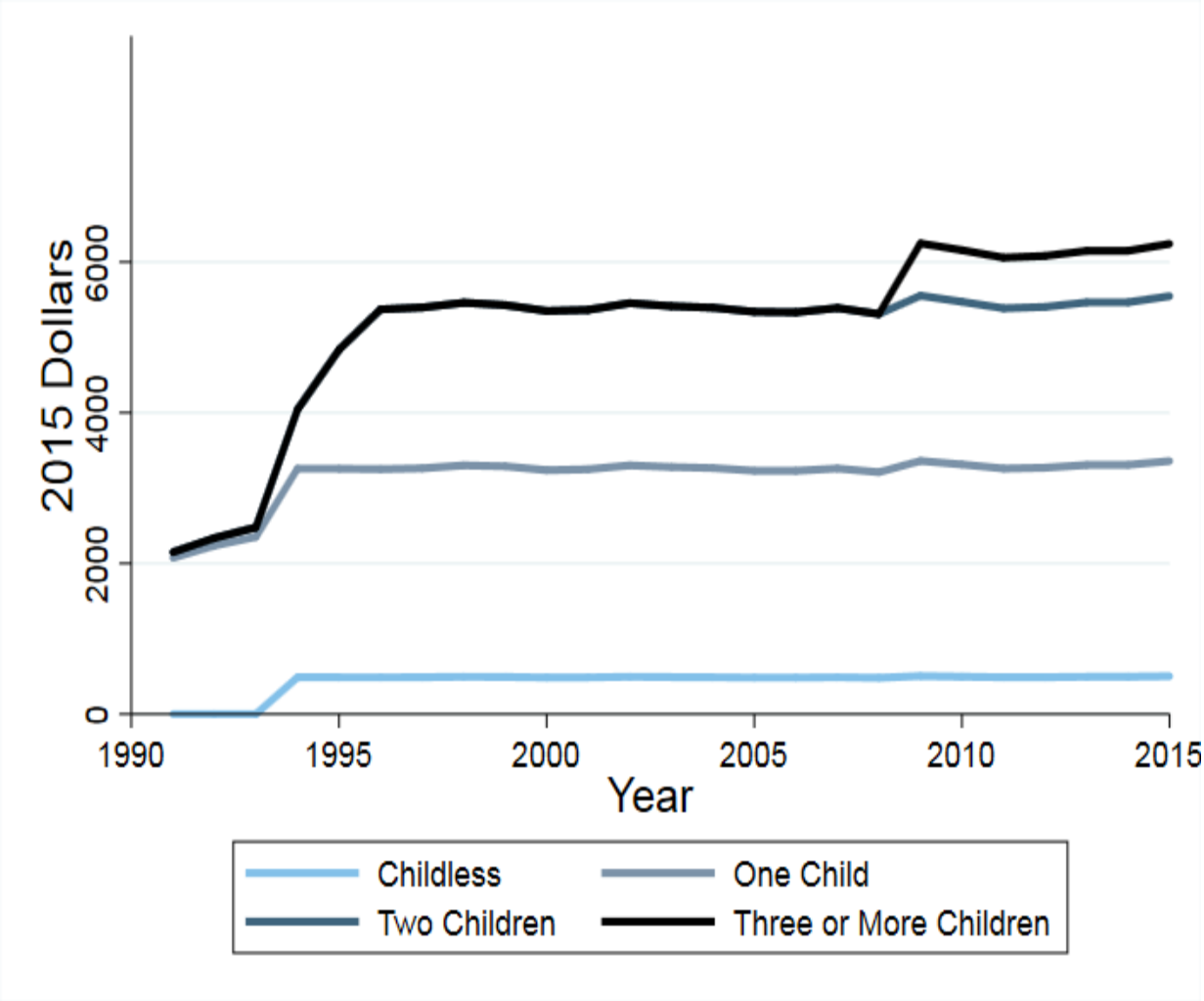


Source: Urban Institute Tax Policy Center 2017

The main changes in the program came from federal expansions for larger family sizes and the introduction of some state EITCs. Since 1993, the credit has been significantly more generous for families with two or more children than for those with just one, while a small credit was added

for families without children. The program became even more generous for families with three or more children and for married couples in 2009 (Figure 2).

Figure 2. Federal EITC Maximum Credit by Number of Children over Time

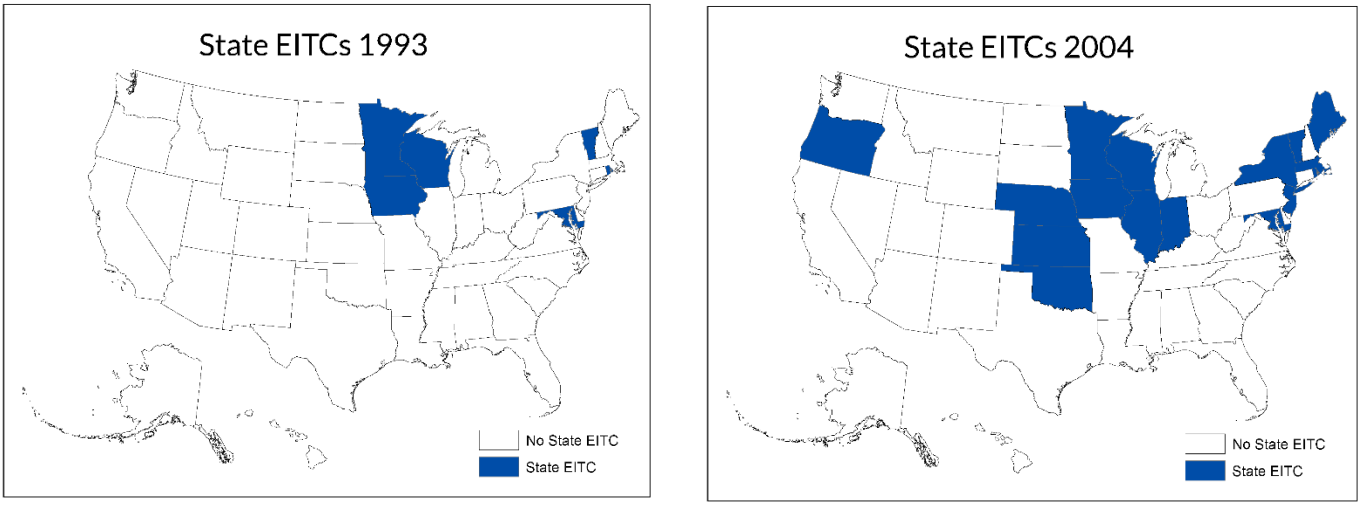


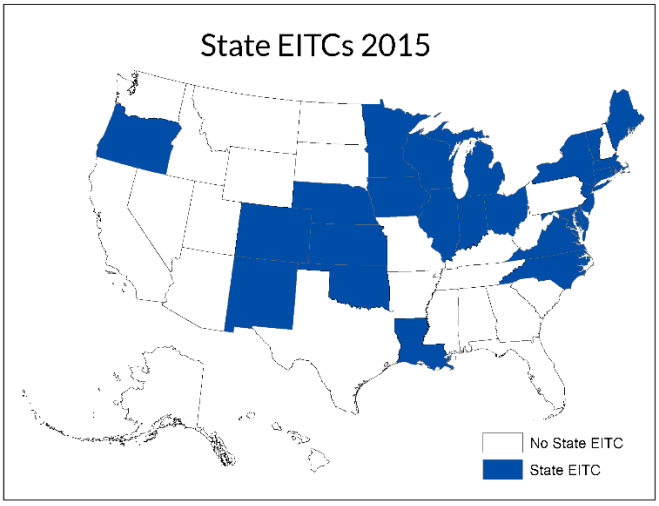
Source: University of Kentucky Center for Poverty Research. 2016. "UKCPR National Welfare Data, 1980-2015." Gatton College of Business and Economics, University of Kentucky, Lexington, KY. http://www.ukcpr.org/data (accessed March 2017)

In addition to the federal EITC program, half of states plus the District of Columbia have established their own state EITC supplements by 2015. State-specific EITCs began in 1986, as Rhode Island established their own nonrefundable EITC equal to a percentage of the federal credit.

As of 2015, 25 states and the District of Columbia had state EITC programs, compared to 16 states and DC in 2004 and 6 states in in 1993 (Figure 3). Most states structure their programs to mirror the federal EITC, by simply matching a percentage of the federal credit. There is substantial variation on state EITCs' matching percentages across states and time. For instance, while Tennessee never established a state EITC supplement, Iowa created its program in 1990 and doubled it in 2013, from 7 to 14 percent of the federal EITC. In a few states, the EITC is non-refundable, making it a less effective incentive for very low-income workers. Even states without state income taxes can offer a state EITC.

Figure 3. State EITC Programs by Year





Source: University of Kentucky Center for Poverty Research. 2016. "UKCPR National Welfare Data, 1980-2015." Gatton College of Business and Economics, University of Kentucky, Lexington, KY. http://www.ukcpr.org/data (accessed March 2017)

4. Data

We use the 1968 to 2015 waves of the Panel Study of Income Dynamics (PSID). The PSID is a nationally-representative household survey that has followed households and their offspring since 1968. The PSID has been collecting information on self-reported general health status (the standard five-point scale from excellent to poor) and functional limitation status since 1984. Starting in 1999 and for all subsequent waves, PSID has collected information on self-reported height, weight, and the prevalence and incidence of a list of chronic conditions for head of the household and spouses. We look at the following five main health outcomes between ages 22 and 27[3]: an indicator for whether the individual reports excellent or very good health at the time of the survey; an indicator for obesity at the time of the survey, where obese individuals have a body mass index greater than 30 based on self-reported weight and height; an indicator for whether the individual has any physical or nervous condition that limits the type or amount of work that he or

[3] This is the same age range that Bastian and Michelmore (2018) used for their employment and earnings outcomes. We also present robustness checks in the appendix where we look at outcomes at age 28-32.

she can do (functional limitations); an indicator for whether the respondent has ever been diagnosed with problems with anxiety, depression, or bad nerves (emotional problems); and an indicator for whether the respondent has ever been diagnosed with high blood pressure or circulation problems (high blood pressure).

The measure of EITC exposure during childhood is defined as the average of the maximum potential federal and state credit a child's family could receive given their state of residence, family size, and tax year (Bastian and Michelmore 2018). Therefore, EITC exposure variation comes from the generosity of the federal credit in a given year, the child's state of residence, and the number of children in the household. The EITC exposure variable is independent of own family income, as those could be endogenously determined by the program. We take the average of EITC exposure during ages 0 to 18, using each observation of the child in the data within the age range.[4]

We limit the sample to individuals whom we can observe at least once between ages 22 and 27. Since the EITC was not implemented until 1975, we drop individuals born prior to 1967 because these individuals were not exposed to the EITC as a young child. The sample is also restricted to individuals who are observed in at least one year between each of the age intervals: 0 to 5, 6 to 12, and 13 to 18. Finally, we limit the sample to individuals who were head or spouse between ages are 22 and 27 because most of the health questions are only asked for this group. In the construction of our main analytical sample, we do not make restrictions based on family income because family earnings could be endogenously determined by the program. However, we present robustness checks where we show effects of EITC on long-term health outcomes where we restrict the sample to low and middle income families only.

[4] As robustness check, we also present results looking at sum of all EITC exposure a child experienced during the period, where for non-interview year, we impute EITC exposure by averaging EITC exposure from the interview years just before and after the non-interview year.

Table 1 includes descriptive statistics for our sample of 2,147 individuals included in the self-reported health and functional limitations regression sample.[5] The average EITC exposure between ages 0 and 18 was $3,553, with exposure ranging from around $2,257 from ages 0 to 5 to $4,850 from ages 13 to 18. EITC exposure between ages 0 and 5 is lower than exposure at older ages because the most significant EITC expansions occurred over past 2 decades, when much of the sample was older than 5.

Average annual family income was $41,113. Just over half of the sample is female (54.7 percent) and 15.8 percent are black, non-Hispanic. Individuals in our sample had an average of 2.2 siblings at age 18. Most individuals in our sample had married parents during their childhood (70.5 percent), a mom that finished high school (95.7 percent), a mom that attended some college (72.7 percent), a dad that finished high school (91.2 percent), and a dad that attended some college (62.6 percent).

[5] The sample size (1,867 individuals) for the obesity, emotional problems, and high blood pressure regression sample is smaller because the PSID began collecting information on these health outcomes in 1999, compared to 1984 for the other two outcomes.

Table 1: Descriptive Statistics of Main Sample

Variable	Mean	Standard Deviation
Average EITC Exposure from Age 0 to 18	$3,553	$812
Average EITC Exposure from Age 0 to 5	$2,257	$974
Average EITC Exposure from Age 6 to 12	$4,198	$1,287
Average EITC Exposure from Age 13 to 18	$4,850	$1,062
Average Family Income from Age 0 to 18	$41,113	$38,587
Female	54.7%	49.8%
Black, non-Hispanic	15.8%	36.5%
Hispanic	1.8%	13.4%
Siblings at Age 18	2.2	1.2
Average Characteristic from Age 0 to 18		
Married Parents	70.5%	37.2%
Mom Finished High School	95.7%	20.4%
Mom Attended Some College	72.7%	44.6%
Dad Finished High School	91.2%	28.4%
Dad Attended Some College	62.6%	48.4%
Number of Observations	2,147	

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID). Note: All monetary variables are in 2015 dollars. All results are weighted by average childhood PSID weights.

5. Empirical Method

Our econometric models exploit state, time, and family size variation in the maximum tax credit for the EITC program. We use a difference-in-differences specification with a continuous treatment measure – the average maximum tax credit an individual was exposed to during his or her childhood. We model the impact of EITC exposure on children's long-term health as follows:

$$Y_{i(22-27)} = \beta_1 EITC_{i(0-18)} + \Phi X_{i(0-18)} + \mu V_{s,(0-18)} + Z_s + W_t + g_s(t) + \varepsilon_i \quad (1)$$

where $Y_{i(22-27)}$ is the average health outcome for individual i between ages 22 and 27.[6] $EITC_{i(0-18)}$ is the average exposure to EITC between ages 0 and 18 described in section 4.[7] $X_{i(0-18)}$ represents a vector of personal characteristics that includes year of birth fixed effects, and

[6] We also present robustness checks in Table A2 where we look at outcomes at age 28-32.
[7] We also present robustness checks in Table A3 using the cumulative maximum tax credit available an individual was exposed to during his or her childhood (Bastian and Michelmore 2018).

indicators for black, Hispanic, and female. In addition, to account for state demographic changes over time, we interact black, Hispanic, and female indicators with state and birth year. $X_{i(0-18)}$ also includes average individual characteristics between ages 0-18: whether the child's mother and father finished high school or at least some college and whether the parents where married. Finally, $X_{i(0-18)}$ also include siblings fixed effects measured at age 18. The inclusion of siblings fixed effects to the model is important because EITC exposure varies discontinuously with the number of children in the household.

$V_{s,(0-18)}$ is a vector of state policy and economic contextual variables. We include the average of the following characteristics between ages 0-18: GDP per capita, the unemployment rate, the top marginal income tax rate, the minimum wage, maximum welfare benefits, and tax revenue. It also includes average state Medicaid income eligibility threshold over the age intervals 0 to 5, 6 to 12 and 13 to 18. These controls are included to address concerns that various state-by-year confounding factors are related to EITC exposure and health in early adulthood. Z_s and W_t are state and year fixed effects, measured at the adult age (last interview within the 22-27 age range). Finally, we also include state-specific quadratic time trends $g_s(t)$ to control for further unaccounted-for policies or conditions that vary by state across time.

We present robustness checks of the main findings of the paper, where we do not control for state-year controls, interactions between demographic characteristics and state and birth year and state-specific quadratic time trends in Appendix Table A1. Standard errors are clustered at the state level. All regressions are weighted with childhood PSID weights averaged across the years from birth to age 18.

To test whether EITC exposure has stronger effects at a specific age range, we also estimate the model where we disaggregate EITC exposure into different age groups:

$$Y_{i(22-27)} = \beta_1 EITC_{i(0-5)} + \beta_2 EITC_{i(6-12)} + \beta_3 EITC_{i(13-18)} + \Phi X_{i(0-18)} + \mu V_{s,(0-18)} + Z_s + W_t + g_s(t) + \varepsilon_i$$

where $EITC_{i(0-5)}$, $EITC_{i(6-12)}$ and $EITC_{i(13-18)}$ are the average exposure to EITC between ages 0-5, 6-12 and 13-18 respectively. The coefficients β_1, β_2 and β_3 represent the impact of an additional $100 of average EITC exposure when the child is 0–5, 6–12, and 13–18 years old, respectively, on subsequent health outcomes. To test whether EITC exposure has a stronger effect at a specific age range, we report F-test for the null hypothesis that β_1, β_2 and β_3 are equal to another.

6. Results

We find that increased exposure to EITC during childhood is associated with better self-reported health status and lower obesity between ages 22 to 27 (Table 2, Panel A). A $100 increase in the average EITC exposure during childhood increases the probability of reporting excellent or very good health by 2.7 percentage points (4.1 percent) and reduces the likelihood of being obese by 1 percentage points (5.1 percent).

Additional EITC exposure is also associated with a lower probability of being disabled (0.5 percentage points or 13.7 percent), although this coefficient is estimated with less precision (p-value<0.1). There is no significant association between EITC exposure and the likelihood of reporting emotional problems or high blood pressure, although the direction on these coefficients is consistent with EITC improving these outcomes.

It is unclear whether EITC exposure has a stronger effect at a specific age range of the child (Table 2 Panel B). While EITC exposure from ages 0 to 5, 6 to 12 and 13-18 is associated with statistically significant improvements in self-reported health at ages 22-27, we cannot reject

that that the coefficients for each age group are equal from one another (p-value of 0.21). In the same way, conditional on EITC exposure at younger ages, EITC exposure from ages 13 to 18 decreases the probability of being obese by 0.7 percentage points from ages 22 to 27. All the age group EITC exposure coefficients for the other three outcomes (functional limitations, emotional problems, and high blood pressure) are statistically insignificant at the 5-percent level.

Table 2: Estimated Effects of EITC Exposure in Childhood on Health Outcomes in Adults Ages 22-27

Dependent Variable	Excellent or Very Good Health	Obese	Functional Limitation	Emotional Problems	High Blood Pressure
Panel A					
Average EITC Exposure from Age 0 to 18 ($100s)	0.027***	-0.010**	-0.005*	-0.003	-0.006
	(0.006)	(0.004)	(0.003)	(0.004)	(0.004)
Panel B					
Average EITC Exposure from Age 0 to 5 ($100s)	0.017**	-0.009	-0.009	0.000	-0.001
	(0.008)	(0.010)	(0.005)	(0.007)	(0.003)
Average EITC Exposure from Age 6 to 12 ($100s)	0.008**	0.001	-0.000	-0.004	-0.004
	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)
Average EITC Exposure from Age 13 to 18 ($100s)	0.006**	-0.007***	-0.001	0.003	0.000
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
F-Test, Coefficients are jointly equal (p-value)	0.211	0.116	0.297	0.153	0.515
Observations	2,147	1,837	2,147	1,867	1,867
Mean Dependent Variable	65.5%	19.6%	7.3%	13.4%	6.6%

***p<0.01, ** p<0.05, * p<0.1

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).

Notes: All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (100s of 2015$). Model controls for state, cohort, year fixed effect, demographic controls, state-year policy and economic controls, interaction controls, and state-specific quadratic time trends (see section 4). Robust standard errors clustered at the family level are in parentheses. All results are weighted by average childhood PSID weights.

Estimates from sensitivity analyses were generally consistent with the overall findings. First, the main model estimates are insensitive to the inclusion or exclusion of groups of control variables (Appendix Table A1). Second, the estimated effects of EITC exposure on self-reported health and obesity status at ages 28-32 remain statistically significant but are estimated with less precision relative to the main model (Appendix Table A2). Finally, we estimate the effect of cumulative EITC exposure on health outcomes in Table A3. In the construction of cumulative exposure measure, we follow Bastian and Michelmore (2018) by summing up all EITC exposure a child experienced between ages 0 to 18.[8]

Family Income Restrictions

While EITC is targeted to low and middle-income family, we do not make any restriction to family income in our analytical sample because family earnings is endogenously determined by program participation. Nevertheless, in Figure 4 we explore whether the EITC program has a stronger impact on health outcomes when restricting the sample to families below different level of the income distribution. We estimate treatment effects imposing different upper bounds to family income to our analytical sample, reporting both coefficients and their 95 percent confidence interval.[9] For the purpose of the Figure, family income is the average family income between age 0 to 18, as presented in Table 1.

In the figure, we also report the predicted share of individuals in our sample who were eligible to EITC during their childhood year by family income groups. While actual family EITC benefits are not reported in the PSID, we predict eligibility for each childhood year of all individuals in our sample. The prediction is based on federal and state EITC rules, state of

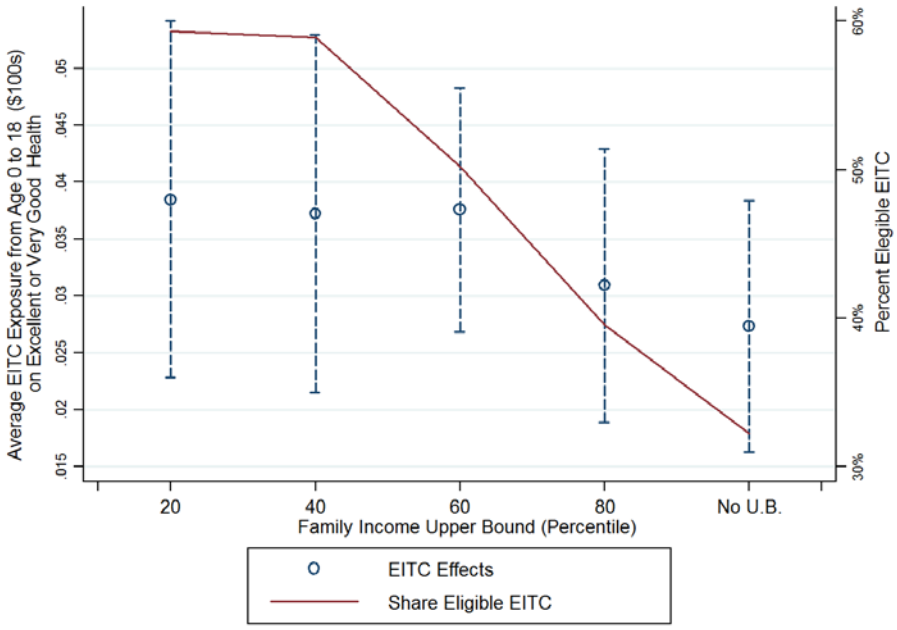
[8] For non-interview years, we impute EITC exposure by averaging EITC exposure from the interview years just before and after the non-interview year.
[9] Note that by construction, the upper bound coefficients (No U.B.) correspond to the results presented in Panel A of Table 2.

residence, number of household children, family income, and parental marital status in the given year.

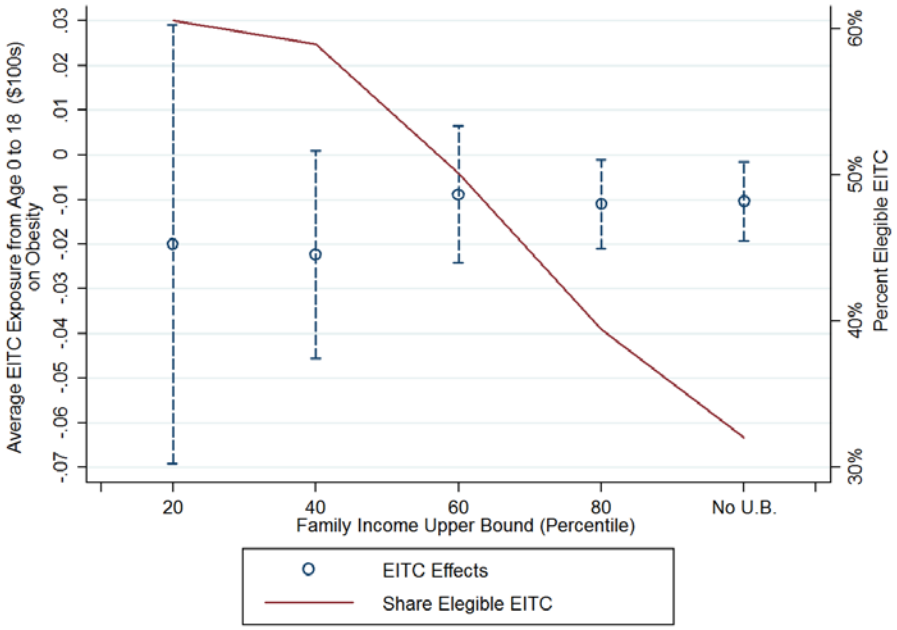
Overall, we find larger effects of EITC exposure when restricting the sample to families in the middle and bottom of the income distribution, which are the families most likely to participate in the program. We estimate that about 59% of individuals who grew up in families in the bottom 40 percentile of the income distribution were eligible to receive EITC during their childhood years. For this group, we find that a $100 increase in average EITC exposure during childhood increases the probability of reporting excellent or very good health by 3.7 percentage points, and reduces the likelihood of being obese by 2.2 percentage points. In other words, adding higher income individuals to the sample—who are less likely to be eligible for EITC benefit—reduces the magnitude associated with the program's long-term health effects in both models.

Figure 4. Estimated Effects of EITC Exposure on Health Outcomes in Adults Ages 22-27 – By Family Income Upper Bound

Panel A -Effect of $100 increase in Average EITC Exposure on Likelihood of Excellent or Very Good Health



Panel B - Effect of $100 increase in Average EITC Exposure on Obesity



Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).
Notes: Coefficients are presented with their 95% confidence interval. All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (in 2015$). Models controls for state, cohort, year fixed effect, demographic controls, state-year policy and economic controls, interaction controls, and

state-specific quadratic time trends (see section 4). Robust standard errors clustered at the state level are in parentheses. EITC eligibility is based on federal and state EITC rules, state of residence, number of household children, family income, and parental marital status in the given year. All results are weighted by average childhood PSID weights.

Subgroup analyses

Figure 5 shows the effect (in percent) of a $100 increase in average EITC exposure from age 0 to 18 on the likelihood of reporting excellent or very good health, and being obese.[10] Parental education, and single- or multi-parental household status are measured at age 18. The lower educated parents group are households where all parents have less than 16 years of education and the higher educated parents group are households where at least one parent has 16 years of education or more.

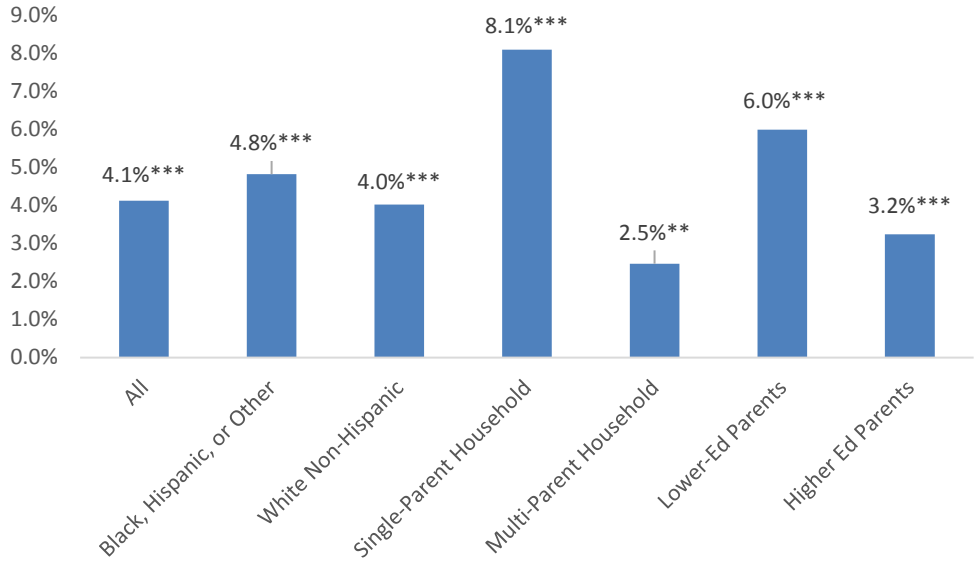
The estimated effects of EITC exposure on self-reported health status (Panel A) are most pronounced among program's targeted population—individuals raised in single-parent households (8.1%) and those raised by lower educated parents (6.0%). However, the estimated EITC effect is statistically significant in multi-parent household or higher educated groups. The estimated effect of EITC exposure on self-reported health status is similar, but slightly larger, among Black, Hispanic and other race children (4.8%) compared to White Non-Hispanic (4.1%).

The EITC effect on obesity (Panel B) is also largest in magnitude among those raised in single-parent households (-7.7%), and those with lower-education parents (-7.0%). In contrast, the estimated EITC effect on obesity is statistically insignificant among these groups' counterparts. EITC exposure is also associated with a 4.5 percent decline in obesity among White Non-Hispanic and 5.7 percent among Black, Hispanics or Other Race, although not statistically insignificant among these two groups.

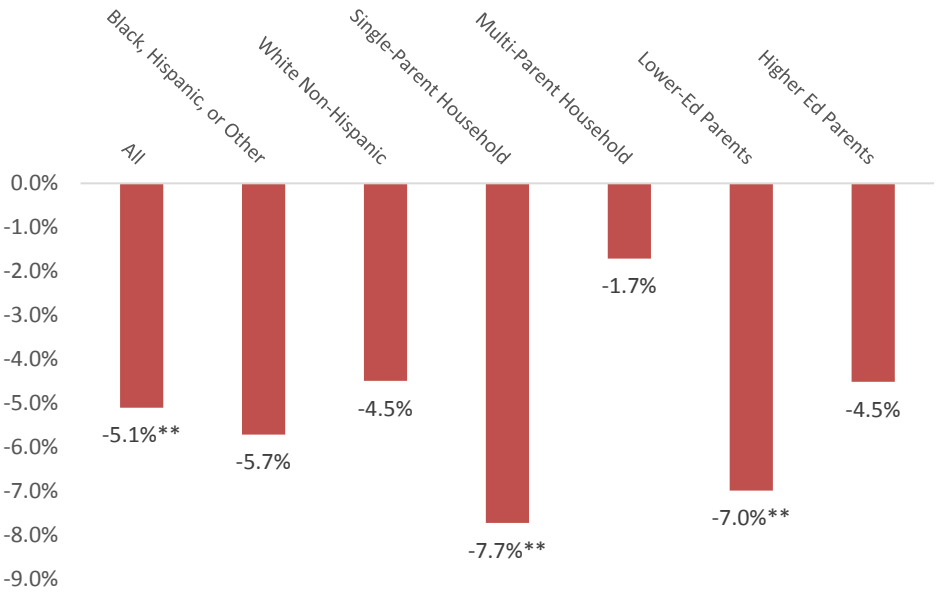
[10] Table A4 in the appendix shows the coefficients of those regressions as well as mean of the outcome of interest within subgroups.

Figure 5. Estimated Effects of EITC Exposure on Health Outcomes in Adults Ages 22-27 – By Subgroup

Panel A - % Effect of $100 increase in Average EITC Exposure on Likelihood of Excellent or Very Good Health



Panel B - % Effect of $100 increase in EITC Exposure on Likelihood of Obesity



***p<0.01, ** p<0.05, * p<0.1
Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).
Notes: All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (100 of 2015$). Lower educated parents are households where all parents have less than 16 years of education; Higher educated parents are households where at least one parent has 16 years of education or more. Models controls for state, cohort, year fixed effect, demographic controls, state-year policy and economic controls,

interaction controls, and state-specific quadratic time trends (see section 4). Robust standard errors clustered at the state level are in parentheses. All results are weighted by average childhood PSID weights.

7. Mechanisms

The results above suggest that EITC exposure in childhood improves self-reported health status and decreases the likelihood of being obese in young adulthood. In this section, we explore several mechanisms through which the EITC could affect these outcomes. Table 3 shows the estimated effects of EITC exposure on imputed family EITC benefits, pretax family earnings, maternal labor supply, likelihood of being uninsured, and daily time parents spend with their children. These outcomes are measured in the same year as EITC exposure and the estimated coefficients should be interpreted as the contemporaneous effect of EITC exposure.

Consistent with Bastian and Michelmore (2018), we find that EITC exposure has a significant impact on family financial resources, primarily through increasing maternal labor supply. A $100 increase in EITC exposure is only associated with a $16.3 increase in imputed EITC benefits[11] (column 1), but a $314 increase in pretax parental earnings (column 2)[12]. A $100 increase in EITC exposure also increases the likelihood of the mother working by 0.3 percentage points (column 3), increases mother's annual weeks worked by 0.14 weeks (column 4), and increases mother's annual hours worked by 3.56 hours (column 5). Overall, these results imply that most of the increase in family resources generated by the EITC comes from increases in labor supply and not the benefit itself.

As previously discussed, EITC exposure could also improve long-term health outcomes through the program's impact on health insurance coverage of those induced to work and their

[11] Actual family EITC benefits are not reported in the PSID, so we use Bastin and Michaelmore (2018) imputed benefit values. The imputation is based on federal and state EITC rules for a given family, which depend on the year, state, number of household children, family income, and marital status in the current year.
[12] To deal with outliers, family earnings is top codded at the 99th percentile.

dependents. These improvements in health could be driven by increased access to and utilization of healthcare associated with gaining health insurance (Baicker et al 2013; Simon et al., 2017). The findings from Table 3 are consistent with this mechanism, indicating that a $100 increase in EITC exposure reduces the likelihood of being uninsured in childhood by 0.2 percentage points (column 6).

In addition, it is possible that by increasing labor supply, EITC expansion may result in less parental time invested in children which may affect long-term health. Findings in Table 3 indicate that this is unlikely to be a strong mechanism. Consistent with Bastian and Michelmore (2018), we find that a $100 increase in EITC exposure is associated with statistically insignificant reductions in the child's daily time spent with his or her mother (column 7), father (column 8), or either parent (15.7 minutes, column 9).

Table 3: Effect of Earned Income Tax Credit (EITC) Exposure on Intermediate Outcomes

Dependent Variable	EITC Benefits ($100) (1)	Family Earnings ($100) (2)	Mother Working (3)	Mother's Annual Weeks Worked (4)	Mother's Annual Hours Worked (5)	Uninsured (6)	Daily Minutes Spent with Mother (7)	Daily Minutes Spent with Father (8)	Daily Minutes Spent with Either Parent (9)
Contemporaneous EITC exposure ($100)	0.163***	3.14***	0.003***	0.14***	3.56**	-0.002***	-0.72	-0.80	-1.52
	(0.023)	(0.64)	(0.001)	(0.04)	(1.51)	(0.000)	(0.65)	(0.60)	(1.09)
Observations	42,306	42,306	42,306	42,306	42,306	8,618	2,919	2,919	2,919
Mean Dependent Variable	5.85	608.5	48.0%	23.6	834.1	7.3%	136.6	79.9	216.5

***p<0.01, ** p<0.05, * p<0.1

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).

Notes: EITC exposure is in hundreds of 2015 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. All regressions include demographic controls; state-year policy and economic controls; state, cohort, and year fixed effects; and state-specific quadratic time trends (see section 4). EITC benefits are imputed by authors and are a function of year, state, marital status, number of household children, and household earnings. Family earnings are the pretax sum of parental earnings top codded at the 99th percentile. Outcomes in columns 1–5 were measured between 1975 and 2011, when individuals in the main sample were between 0 and 18 old; outcome in column 6 (Uninsured) was measured between 1999 and 2011; and outcomes in columns 7-9 come from the 1997, 2002, and 2007 Child Development Survey (CDS)

8. Conclusion

Using 1968 to 2015 waves of the PSID and variation in federal and state EITC benefits over time, this study finds that EITC exposure in childhood significantly improves self-reported health and lowers the likelihood of being obese in early adulthood. We find that a $100 increase in the average EITC exposure, measured as the maximum credit available based on year, family size, and state of residence, from ages 0 to 18 increases the probability of reporting excellent or very good health by 2.7 percentage points (4.1 percent) and reduces the likelihood of being obese by 1 percentage point (5.1 percent) between ages 22 and 27. These findings are robust to several model specifications and it does not appear as if the EITC effects are driven by exposure within a particular age group. We find larger effects among those raised in single-parent households and lower educational attainment households.

EITC exposure in childhood can improve health outcomes later in life through several mechanisms. EITC generates significant increases in household income through the tax credit itself and increases in earnings via labor supply incentives. A $100 increase in contemporaneous EITC exposure is associated with a $16.3 increase in EITC benefits and a $314 increase in pretax family earnings (primarily via increase in the likelihood of mom's working), which translates into over $5652 over an 18-year period. These results are largely consistent with the evidence that increasing economic resources to low-income children improves their later life health outcomes (e.g, Hoynes et al 2016). In addition, contemporaneous EITC exposure increases the likelihood of having health insurance coverage in childhood, which could potentially improve long-term health outcomes through increased access to and utilization of healthcare services and reduced financial risk associated with high out-of-pocket health expenses (Miller and Wherry 2018; Wherry et al. 2018).

To put these results in perspective, we calculate the effect of the most recent EITC program expansion on a 13-year old living in a 3-child household in 2009. The American Recovery and Reinvestment Act of 2009 increased the annual credit amount for families with three or more children by about $600 in that year (Figure 2). This expansion translated to an increase of $3,600 in total EITC benefits or $200 in the average EITC the 13-year child was exposed to between ages 0 to 18. EITC also has multiplicative effect as this $200 increase in EITC exposure translates to an additional $600 increase in family earnings per year due to labor supply responses to the program. Our model predicts that the expansion will lead to a 5.4 percentage point (8.2%) increase in the probability of reporting excellent or very good health and 2.0 percentage point (10%) decline in the probability of being obese when the child becomes a young adult.

These results are largely consistent with the evidence on the longer-term effects of EITC exposure in human capital and employment outcomes. Bastian and Michelmore (2018) estimate an additional $167 in the annual maximum EITC when a child is 13–18 years old leads to a 1.3% increase in high school graduation, a 4.2% increase in college graduation, and a 1.0% increase in employment in adulthood.[13] The results are also consistent with the literature on the effect of increasing family economic resources during childhood improves later life health outcomes. Hoynes et al (2016) estimate that full exposure to food stamps through age five leads to a 0.4 standard deviation reduction in metabolic syndrome (a cluster of conditions including obesity, high blood pressure, heart disease, and diabetes) and an about 30-percentage-point increase in reporting good health at an adult age.

Overall, our results suggest nontrivial long-term health impacts of the EITC. As a result, this paper provides external benefits of the program which are not typically not taken into account

[13] Bastian and Michelmore (2018) look at the cumulative measure of EITC exposure. An additional $1,000 in cumulative exposure between ages 13 to 18 can be translated to permanent increase of $167 at age 13.

given the non-health nature of the EITC. Our findings should be considered in discussions of the social costs and benefits of the program (e.g Bastian and Jones 2018), as heathier individuals are more likely to be in the work force and less likely to rely on public assistance programs. More broadly, these findings suggest that programs providing income supports for the poor or near-poor, such as EITC, SNAP, TANF, and unemployment benefits, are likely to provide long-term health benefits children who are exposed to the program. In addition to this poverty-reducing benefit, this analysis shows that the EITC could improve several long-term health outcomes for children from households eligible for the credit.

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Appendix

Table A1: Estimated Effects of EITC Exposure in Childhood on Health Outcomes in Adults Ages 22-27 – Robustness Checks

Panel A

Dependent Variable	Excellent or Very Good Health		
Average EITC Exposure from Age 0 to 18 ($100s)	0.023***	0.022***	0.027***
	(0.004)	(0.004)	(0.006)
Observations	2,147	2,147	2,147
R-squared	0.197	0.206	0.325
Controls			
State, Cohort, Year Fixed Effect	X	X	X
Demographic Controls	X	X	X
State-Year Controls		X	X
Interaction Controls			X
State-Specific Quadradic Time Trends			X

Panel B

Dependent Variable	Obese		
Average EITC Exposure from Age 0 to 18 ($100s)	-0.010**	-0.009*	-0.010**
	(0.004)	(0.005)	(0.004)
Observations	1,837	1,837	1,837
R-squared	0.130	0.138	0.245
Controls			
State, Cohort, Year Fixed Effect	X	X	X
Demographic Controls	X	X	X
State-Year Controls		X	X
Interaction Controls			X
State-Specific Quadradic Time Trends			X

Panel C

Dependent Variable	Functional Limitations		
Average EITC Exposure from Age 0 to 18 ($100s))	-0.004**	-0.003	-0.005*
	(0.002)	(0.002)	(0.003)
Observations	2,147	2,147	2,147
R-squared	0.088	0.092	0.182
Controls			
State, Cohort, Year Fixed Effect	X	X	X
Demographic Controls	X	X	X
State-Year Controls		X	X
Interaction Controls			X
State-Specific Quadradic Time Trends			X

Panel D

Dependent Variable	Emotional Problems		
Average EITC Exposure from Age 0 to 18 ($100s)	-0.002	-0.002	-0.003
	(0.003)	(0.003)	(0.004)
Observations	1,867	1,867	1,867
R-squared	0.156	0.165	0.280
Controls			
State, Cohort, Year Fixed Effect	X	X	X
Demographic Controls	X	X	X
State-Year Controls		X	X
Interaction Controls			X
State-Specific Quadradic Time Trends			X

Panel E

Dependent Variable	High Blood Pressure		
Average EITC Exposure from Age 0 to 18 ($100s)	-0.006**	-0.007**	-0.006
	(0.003)	(0.003)	(0.004)
Observations	1,867	1,867	1,867
R-squared	0.079	0.085	0.194
Controls			
State, Cohort, Year Fixed Effect	X	X	X
Demographic Controls	X	X	X
State-Year Controls		X	X
Interaction Controls			X
State-Specific Quadradic Time Trends			X

***p<0.01, ** p<0.05, * p<0.1

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).
Notes: All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (100s of 2015$). Robust standard errors clustered at the state level are in parentheses. All results are weighted by average childhood PSID weights.

Table A2: Estimated Effects of EITC Exposure in Childhood on Health Outcomes in Adults Ages 28-32

Dependent Variable	Excellent or Very Good Health	Obese	Functional Limitation	Emotional Problems	High Blood pressure
Panel A					
EITC Exposure from Age 0 to 18	0.018**	-0.020**	-0.003	-0.001	0.009
	(0.008)	(0.008)	(0.006)	(0.007)	(0.006)
Panel B					
EITC Exposure from Age 0 to 5	0.048	-0.031	0.008	0.011	0.021**
	(0.029)	(0.028)	(0.011)	(0.016)	(0.009)
EITC Exposure from Age 6 to 12	-0.006	-0.002	0.004	0.000	0.003
	(0.006)	(0.008)	(0.003)	(0.005)	(0.004)
EITC Exposure from Age 13 to 18	0.012***	-0.009**	-0.005*	-0.003	0.001
	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
R-squared					
Prob. F-Test, Coefficients are jointly equal	0.054	0.687	0.168	0.638	0.070
Observations	1,572	1,508	1,574	1,566	1,567
Mean Dependent Variable	67.5%	23.0%	7.5%	13.5%	8.9%

***p<0.01, ** p<0.05, * p<0.1

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).

Notes: All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (100s of 2015$). Model controls for state, cohort, year fixed effect, demographic controls, state-year policy and economic controls, interaction controls, and state-specific quadradic time trends. Robust standard errors clustered at the state level are in parentheses. All results are weighted by average childhood PSID weights.

Table A3: Estimated Effects of EITC Exposure in Childhood on Health Outcomes by Subgroups

Group	Black or Hispanic	White or Asian	Single-Parent Household	Multi-Parent Household	Lower-Ed Parents	Higher Ed Parents
Panel A						
Dependent Variable			**Excellent or Very Good Health**			
EITC Exposure from Age 0 to 18 ($1,000s)	0.016***	0.010***	0.020***	0.005	0.015***	0.010**
	(0.004)	(0.003)	(0.005)	(0.004)	(0.005)	(0.005)
Observations	878	1,269	884	1,263	1,323	824
Mean Dependent Variable	58.1%	67.1%	59.3%	68.9%	58.4%	74.1%
Panel B						
Dependent Variable			**Obese**			
EITC Exposure from Age 0 to 18 ($1,000s)	-0.005	-0.005**	-0.010***	-0.001	-0.010**	-0.001
	(0.006)	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)
Observations	750	1,087	771	1,066	1,114	723
Mean Dependent Variable	28.0%	17.8%	23.3%	17.5%	22.9%	15.5%
Panel C						
Dependent Variable			**Functional Limitation**			
EITC Exposure from Age 0 to 18 ($1,000s)	-0.003	-0.003*	-0.002	-0.002	-0.003	-0.003*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Observations	878	1,269	884	1,263	1,323	824
Mean Dependent Variable	5.1%	7.7%	6.7%	7.6%	8.7%	5.6%

***p<0.01, ** p<0.05, * p<0.1

Source: 1968-2015 waves of the Panel Study of Income Dynamics (PSID).

Notes: All outcomes are measured as averages between age 22 and 27 from 1989 to 2015. EITC exposure is defined as the average of the maximum potential federal and state EITC a household could receive, given the year, state, and number of children (100s of 2015$). Lower educated parents are households where all parents have less than 16 years of education; Higher educated parents are households where at least one parent has 16 years of education or more. Models controls for state, cohort, year fixed effect, demographic controls, state-year policy and economic controls, interaction controls, and state-specific quadradic time trends. Robust standard errors clustered at the state level are in parentheses. All results are weighted by average childhood PSID weights.