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Poverty, Pregnancy, and Birth Outcomes: A Study of the Earned Income Tax Credit

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Abstract

Background—Economic interventions are increasingly recognized as a mechanism to address perinatal health outcomes among disadvantaged groups. In the United States, the earned income tax credit (EITC) is the largest poverty alleviation program. Little is known about its effects on perinatal health among recipients and their children. We exploit quasi-random variation in the size of EITC payments over time to examine the effects of income on perinatal health.

Methods—The study sample includes women surveyed in the 1979 National Longitudinal Survey of Youth (N=2,985) and their children born during 1986–2000 (N=4,683). Outcome variables include utilization of prenatal and postnatal care, use of alcohol and tobacco during pregnancy, term birth, birthweight, and breast-feeding status. We examine the health effects of both household income and EITC payment size using multivariable linear regressions. We employ instrumental variables analysis to estimate the causal effect of income on perinatal health, using EITC payment size as an instrument for household income.

Results—We find that household income and EITC payment size are associated with improvements in several indicators of perinatal health. Instrumental variables analysis, however, does not reveal a causal association between household income and these health measures.

Conclusions—Our findings suggest that associations between income and perinatal health may be confounded by unobserved characteristics, but that EITC income improves perinatal health. Future studies should continue to explore the impacts of economic interventions on perinatal health outcomes, and investigate how different forms of income transfers may have different impacts.

Beyond improvements to healthcare access and quality, economic interventions are increasingly recognized as a mechanism to address perinatal health outcomes.¹ In the United States, the largest program for poverty alleviation is the earned income tax credit (EITC). The EITC involves a tax rebate to low-income families contingent upon their employment, with larger benefits for recipients with children. The size of the credit increases with increasing earned income, eventually plateauing followed by a phase-out of benefits

(Supplemental Figure 1).² Initiated in 1975, the program was expanded in 1993, creating substantial variation in the size of the tax credit awarded to recipients. Individual states also offered differing amounts of earned income tax credits that underwent expansions during the study period.³ The quasi-random nature of these variations – in that they are unassociated with individual characteristics – presents the opportunity to more clearly identify the impacts of the EITC on health. During 1986 to 2000, the period we examine in this study, the inflation-adjusted maximum benefit size for a family with two or more children increased four-fold (Figure 1). Studies have shown that the EITC has successfully brought millions of families out of poverty.⁴

While not specifically designed as a health-improving intervention, the impact of the EITC on child health outcomes has increasingly become a subject of research. This work has found that larger tax credits bring about improved child achievement scores, improvements in indices of child development, and improved subjective child health status.^{5–7} Prior studies of perinatal health outcomes in particular have found that larger EITC benefits are associated with increased birthweight, decreased prevalence of maternal smoking, and higher numbers of prenatal visits.^{8–10} The results, however, have not been uniformly positive, as higher payments have been associated with increased odds of very low birthweight among low-income black mothers.¹¹ Studies of welfare reform have also shown that stringent work requirements can lead to decreased breast feeding,¹² suggesting that poverty alleviation interventions contingent upon employment may bring about unintended consequences. Moreover, assessments of employment-dependent tax credits in other high-income countries have failed to show improvements in recipients' self-reported health status.¹³

There are multiple pathways through which maternal socioeconomic disadvantage during pregnancy could impact perinatal health. Women with lower household income suffer from higher rates of malnutrition,¹⁴ exhibit disproportionately high rates of risky health behaviors such as smoking and alcohol use,^{15, 16} and demonstrate heightened psychological stress associated with neuroendocrine dysfunction.¹⁷ They are also less likely to have access to adequate prenatal care services, and less likely to breastfeed their children.^{18, 19} Mediated by these pathways, poverty during pregnancy has been found to have long-lasting effects on child health and cognitive development.²⁰ Almost without exception, however, studies linking poverty and perinatal health are correlational in nature, unable to establish whether the observed relationship is biased by unobserved confounding factors.

This study contributes to the literature on the health effects of poverty alleviation programs by exploiting variation in the size of EITC payments during 1986–2000 to examine the effects on a wide array of perinatal health outcomes. We hypothesize that larger payments are associated with improved health, taking advantage of the rich set of covariates in our dataset to control for potential confounders. Given the likelihood of residual confounding by unobserved factors, however, we also use quasi-experimental methodologies to address this potential source of bias. We employ instrumental variables (IV) analysis, a technique that relies on the existence of a quasi-randomly assigned variable (the instrument, *Z*), which impacts the outcome (*Y*) only through the exposure (*X*) (Figure 1). IV analyses address issues of confounding by unobserved characteristics that impact both the outcome and the

exposure. This study thus adds to the literature clarifying the links between maternal socioeconomic status and perinatal health.

METHODS

Data Set

The study sample includes women surveyed in the 1979 National Longitudinal Survey of Youth (NLSY), a nationally representative cohort study. As part of this survey, women were asked questions regarding each of their pregnancies. Data were collected annually in 1979–1994, and biennially thereafter, although women reported on pregnancies that occurred during non-survey years as well. Analyses are restricted to children born from 1986 to 2000, the years during which the size of EITC payments varied the most. Some women reported on multiple pregnancies, so the data set includes 2,985 women and 4,683 of their children (Table 1).

Measures

The independent variable is the size of the EITC benefit for which a woman is eligible, including federal as well as state benefits, if they were offered. Changes in tax policy during the study period resulted in substantial quasi-random variation in the size of the credits over time and depending on the number of children in a family (Figure 2). While the NLSY does not include questions about tax credits, we are able to calculate this value based on the pre-tax household income reported by participants. This was done using the Taxsim package for Stata, maintained by the National Bureau of Economic Research.²¹ For women who are married, this includes spousal income. We assume that 100% of individuals who are eligible for the credit based on their income actually receive it, as we are unable to determine actual recipients in our sample. Prior studies have shown that over 80% of eligible families receive the credit,²² so that this strategy – which has been used in prior studies – would bias our results to be closer to the null under expected scenarios.^{6, 9} Income and EITC are inflation-adjusted and presented in year 2000 U.S. dollars.

Prior research has shown that individuals tend to “bunch” at the exact level of income that would maximize the tax credit, suggesting that families with unobserved qualities may select into receipt of the maximum credit.⁴ To reduce the bias brought about by this selection process, we use a woman’s demographic and income data from two years prior to impute her current EITC benefit. This lagged income is correlated with current income, yet because the income levels that maximize the credit are different year-to-year, this reduces the selection bias described above. While it does introduce measurement error into our findings, our focus is on an identification strategy that minimizes bias. This approach has been used in prior studies of the EITC.^{6, 7}

As three-quarters of EITC benefits are paid out in February and March,²³ we use income and the size of the EITC payment in the *prior* year as the predictor variables for children born in January to April of a given year, and values from the *current* year as the predictor variables for children born in May to December. This technique has been used in previous work studying the effects of the EITC on birthweight.⁹ Since the NLSY was conducted

biennially in later years, this means that some observations were dropped due to missing predictors: namely, children born in January to April of even years, or May to December of odd years.

Outcome variables include several factors that are important indicators of perinatal health (Table 1).^{24, 25} These include the month of the mother's first prenatal visit, whether she consumed alcohol during the pregnancy, whether she consumed tobacco during the pregnancy, and whether the child was seen for a routine well-child check in the first month after birth. Women also reported on the length of the gestation as a continuous variable, from which we calculated a dichotomous variable for whether the pregnancy went to term (37–42 weeks). Child's birthweight was reported as a continuous variable. Finally, the mother reported whether she had ever breastfed the child.

Covariates include child's gender and race; and mother's age, educational attainment (as a categorical variable), marital status, hours worked in the last year, and number of dependent children. We also included mother's self-reported pre-tax household income – which includes spouse's income, if married – as a third-degree polynomial, as well as dummy variables for the child's year of birth to adjust for secular trends. Additional covariates include the mother's score on a variety of psychological and health scales that may confound the relationship between income and perinatal health: the Center for Epidemiologic Studies – Depression Scale (CES-D), the Rosenberg Self-Esteem Scale, the Rotter Locus of Control Scale, the Pearlin Mastery Scale to quantify perceived sense of control, the Short Form-12 (SF-12) physical health survey, and an intelligence test in the form of the Armed Forces Qualifications Test (AFQT). These variables have been described in previous work.²⁶

During the study period, response rates for the NLSY were 83.4–95.6%.²⁶ Moreover, missing values are common due to refusal, out-of-range entries, etc., with concern for higher rates of missing among low-income individuals. We consequently use multiple imputation using chained equations to impute missing values using the *ice* command in Stata (Supplemental Methods). As the goal of this study is causal inference rather than the estimation of population statistics, we do not use survey weights in this analysis.²⁷

Ethics Approval

Ethics approval for the NLSY was provided by the institutional review boards of Ohio State University and the National Opinion Research Center at the University of Chicago, and by the U.S. Office of Management and Budget.

Data Analysis

We fit three different sets of models to examine the effects of income on perinatal health. We first examine the association between a respondent's pre-tax household income and perinatal health. In these models, the primary predictor is pre-tax household income. Next, we estimate the effect of EITC payments on perinatal health; in these models, the size of the EITC payment serves as the predictor variable. We employ multivariable linear regressions, with linear probability models for binary outcomes. Each model controls for the covariates

described above. In these analyses, we only include individuals with household incomes of under \$100,000, as these are a more appropriate comparison group for EITC recipients. Standard errors are clustered at the household level.

Our third type of model employs instrumental variables (IV) analysis, a causal inference methodology that is becoming increasingly popular in epidemiologic studies.^{28, 29} IV analyses address the challenge in which the relationship between a predictor (X) and an outcome (Y) is confounded by unobserved characteristics (U), and in which the predictor cannot plausibly be randomized (Figure 1). They rely on the existence of a quasi-randomly assigned variable (Z), which impacts the outcome (Y) only through the exposure (X). In this study, we assume that the variation in the size of EITC benefits over time – which is driven by exogenous policy changes – affects perinatal health through its impact on post-tax income. There is a growing body of research that uses EITC payments as an instrument for income,^{6, 7, 30} and this is the strategy that we employ in this study. While this addresses the confounding that is likely present in the associations between income and health in our first set of analyses, residual confounding may persist in the case of an imperfect instrument; the covariates described above are therefore included in these models as well.

As prior studies have not established the validity of multiple imputation in IV analysis,³¹ these regressions are carried out using unimputed data. As above, they involve multivariable linear regressions that control for the covariates described above, with standard errors clustered at the household level.

RESULTS

Sample Characteristics

The mean age of women in this sample is 28.7 years (Table 1). Only 42.4% have completed more than a high school education, and 73.2% are married. Average household income is \$44,371, and about a quarter were eligible for EITC at some point during the study period. Just under half of children in the sample are black or Hispanic. There is substantial variation in the health outcomes of interest (Table 1).

Income and Perinatal Health

Our first set of analyses examines the association between pre-tax household income and perinatal health (Table 2, Supplemental Table 1). We find that higher income is marginally significantly associated with an earlier first prenatal care visit ($\beta = -0.0092$ per \$1,000, $p = 0.09$) and higher birthweight ($\beta = 3.68$ grams per \$1,000, $p = 0.07$), and significantly associated with reduced likelihood of tobacco use during pregnancy ($\beta = -0.0027$ per \$1,000, $p = 0.04$) and increased likelihood of attending a well-child check in the first month after birth ($\beta = 0.0032$ per \$1,000, $p = 0.04$).

EITC and Perinatal Health

We next examine the association between EITC payment size and perinatal health (Table 3, Supplemental Table 2). Greater payment sizes are marginally significantly associated with increased likelihood of going to term ($\beta = 0.032$ per \$1,000, $p = 0.06$), increased birthweight

($\beta = 65.1$ grams per \$1,000, $p = 0.05$), and increased likelihood of breast feeding ($\beta = 0.042$ per \$1,000, $p = 0.08$).

Instrumental Variables Analysis

Our final set of models uses EITC payment size as an instrument for post-tax income to estimate the effect of income on perinatal health. In the first stage of the IV analysis, we find that payment size is a significant predictor of post-tax household income, with a coefficient of 2,737; this is consistent with the EITC's impact on income through both the credit itself as well as the additional earnings from the greater labor participation it incentivizes (Table 3). The F-statistic for the first stage of each model is well above the standard cut-off of 10, indicating that EITC payment size is a strong instrument for post-tax income even after controlling for pre-tax income (Table 2). In these models, there is no significant association between income and any of the perinatal health outcomes of interest (Table 2, Supplemental Table 3).

COMMENTS

In this study, we employ several models to examine the association between income and perinatal health, exploiting quasi-random variation in EITC payment sizes to do so. While we find an association between both income and EITC payment size and a variety of perinatal health outcomes, we do not find any effect of income on perinatal health when we employ EITC payment size as an instrument for post-tax income in IV analyses.

While marginally significant, our findings on the association between EITC payment size and birthweight are consistent with prior studies. Several studies have found that larger payments are associated with higher birthweights among recipients' children.^{8–10} The effect size in this study is roughly comparable to those in prior studies, although other researchers estimate the impact of the program overall rather than quantifying the increase per dollar as we do here. Potential mechanisms for the observed association include improved nutrition due to the economic boost or reduced smoking. We do not find an association between maternal smoking and EITC payment size, although prior work finds that EITC payments are associated with reduced maternal smoking.^{10, 32, 33} Previous research has also shown that stress – including that due to financial hardship – is associated with lower birthweight, suggesting that alleviating maternal stress may be a pathway through which the EITC acts.¹⁷ Indeed, it has been shown that the EITC is associated with improved maternal mental health as well as improvements in physiologic markers of stress.³⁴

We demonstrate a marginally significant association between larger EITC benefit size and term birth, which is a novel finding. Prior work has suggested that poverty is associated with an increase in preterm birth, due to decreased access to care, increased risky health behaviors, maternal stress, and other factors.³⁵ We do not find an association between EITC payment size and maternal smoking or prenatal care access.

We also find that higher EITC payments are marginally significantly associated with an increased likelihood of breast feeding. To our knowledge, these findings have not been previously demonstrated in the literature on EITC. In fact, prior work has shown that

stringent work requirements that were adopted as part of welfare reform decreased breast feeding,¹² and that employment is a predictor of reduced breast feeding.³⁶ Yet it has also been shown that decreased maternal stress and anxiety are associated with increased breast feeding,³⁷ as are maternal knowledge and social support.³⁸ It may be that the EITC has a stronger influence on these latter pathways, a question which can be addressed in future studies.

We observe that the types of health outcomes that are positively associated with income are not the same as those that are positively associated with EITC payment size. It may be that the type of income boost that the EITC provides – namely, a lump sum provided at the beginning of the year – leads to a different effect on health outcomes as compared with the smoother distribution of employment income over the course of the year. Several prior studies among EITC recipients suggests that they are more likely to use the one-time payment to purchase durable goods or make large purchases, although some of the payment is used to smooth income over the rest of the year.^{39, 40} This focus on asset accumulation may be beneficial for some aspects of perinatal health but not others; for example, the added financial boost may reduce maternal stress, but it may not lead to improved nutrition over the course of her pregnancy. These findings should be replicated in the future using different samples.

We do not find any significant associations with perinatal health when using EITC as an instrument for post-tax income, despite demonstrating the strength of the instrument. This suggests that the associations we demonstrate in the models above may be confounded by other unobserved sociodemographic characteristics, a possibility that has long been recognized in prior research on the links between socioeconomic status and health.⁴¹

This study has several limitations. As the NLSY involves annual and biennial surveys, there may be measurement error in the self-reported measures we employ here, as well as recall bias for those not interviewed in the year of a child's birth. This also precludes us from teasing apart the timing of exposures during particular trimesters, especially because we are not able to determine the timing of the receipt of a family's EITC payment. Our IV analysis is limited in that there are likely other pathways linking EITC payments and perinatal health. That is, the EITC has been shown to increase labor participation among female-headed households,⁴² which weakens the validity of the payments as an instrument for post-tax income. The results should therefore be interpreted with caution, although nonetheless this approach is one that is increasingly used in research on the EITC.^{6, 7, 30, 43} The IV analysis is also limited in that the results are primarily generalizable to income boosts that are due to changes in the EITC and among individuals who are similar to our study sample, i.e. the "local average treatment effect."⁴⁴

Conclusion

This study contributes to the literature on the links between maternal household income and perinatal health. We exploit quasi-random variation in the generosity of the EITC program over time to examine the association between income boosts and a variety of perinatal health outcomes. We find that both income and EITC payment size are associated with improvements in health outcomes, although an IV approach fails to find a causal link for

income. Future studies should continue to explore the impacts of economic interventions on perinatal health outcomes, and investigate how different forms of income transfers may have different impacts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Instrumental variables design

Note: Instrumental variables analysis is used in situations where the relationship between the exposure (X) and outcome (Y) is possibly confounded by other unobserved factors (U), and in which the exposure cannot be randomized. It exploits the existence of a third variable – the instrument (Z) – which itself is quasi-random, and which influences the outcome (Y) only through the exposure (X).

Figure 2. Average EITC payment size by year and number of children

Note: This figure demonstrates the variation in average EITC payment size among EITC-eligible participants in the study sample. Values are inflation-adjusted to year 2000 dollars. N = 2,985 households.

Table 1

Sample characteristics.

Maternal characteristics (N = 2,985)	
Age (mean (SD))	28.7 (3.7)
Education at age 25 (%)	
Less than high school	20.4
High school	37.3
More than high school	42.4
Married (%)	73.2
No. of dependents in household (mean (SD))	1.7 (1.2)
Household income (mean (SD))	44,371 (24,766)
EITC	
No. ever eligible for EITC	816
Payment size, if eligible (mean (SD))	626 (548)
Child characteristics (N = 4,683)	
Female gender (%)	48.9
Race (%)	
Black	25.2
Hispanic	19.7
White/Other	55.1
Perinatal health outcomes	
Month of 1 st prenatal visit (mean (SD))	2.4 (1.7)
Mother drank during pregnancy (%)	8.3
Mother smoked during pregnancy (%)	24.2
Well-child check in 1st month (%)	66.5
Born at term (%)	87.5
Birth weight in grams (mean (SD))	3,347 (628)
Ever breastfed (%)	52.6

Note: Characteristics tabulated using imputed data for individuals with pre-tax household income of under \$100,000. Household income includes spouse's income, if married. Earned income tax credit calculated using Taxsim for Stata. Income and EITC are inflation-adjusted to year 2000 dollars.

Table 2

Association of household income and EITC payment size with perinatal health, 1986–2000.

β Coefficient [95% CI]							
	Month of 1 st prenatal visit	Alcohol during pregnancy	Tobacco during pregnancy	Well-child check in 1st month	Term pregnancy	Birth weight	Breastfed
Panel A: Association between household income and perinatal health							
Household income (per \$1,000)	−0.0092 ⁺ [−0.020, 0.0016]	−0.0010 [−0.0027, 0.0007]	−0.0027 [*] [−0.0053, −0.0002]	0.0032 [*] [0.00, 0.0063]	0.0007 [−0.0015, 0.0029]	3.68 ⁺ [−0.32, 7.67]	0.0022 [−0.0005, 0.0050]
No. of children	3,906	4,054	4,042	3,694	3,944	3,938	4,070
Panel B: Association between EITC payment size and perinatal health							
EITC amount (per \$1,000)	0.054 [−0.12, 0.22]	−0.0035 [−0.028, 0.021]	0.011 [−0.034, 0.057]	−0.021 [−0.075, 0.032]	0.032 ⁺ [−0.0011, 0.065]	65.1 ⁺ [−0.46, 130.6]	0.042 ⁺ [−0.0055, 0.089]
No. of children	3,906	4,054	4,042	3,694	3,944	3,938	4,070
Panel C: Effect of household income on perinatal health, using EITC as an instrument							
Household income (per \$1,000)	0.019 [−0.070, 0.11]	0.0057 [−0.0087, 0.020]	0.0013 [−0.022, 0.025]	−0.0068 [−0.033, 0.020]	0.0056 [−0.013, 0.024]	18.0 [−17.8, 53.8]	0.017 [−0.0045, 0.038]
1 st Stage F-statistic	204	214	216	197	208	224	190
No. of children	1,779	1,845	1,842	1,712	1,799	1,803	1,798

Note:

+ p<0.1,

* p<0.05.

Analyses involve multivariate linear regression, with linear probability models for binary outcomes. All models control for mother’s marital status, annual hours worked, number of dependent children, age, educational attainment, third-degree polynomial for household income, scores on CES-D (depressive symptoms), Rotter Scale (locus of control), Pearlin Scale (perceived control), Rosenberg Scale (self-esteem), AFQT (intelligence), and SF-12 (physical and mental health), and child’s gender and race. Models also include dummy variables (fixed effects) for child’s year of birth to adjust for secular trends. Standard errors clustered at household level. Income is inflation-adjusted to year 2000 dollars. Panels A and B employ imputed data, as described in the Supplemental Methods, while instrumental variables analyses in Panel C employ unimputed data. Full models including all covariates are included in the Supplement.

Table 3

Association of EITC payment size, sociodemographic characteristics, and psychological factors with post-tax household income, 1986–2000 (first stage of IV analysis).

	β Coefficient [95% CI]
EITC amount (per \$1,000)	2,737** [2,365, 3,109]
Married	189.9 [−256.2, 636.0]
Annual hours worked (per 100)	27.19+ [−0.77, 55.14]
No. children	−10.44 [−213.8, 193.0]
Age	−207.1** [−297.3, −117.0]
Education (reference < HS)	
HS complete	−423.5+ [−886.5, 39.39]
More than HS	−380.3 [−960.3, 199.7]
Household income (per \$1,000)	954.0** [895.2, 1,013]
Household income^2	−0.088 [−1.64, 1.46]
Household income^3	−0.0067 [−0.019, 0.0052]
CES-D	−4.09 [−33.56, 25.38]
Rosen	−17.93 [−87.71, 51.85]
SF-12 Physical	−0.066 [−0.28, 0.15]
SF-12 Mental	0.035 [−0.21, 0.28]
Pearlin	−63.44* [−124.8, −2.07]
Rotter	23.90 [−52.99, 100.8]
AFQT	−0.016** [−0.025, −0.0071]
Child female	69.56 [−283.0, 422.2]
Child race (reference white/other)	
Black	289.6 [−170.8, 749.9]
Hispanic	461.6 [−96.63, 1,020]
Constant	6,947** [3,715, 10,180]
No. of children	2,026

Note:

+ p<0.1,

* p<0.05,

** p<0.01.

Analysis involves multivariate linear regression. Model includes dummy variables (fixed effects) for child's year of birth to adjust for secular trends. Standard errors clustered at household level. Income and EITC are inflation-adjusted to year 2000 dollars. CES-D is a measure of depressive symptoms, Rotter Scale is a measure of locus of control, Pearlin Scale is a measure of perceived control, Rosenberg Scale is a measure of self-esteem, AFQT is a measure of intelligence, and SF-12 is a measure of physical and mental health.