

Impact of Maternal Smoking during Pregnancy on Children's Body Weight: New Evidence from Longitudinal Data

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Research summary

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- ✦ To ensure comparability of our estimates, our analysis provides child age- and sex-specific effects of maternal smoking during pregnancy.
- ✦ The study utilizes matched mother-child data from the National Longitudinal Surveys (NLSY and NLS-CYA).
- ✦ Our results indicate that smoking during pregnancy has a negative impact on children's birthweight.
- ✦ However, during later years of pre-school period, children of mothers who smoked during pregnancy catch up with the children of non-smokers.

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Background

Existing literature

- “Maternal smoking is an ongoing public health problem in the United States. In 2013, about 1 in 5 women smoked in the 3 months before pregnancy, and about 1 in 10 smoked during the last 3 months of pregnancy.” - Centers for Disease Control and Prevention
- Maternal smoking during pregnancy is linked with a wide array of both short-term and long-term child outcomes.
- Short-term consequences include premature childbirth; fetal growth restriction; **lower birthweight**; and infant mortality (Meyer & Tonascia, 1977; Cnattingius, 2004).
- Long-term health outcomes include higher blood pressure levels, respiratory and pulmonary disorders; psychological and behavioral problems; and **higher likelihood of childhood obesity** (Weitzman, Gortmaker, & Sobol, 1992; Vik et al., 1996; Von Kries et al., 2002).

Main motivation

- The evidence on the relationship of maternal smoking during pregnancy with lower birthweight and increased risk of having excess weight during later childhood years is of particular importance to our analysis.
- In particular, prenatal exposure to maternal smoking results in fetal growth retardation.
- On the other hand, maternal smoking during pregnancy is associated with stunted growth; higher risk of adiposity; and obesogenic growth during later childhood (Ino, 2010; Howe et al., 2012; Li et al., 2016).
- Further, the majority of previous studies in the related space are based on descriptive analysis.
- Unique opportunity to contribute to the current literature by testing the **'catch-up'** hypothesis indicated by the two separate evidence found in the existing studies.

Data

The National Longitudinal Surveys

- We match mothers' data from the National Longitudinal Survey of Youth (NLSY79) with their biological children's information from the Children and Young Adults Survey (NLS-CYA).
- Child bodyweight outcomes and birth-related information are obtained from the NLS-CYA.
- The outcomes of interest are children's weight (in pounds) and body mass index (BMI) estimated from the children's height and weight information.
- Key explanatory variables include:
 - a. Binary indicator of whether mom smoked during pregnancy.
 - b. Discrete indicator of quantity smoked during pregnancy.
- Other covariates: To minimize omitted variable biases, we include controls for mothers' schooling, age, body mass index, indicators of being married and employed, indicator of other substance use during pregnancy, household size and family's poverty status.

Data structure

- The NLS-CYA is a biennial survey.
- The data incorporates birth-related information of all the children included in our sample.
- However for later childhood years, while some children are surveyed during odd-numbered ages (1,3, and 5) others are surveyed during even-numbered ages (2 and 4).
- This particular structure restricts us from evaluating child outcomes for consecutive years.
- The advantage is that the data allows us to test the robustness of the relationship of interest across two different child samples.
- Given our empirical approach, we restrict our analysis to preschool years to ensure precision of our estimates.

Brief descriptive information on mothers

- Approximately 29% of mothers reported smoking during pregnancy. 21% smoked less than a pack and the rest 8% smoked one pack or more.
- In addition, 45% of mothers reported using other substances during pregnancy (drinking/ marijuana/ cocaine).
- Almost all mothers (99%) paid prenatal visits to their doctors.
- Proportion of married mothers varies between 65% and 75% across childhood years.
- The percentage of employed mothers across child samples ranges from 92% to 98%.
- The average schooling of mothers exceeds high-school graduation level.

Comparing child bodyweights - Smokers Vs Non-smokers

	Age	Weight in pounds-children of non-smokers	Weight in pounds-children of smokers	Difference (1) - (2)	BMI - children of non-smokers	BMI-children of smokers	Difference (4) - (5)
		(1)	(2)	(3)	(4)	(5)	(6)
Girls	Birth	7.351	6.827	0.524***	13.148	12.418	0.730***
	1 year	21.038	21.142	-0.104	19.104	19.348	-0.244
	2 years	26.882	26.759	0.123	18.566	18.814	-0.247
	3 years	31.284	31.708	-0.013	16.737	17.598	-0.859*
	4 years	36.134	36.196	-0.061	16.174	16.904	-0.730*
	5 years	41.371	41.656	-0.283	16.063	16.111	-0.048
Boys	Birth	7.592	7.095	0.497***	13.090	12.740	0.349***
	1 year	22.901	22.970	0.068	20.057	20.083	0.026
	2 years	28.563	28.341	0.222	18.731	18.960	-0.229
	3 years	32.701	32.674	0.026	17.481	17.693	-0.211
	4 years	37.736	36.598	1.137**	16.486	16.580	-0.094
	5 years	42.328	42.339	-0.011	16.178	15.976	0.201

Identification strategy

Empirical model

At each child age, we employ Rosenzweig & Wolpin's (1991) strategy to estimate:

$$Y_{cm} = \alpha_1 + \delta \cdot \text{Smoked}_{cm} + \alpha_2 \cdot X_{cm} + \mu_m + \epsilon_{cm} \quad (1)$$

where Y is bodyweight outcome (weight or BMI) of child c born to mother m .

Smoked is an indicator of whether (or how much) a mother smoked during pregnancy.

X is a vector of mother characteristics.

μ_m represents mother fixed effects (that can also be interpreted as siblings or family fixed effects).

ϵ_{cm} represents the error term.

Given the evidence on state-dependence of bodyweight measures, we perform additional robustness checks by estimating:

$$Y_{cm} = \beta_1 + \rho \cdot \text{Smoked}_{cm} + \omega \cdot \text{Lag}Y_{cm} + \beta_2 \cdot X_{cm} + \mu_m + v_{cm} \quad (2)$$

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Primary findings

Using children's weight as dependent variables

ALL CHILDREN		WEIGHTS (IN POUNDS)				
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.287*** (0.091)	0.257 (0.711)	-0.940 (0.983)	1.672** (0.738)	1.278 (1.108)	0.791 (0.964)
Number of mothers	3714	1749	1858	2048	2137	2243
Sample size	6146	2210	2372	2700	2835	3057

GIRLS						
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.254* (0.151)	0.946 (1.501)	-1.348 (1.877)	0.314 (1.316)	0.061 (1.852)	2.379 (2.011)
Number of mothers	2361	945	1057	1152	1220	1270
Sample size	2995	1066	1200	1325	1410	1488

BOYS						
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.368** (0.176)	-0.937 (1.300)	-2.344* (1.305)	3.185* (1.685)	3.820* (2.272)	1.821 (2.416)
Number of mothers	2411	1014	1041	1208	1246	1337
Sample size	3151	1144	1172	1375	1425	1569

Notes: Fixed effects regressions control for mother's schooling, marital status, employment status, age, weight, family size and poverty status, birth order (and sex for the all sample regressions). The regressions for children's weight (as dependent variable) additionally controls for children's height (in feet). Robust standard errors in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Using children's BMI as dependent variables

ALL CHILDREN		BODY MASS INDEX				
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.577** (0.254)	0.486 (0.945)	-1.878 (2.272)	0.931 (0.753)	1.551* (0.910)	0.485 (0.506)
Number of mothers	3714	1749	1858	2048	2137	2243
Sample size	6146	2210	2372	2700	2835	3057
GIRLS						
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.511 (0.387)	-2.178 (2.302)	-3.071 (1.995)	-0.402 (1.246)	-0.089 (1.311)	0.885 (0.768)
Number of mothers	2361	945	1057	1152	1220	1270
Sample size	2995	1066	1200	1325	1410	1488
BOYS						
Age-	Birth	1 year	2 years	3 years	4 years	5 years
Smoked	-0.720 (0.526)	1.265 (2.018)	-2.080 (1.981)	1.596 (1.664)	2.896 (1.986)	0.379 (1.012)
Number of mothers	2411	1014	1041	1208	1246	1337
Sample size	3151	1144	1172	1375	1425	1569

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Controlling for lagged bodyweight measures

ALL										
Age-	1 year old		2 years old		3 years old		4 years old		5 years old	
Variables	Weight	BMI	Weight	BMI	Weight	BMI	Weight	BMI	Weight	BMI
Smoked	0.188 (0.908)	0.498 (1.264)	-2.536** (0.990)	-0.768 (2.187)	1.420 (0.934)	1.639* (0.841)	1.302 (1.145)	1.605 (0.993)	0.399 (1.116)	1.463** (0.615)
No. of mothers	1590	1536	1687	1610	1608	1511	1741	1655	1841	1888
Sample size	1937	1855	2063	1951	2057	1897	2221	2087	2397	2489
GIRLS										
Smoked	1.026 (1.908)	-3.472 (3.132)	-2.769 (1.768)	-2.492 (2.907)	0.160 (1.453)	0.140 (1.041)	-0.037 (2.286)	-3.377 (2.897)	1.172 (2.082)	0.584 (0.884)
No. of mothers	848	818	942	890	884	823	983	929	1054	1025
Sample size	932	899	1044	980	1000	928	1111	1046	1215	1174
BOYS										
Smoked	0.203 (1.542)	0.992 (3.057)	-3.723*** (1.280)	-5.105 (4.423)	2.245 (1.890)	2.664** (1.227)	3.287 (2.106)	2.237** (1.028)	2.088 (2.826)	1.721 (1.191)
No. of mothers	907	870	922	884	944	944	995	937	1110	1075
Sample size	1005	956	1019	971	1057	969	1110	1041	1274	1223

Notes: Fixed effects regressions control for lagged outcome variable, mother's schooling, marital status, employment, age, weight, family size and poverty status, birth order (and sex for the full sample regressions). Robust standard errors in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Summarizing key findings

- ☛ Controlling for mother-specific fixed effects, our analysis indicates that children of smokers are born with significantly lower birthweight than non-smokers' children.
 - Our study updates and confirms Rosenzweig & Wolpin's (1991) findings.
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 - Negative impacts at birth, which are larger in magnitude the greater the quantity smoked.
 - From age three to five, these effects are either positive or statistically insignificant.
- ☛ In general, the above results support the 'catch-up' hypothesis.

Conclusion

Limitations and way forward

- ★ Focusing on child health implications, our study provides policy-relevant evidence to substantiate the need for effective social interventions to reduce a large preventable health risk.

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- ★ Information on mothers' smoking status is not available for all survey years.
- ★ Plan to perform further robustness tests to see if the key results hold across alternative specifications.
- ★ Future analysis could evaluate the mechanisms underlying the catch-up phenomena and also explore other health outcomes commonly associated with maternal smoking during pregnancy.

Thank You

Thank you very much for your time.

Full study is available at [▶ AUT WP Series 2018](#).

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