

Analysis of Smoking Prevalence and Cessation Before and During Pregnancy in the National Children's Study

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BACKGROUND

Cigarette tobacco smoking is known to have negative effects on the health of the smoker and those with secondary exposure. Tobacco use during pregnancy brings additional adverse effects and risks on the pregnancy, the developing fetus, and the post-partum infant. Pregnancy risks include an increased risk for miscarriage, an increased risk for placental abruption, a separation for the placenta from the uterine wall, and an increased risk of preterm labor (McCowan et al., 2009). Developing fetuses have an increased risk for certain birth defects and an increased chance of low birth weight (Hackshaw, Rodeck, & Boniface, 2011; Jaddoe et al., 2008). Post-partum, smoking during pregnancy is one risk factor for Sudden Infant Death Syndrome (SIDS).

The National Children's Study (NCS) Vanguard Study was a pilot for a planned Main Study cohort and started in 2009. The study was conceived to be a nationally representative longitudinal cohort study of 100,000 children from before birth through age 21. The study aimed to evaluate environmental influences on child health and development (Hudak et al., 2016). The NCS Vanguard Study enrolled and followed more than 5,400 birth families in 43 counties across 31 states throughout the United States. To recruit those families, the study conducted pre-pregnancy and pregnancy visits with over 7,900 women. Collecting multiple types of data, include questionnaires on participant demographics, medical conditions and history, and lifestyle choices. Additionally nearly 19,000 biological and 4,000 environmental primary samples from the women, children, and fathers in the study are available to approved researchers who want to incorporate laboratory results in their analysis.

Smoking is a modifiable health activity and women who smoke prior to pregnancy are recommended to stop during the pregnancy to reduce the mentioned risks. The NCS offers a unique opportunity to explore the relationship between maternal cigarette smoking prior to and during pregnancy.

METHODS

Data Source and Study Sample

The NCS Vanguard Study sample was a prospective, longitudinal cohort of mother-child pairs residing in the U.S. Potential mothers were recruited preconception, during pregnancy or at childbirth and were followed for up to 4 years. At preconception and pregnancy visits, a woman's smoking status was measured by asking "Does Participant currently smoke cigarettes or use any other tobacco product?" Mothers not part of the preconception cohort were asked during pregnancy visits "In the 3 months before Participant knew she was pregnant, did Participant smoke any cigarettes?" Demographic and socio-economic characteristics of the mother were collected during the study. Marital status and education reported during the mothers' pregnancy visits were used in the analysis, whereas employment at time of birth were collected at peri- and post-natal visits. Residence was defined using the United States' Office of Management and Budget's (OMB) Metropolitan and Micropolitan Statistical Areas (MSA). Participants were considered "urban" if they resided in a county designated as a MSA, and non-urban or "rural" if they did not.

Statistical Analysis

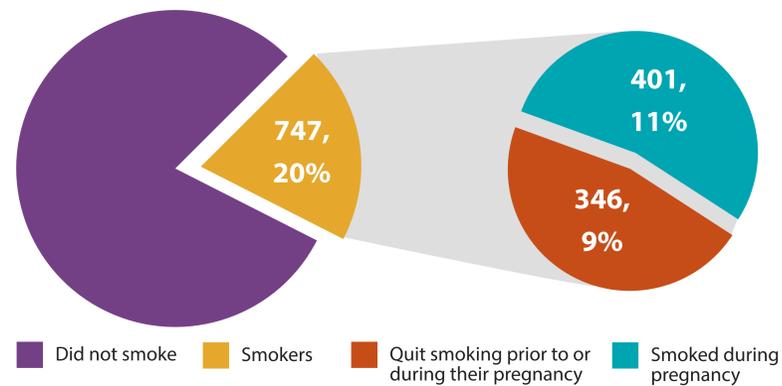
Descriptive analyses were performed using SAS Version 9.4 (SAS Institute Inc., Cary, NC). Differences between categorical variables were analyzed using Rao-Scott Chi-Squared and Rao-Scott Modified Chi-Squared tests with 5% level of significance. Sampling weights were not used in analysis due to unavailability of weights with the NCS Vanguard Study sample. The sample used in this analysis was restricted to women with one NCS child (no multiple births or sibling births).

RESULTS

Smoking Status

Of the 3,822 NCS mothers who responded to questions on their smoking status, 3,075 indicated they did not smoke and 747 indicated some smoking status. **Figure 1** displays the smoking status of NCS mothers by smokers and not smokers, breaking out the smokers into those who quit prior to or during pregnancy (346) and those who did not quit (401).

Figure 1. Smoking Status of NCS Mothers



Demographic Characteristics of Prior and Current Smokers

Table 1 displays the demographic and socio-economic characteristics and differences between NCS Mothers who were able to quit smoking prior to or during their pregnancy and those who smoked during the pregnancy. There were not significant differences in racial-ethnicity of the smoking mothers. For education, the quitters and non-quitters were significantly different. The quitting population showed a greater level of education; with 55% have some post high school education versus 38% on non-quitters. The quitting population was more likely to be employed at the time of birth (44%) versus non-quitters (29%). Quitting women (33%) were more likely to have a higher income than non-quitting women (12%), but both groups of smokers were lower than non-smokers (46%, data not shown). For reference, the 2016 Census median income was \$57,617. The quitting population was significantly more likely to be married. There was not a significant differences in geographic location, but more women who smoked during pregnancy were identified in non-metropolitan areas.

Table 1. Demographics of NCS Mothers Who Quit Smoking Prior to or During Pregnancy Versus Mothers Who Smoked During Pregnancy

Variable	Quit Smoking Prior to or During Their Pregnancy		Smoked During Pregnancy		p-value (0.05)
	n	%	n	%	
Race/Ethnicity N (%)					p=0.5103
Hispanic	55	15.9	46	11.5	
White, Non-Hispanic	199	57.5	239	59.6	
Black, Non-Hispanic	58	16.8	83	20.7	
Other or Missing	34	9.8	33	8.2	
Maternal Education, N (%)					p=0.0006
Less than High School	69	19.9	106	26.4	
High School Graduate or GED	88	25.4	142	35.4	
Some College or Associate Degree	132	38.2	121	30.2	
College Graduate or Above	57	16.5	32	8	
Maternal Employment, N (%)					p < .0001
Employed at time of birth	153	44.2	117	29.2	
Not employed at time of birth	145	41.9	245	61.1	
Unknown	48	13.9	39	9.7	
Annual Household Income, N (%)					p=0.0001
Less than \$50,000	206	59.5	31	78.6	
\$50,000 or more	115	33.2	47	11.7	
Unknown	25	7.2	39	9.7	
Marital Status during Pregnancy, N (%)					p=0.0001
Married	157	45.4	116	28.9	
Not Married	189	54.6	285	71.1	
Geographic location, N (%)					p=.1069
Metropolitan	268	79.1	258	65.2	
Non-Metropolitan	71	20.9	138	34.8	

Outcome at Birth

At birth, there was a significant difference in age between those who did not smoke (28.7 y/o) and those who reported smoking at any time, either prior to (26.2 y/o) or during pregnancy (26.3 y/o), **Table 2**. For gestational age, there was no difference between smokers and non-smokers, **Figure 2**. Children of non-smoking mothers (2987g) were significantly larger than those of previous (2760g) or current (2787g) smokers. The child birthweights of those who quit and did not quit were not significantly different, **Figure 3**.

Table 2. Birth Outcome by Smoking Status

Variable	Total		Did Not Smoke		Quit Smoking Prior to or During Their Pregnancy		Smoked During Pregnancy		p-value (0.05)
	Mean	σ	Mean	σ	Mean	σ	Mean	σ	
Maternal Age (years) at Child's Birth	28.7	6.3	29.2	6.2	26.2	6.9	26.3	6.5	p < 0.0001
Gestational Age in Weeks	37.6	7.4	37.7	7.2	37.2	8.7	37.3	7.6	p=0.3067
Child's Birth weight in Grams	2946	1226	2987	1218	2760	1338	2787	1182	p=0.0347

Figure 2. Mean Gestational Age in Weeks of NCS Children at Birth

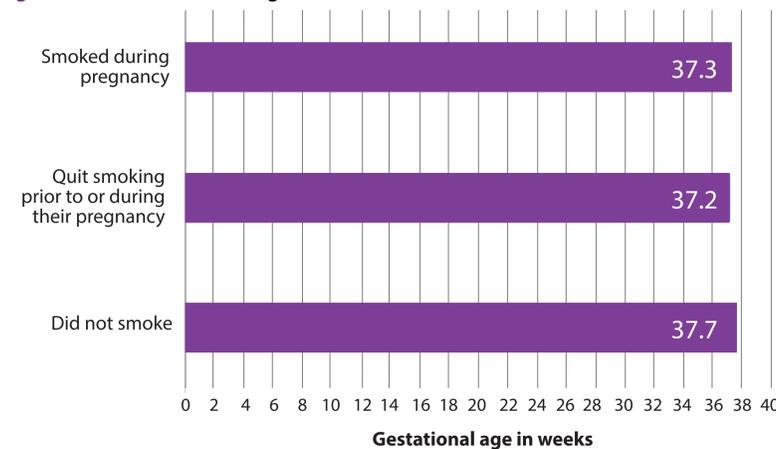
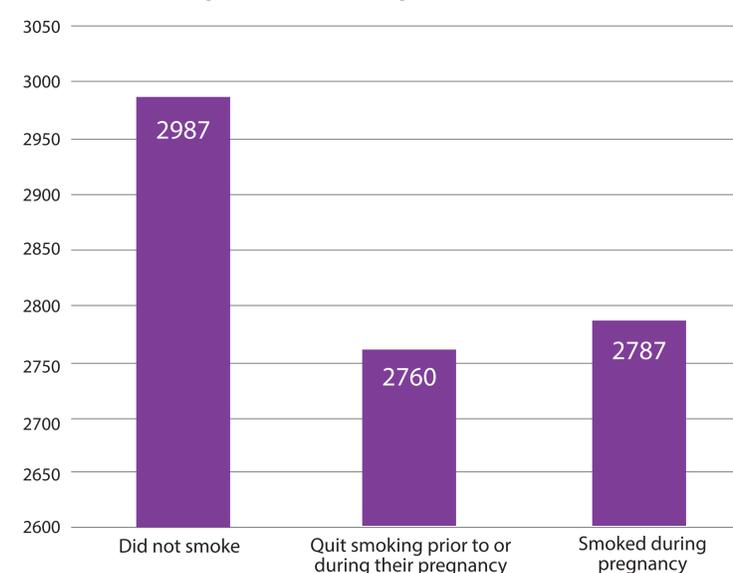


Figure 3. Mean Birth Weight of NCS Children (g)



CONCLUSION

Pregnancy smoking status is one of many areas of maternal and child health data collected as part of the National Children's Study. Most participants in the NCS did not smoke, but of those who did smoke about half were able to quit smoking prior to or during the pregnancy. Those who quit smoking had higher level of education, employment at birth, income, and were more likely to be married. These lower socioeconomic indicators among non-quitters are similar to previous reports (Curtin & Matthews, 2016). The maternal age a birth was older for the non-smokers, and similarly younger for the smokers (quitting and non-). The gestation age of the child was the same among all women, which is different from previous reports (McCowan et al., 2009). NCS data showed a higher birth weight for babies of non-smoking women compared to a similarly lower birth weight of women who smoked 3 months prior to or during a pregnancy. This suggests quitting just prior to pregnancy, may not achieve parity with non-smokers, and that women should be encouraged to quit more than three months prior to pregnancy, if not earlier.

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BIBLIOGRAPHY

- Curtin, S. C., & Matthews, T. J. (2016). Smoking Prevalence and Cessation Before and During Pregnancy: Data From the Birth Certificate, 2014. *Natl Vital Stat Rep*, 65(1), 1-14.
- Hackshaw, A., Rodeck, C., & Boniface, S. (2011). Maternal smoking in pregnancy and birth defects: a systematic review based on 173 687 malformed cases and 11.7 million controls. *Human Reproduction Update*, 17(5), 589-604. doi:10.1093/humupd/dmr022
- Hudak, M. L., Park, C. H., Annett, R. D., Hale, D. E., McGovern, P. M., McLaughlin, T. J., ... Balsam, M. J. (2016). The National Children's Study: An Introduction and Historical Overview. *Pediatrics*, 137(Supplement 4), S213-S218. doi:10.1542/peds.2015-4410B
- Jaddoe, V. W. V., Troe, E.-J. W. M., Hofman, A., Mackenbach, J. P., Moll, H. A., Steegers, E. A. P., & Witteman, J. C. M. (2008). Active and passive maternal smoking during pregnancy and the risks of low birthweight and preterm birth: the Generation R Study. *Paediatric and Perinatal Epidemiology*, 22(2), 162-171. doi:10.1111/j.1365-3016.2007.00916.x
- McCowan, L. M. E., Dekker, G. A., Chan, E., Stewart, A., Chappell, L. C., Hunter, M., ... North, R. A. (2009). Spontaneous preterm birth and small for gestational age infants in women who stop smoking early in pregnancy: prospective cohort study. *BMJ: British Medical Journal*, 338. doi:10.1136/bmj.b1081

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NICHD Website <https://www.nichd.nih.gov/research/NCS/>
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