The Effect of Neighborhood Characteristics on the Health of Pregnant Women and Infants

Introduction:

At the end of the last decade, approximately $2.6 trillion was spent on healthcare (Martin et al, 2012), yet 8% of babies were born low birthweight (Martin et al, 2010). Low birth weight are all related to many other health problems such as cardiovascular disease, diabetes and stroke, which are some of the leading causes of preventable death.

The traditional solution to these health problems is individual-based medication and treatment. However, the observation that individuals living in low socioeconomic status neighborhoods generally have worse health than individuals in wealthier neighborhoods raises the question: can individual health be improved by changing the characteristics of the neighborhoods in which they live?

The physical and social aspects of neighborhood can influence the health of pregnant women and infants by affecting health behaviors and stress. For example, crime in the neighborhood may lead to stress or anxiety, a risk factor for low birthweight and preterm birth (Dole et al, 2003). Psychosocial stress may manifest itself in worse maternal health, reduced physical activity and prenatal care use, and increased reliance on substances such as alcohol and tobacco (or an inability to quit during pregnancy). The availability of substances such as alcohol and tobacco are likely to have a direct effect on pregnant women's demand for these goods, as they relate to the cost of quitting during pregnancy. Thus, these factors are expected to have a combined deleterious effect on women's prenatal behaviors and may eventually result in worse health of their offspring.

The Current Evidence:

There is large cross-sectional literature investigating whether various neighborhood characteristics such as neighborhood poverty, crime prevalence and access to fast food restaurants are associated with worse health for pregnant women and poor infant health. The cross-sectional studies reviewed in Ellen et al, (2001) for example show that living in high poverty neighborhoods is significantly associated with a higher probability of low birthweight, and pregnant women living in violent neighborhoods are more likely to experience pregnancy complications. Some have inferred from these associations that an important means of improving health is to improve the social and economic context of neighborhoods. However, these associations do not demonstrate causality because there may be unobserved factors that affect both the choice of neighborhoods and health.

A few studies have attempted to establish causality using fixed effects and instrumental variable techniques[1]. Lhila (2011) examined the effect of number of fast-food restaurants in the metropolitan area (MSA) on birthweight and excessive prenatal weight gain, controlling for the influence of unobserved neighborhood factors, including MSA fixed-effects. She found a statistically significant effect of fast food access on the probability of excessive weight gain but no significant effect on birthweight. Currie et al, (2010) also attempted to estimate the causal effect of the presence of a fast-food restaurant on child obesity and weight gain for pregnant women. Fast-food restaurants were found to exert a significant effect on both child obesity and excessive weight gain in models that included school fixed effects and zipcode and mother fixed effects respectively.

[1] Causal effects of neighborhood poverty on adult and youth health have also been estimated using the moving to opportunity housing intervention randomly moved families from high-poverty areas to low-poverty areas. The intervention has not however evaluated the health of infants or pregnant women, as no information was collected on them.

Aim and Contribution:

We aim to investigate neighborhood crime prevalence and access to alcohol and tobacco reduce prenatal care use, increase smoking, drinking, and excessive weight gain during pregnancy, and lead to worse infant health. Specifically we will investigate the association through simple Ordinarily Least Squares (OLS) regressions, and causality though fixed-effect regression techniques.

Although our econometric methodology is by no means perfect, we contribute by adding evidence to the small literature on whether neighborhood conditions causally affect the health of pregnant women and infants.

Econometric methodology:

A reduced-form model used to investigate neighborhood effects is given in equation (1). The health of woman/child *i* living in neighborhood *j* at time *t* (H_{ijt}) is related to mother and child characteristics (X_{ijt} – such as child sex, birth order, mother's educational attainment, marital status, race/ethnicity and age), characteristics of neighborhood (N_{jt}), unobserved neighborhood characteristics (γ_j), year dummies (τ_t), and a stochastic error term (ξ_{ijt})

(1) $H_{ijt}=\beta_1 X_{ijt} + \beta_2 N_{jt} + \gamma_j + \tau_t + \xi_{ijt}$

Using Ordinary Least Squares (OLS) regression to estimate the relation between neighborhood characteristics and infant health will yield potentially biased estimates because of unobserved neighborhood factors that may be correlated with both neighborhood characteristics and women's demand for substances, their health seeking behavior, and the health of their infants. For example, norms and attitudes towards violence and substance use in a neighborhood may be correlated with both its measurable characteristics, such as crime prevalence and number of bars and liquor stores, and women's proclivity towards smoking, drinking, and seeking adequate medical care during pregnancy. In order to obtain causal estimates of neighborhood effects on pregnancy and infant health, we propose including MSA fixed effects, γ_j.

This identification strategy assumes that unobserved neighborhood traits, e.g. norms and attitudes that are potentially correlated with neighborhood characteristics and health outcomes, are fixed (over time) and that accounting for these fixed effects allows us to make causal inferences about neighborhood effects on health. This method has two potential limitations. First, it is possible that unobserved neighborhood traits that we assume to be fixed are in fact time variant. While this is an important caveat to bear in mind, our assumption is defendable on grounds that if they do change, traits like norms and attitudes are likely to change slowly. Nonetheless, we will test the robustness of the results by replacing fixed effects with neighborhood controls that change over time and are correlated with norms and attitudes. Data on time-varying neighborhood factors, e.g., racial, educational, and income distribution in the neighborhood, are available in the Area Resource Files, with which the applicants are familiar. Second, the methodology does not completely account for the possibility that individuals hold information that may drive both their choice of neighborhood and health outcomes. In other words, unobserved individual factors, e.g. taste for substances, may be correlated with both the decision to locate in a neighborhood with high density of tobacco outlets and pregnancy outcomes, which may bias the results. This may not be too problematic as neighborhood fixed-effects account for the neighborhood average and a randomly selected woman's traits is likely to be highly correlated with the average traits of women residing in the neighborhood.

Datasets:

We will use the Natality Detail Files (NDF) as the primary data source. NDF is a compilation of birth certificates of the universe of children born in the U.S., approximately 4 million per year. The NDF provides information on the dependent variables in this analysis, infant health

outcomes (birthweight, gestational age, Apgar scores) and mother's prenatal health behaviors (timing of first prenatal care visit, the number of prenatal care visits, prenatal weight gain, tobacco use, and alcohol consumption). NDF reports mother's county and MSA of residence at the time of childbirth, which will serve as alternate definitions of neighborhood. We will use a subset of the most recent 10 years of the NDF data, 2001 through 2010, a time period long enough to capture changes in neighborhood factors. The NDF will be merged with data from the following sources to construct neighborhood measures:

Crime data: Starting in 1930, the U.S. Federal Bureau of Investigation has been collecting and publishing crime statistics from law enforcement agencies across the U.S. The Uniform Crime Reports (UCR) contains the counts of violent and property crimes reported, by city and county of occurrence. We propose using these data to construct the crime prevalence per 100,000 residents in the mother's county of residence. Since the threat of violent crimes and property crimes are likely to have a different effect on stress, we will include the two crime measures independently in the model.

Alcohol and cigarettes supply data: The U.S. County Business Patterns provides annual counts of establishments for each industry code in the county. We propose using the 6-digit North American Industry Classification System (NAICS) code to identify establishments that serve/sell alcoholic beverages and cigarettes in the mother's county of residence. NAICS codes 722410, 445310, and, 453991 identify drinking places, liquor and package stores, and tobacco outlets, respectively. Further, number of convenience stores, attached or not attached to gas stations (NAICS codes 447110 and 445120, respectively) and grocery stores (445110) will be considered as they may be relevant sources of supply, depending on alcohol laws in the mother's state of residence. Counts of such establishments per 10,000 residents will measure the supply of alcohol and tobacco, respectively, in the mother's county of residence. Further, county-level measures will be summed to obtain MSA-level supply of alcohol and tobacco, which will allow us to test the sensitivity of our results to alternate geographic definitions.

References:

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