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Prenatal investments, breastfeeding, and birth order

Kasey Buckles [a, b, *], Shawna Kolka [c]

[a] Department of Economics, University of Notre Dame, Notre Dame, IN, USA
[b] National Bureau of Economic Research, Cambridge, MA, USA
[c] University of Notre Dame, Notre Dame, IN, USA

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ABSTRACT

Mothers have many opportunities to invest in their own or their child's health and well-being during pregnancy and immediately after birth. These investments include seeking prenatal care, taking prenatal vitamins, and breastfeeding. In this paper, we investigate a potential determinant of mothers' investments that has been largely overlooked by previous research—birth order. Data are from the National Longitudinal Study of Youth 1979 (NLSY79) Child and Young Adult Survey, which provides detailed information on pre- and post-natal behaviors of women from the NLSY79. These women were between the ages of 14 and 22 in 1979, and form a nationally representative sample of youth in the United States. Our sample includes births to these women between 1973 and 2010 (10,328 births to 3755 mothers). We use fixed effects regression models to estimate within-mother differences in pre- and post-natal behaviors across births. We find that mothers are 6.6 percent less likely to take prenatal vitamins in a fourth or higher-order birth than in a first and are 10.6 percent less likely to receive early prenatal care. Remarkably, mothers are 15.4 percent less likely to breastfeed a second-born child than a first, and are 20.9 percent less likely to breastfeed a fourth or higher-order child. These results are not explained by changing attitudes toward investments over time. These findings suggest that providers may want to increase efforts to encourage these behaviors at women with higher parity. The results also identify a potential mechanism for the emergence of differences in health and other outcomes across birth orders.

1. Introduction

Mothers have many opportunities to invest in their own or their child's health and well-being during pregnancy and immediately after birth. For example, the American College of Obstetrics and Gynecology recommends that most women take a prenatal vitamin that includes folic acid and iron to reduce the risk of neural tube defects and anemia (ACOG, 2012). Receiving early prenatal care has been shown to decrease the likelihood of adverse birth outcomes, including prematurity (Evans and Lien, 2005; Subramanian et al., 2012). After birth, women may begin breastfeeding their child; the American Academy of Pediatrics recommends breastfeeding as a means to improve infant health and possibly increase neurodevelopment (AAP, 2005).

Given the value of these investments, previous research has attempted to identify characteristics that predict patient behavior. In their model of prenatal care utilization, Campbell et al. (1995) find that attitudes toward prenatal care, the pregnancy, and the provider were important indicators of actual usage of care. Dubay et al. (2001) show that the timing of prenatal care initiation varies by maternal race, education, and marital status. These three characteristics have also been found to be correlated with breastfeeding initiation, along with ethnicity, immigration status, and income (Disdieker et al., 1985; Celi et al., 2005; Singh et al., 2007). And while research on predictors of prenatal vitamin use is more limited, there is a vast literature that documents correlates of compliance with prescription medications (see Vermeire et al. (2001) for a review).

In this study, we investigate a potential predictor of pre- and post-natal investments in health and infant well-being that has received comparatively less attention: birth order. Birth order is easily observed by the provider, and there is reason to believe that women may not invest equally in children of different order, as previous work has documented differences in later-life investments. For example, Price (2008) shows that *within* families, later-life investments like time spent reading to or playing with a child are greater for first-born children (see also Monfardini and See (2012)).

* Corresponding author. Department of Economics, University of Notre Dame, Notre Dame, IN 46556, USA.
E-mail address: kbuckles@nd.edu (K. Buckles).

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If these differences in investments are a reflection of increased constraints on resources (time or financial) for higher-order births, we may see differences in very early investments as well. Mothers may also update their beliefs about the costs or benefits of certain investments with each successive pregnancy. We hypothesize that pre- and post-natal investments in health and child well-being will decrease for higher-order pregnancies. Evidence of such an effect would be useful for providers, as it would identify higher parity as a predictor of reduced investments in maternal or child health. Differences in investments by birth order could also contribute to observed birth order effects for later-life outcomes.

Two papers have explored this hypothesis in a developing-country context. Using variation across families, Guliani et al. (2012) find that higher-parity births in developing countries are less likely to take place in a health facility. In contrast, de Haan et al. (2012) find that in Ecuador, *later*-born children are breastfed for longer (and also have greater human capital). In a concurrent study, Lehmann et al. (2012) also use data from the NLSY79 to document birth order differences in prenatal care and breastfeeding rates, as well as smoking during pregnancy and early-life home environment. The focus of their paper is to examine the role of prenatal and early-life investments in explaining birth order differences in cognitive and non-cognitive test scores; the authors find that these differences explain little of the variation in test scores. Finally, Kristensen and Bjerkedal (2007) propose that differences in prenatal factors by birth order may contribute to differences in outcomes, but they are concerned with biological differences (specifically, due to exposure to maternal antibodies) rather than the behavioral differences studied here.

2. Data and methods

2.1. Data

Data on the mothers in our study come from the 1979 National Longitudinal Survey of Youth (NLSY79). The NLSY79 is a publicly available, nationally representative panel survey of persons who were ages 14–22 in 1979. Respondents were surveyed annually from 1979 to 1994, and have been surveyed biennially since. The most recent data available are from the 2010 survey, when the respondents were ages 45–53—so that for women, complete fertility histories are observed. In fact, over 99 percent of births used in this study occur by 2002. Data on prenatal care behaviors, breastfeeding, and child characteristics come from the NLSY79 Child and Young Adult Survey (NLSY-CYA), which is a separate survey that collects information on all children born to women in the original NLSY79. The two surveys together give us a panel data set with multiple observed pregnancies for each mother, which is important for the estimation strategy described below.

We limit the NLSY79 sample to women who have more than one birth. This leaves us with 3755 women (60 percent of the original NLSY79 women), who have a total of 10,328 children. For some of the analysis, we stratify the results by family size. 52 percent of the women in our sample have 2 children, 30 percent have three children, and 18 percent have four or more children.

Missing data on prenatal vitamin use, prenatal care, and breastfeeding cause twenty-two, thirteen, and six percent of the data to be dropped from the regressions for those outcomes, respectively. This could cause our regression estimates to be biased, if missingness is correlated with either the dependent or independent variables (Lynch, 2003). Because the prenatal care and breastfeeding samples have fewer missing observations and the included and omitted samples have similar socio-economic status, we believe that our estimates for those investments are not biased by missing data. However, those who have missing prenatal vitamin data have less education, are less likely to be married at the time of the birth, and are more likely to be black than the regression sample. This leads us to conclude that the data on vitamin use are not *observed at random*, as missingness is correlated with observed characteristics (Lynch, 2003). This type of missingness will cause bias if the model is incorrectly specified. The data may also be *missing at random*, if missingness is correlated with vitamin use. We cannot test for this type of missingness, but if it exists, our estimates will be biased. Possible strategies for addressing the issue include selection correction models and alternative data sources, but we were unable to find data that meet the requirements for these methods. Our results for vitamin use should therefore be interpreted with caution, as they are only consistent under the assumptions that the model is correctly specified and the data are missing at random.

2.2. Methods

To investigate the relationship between birth order and early investments, we begin by estimating multivariate regression models using ordinary least squares (OLS). Our dependent variables are dummy variables indicating specific investments, so we estimate linear probability models. The independent variables of interest are dummies indicating that the child has birth order of two, three, or four or more. The OLS regressions include controls for mother's age and marital status at birth, child gender, and dummies for child year of birth. These characteristics are chosen to be consistent with our preferred fixed effects model, described below. It is particularly important to include the controls for year of birth, to avoid conflating birth order effects with cohort effects that might exist if technologies, recommendations, or attitudes toward certain investments change over time.

The OLS estimates will identify population-level differences in investments by birth order. However, the results of this analysis will not tell us whether the average mother has different levels of investment in her own children across birth orders. To see this, suppose that mothers of four are less likely to make investments than mothers of two. We would observe lower rates of investment for fourth-born children on average than for second-born children, even if mothers invest in each of their *own* children equally. For this reason, our preferred estimates are from a fixed-effects model, in which the coefficients are estimated using only within-mother variation in investments across birth order. Intuitively, the fixed effects estimates tell us whether the average mother is less (or more) likely to invest in her own later-born children. An additional advantage of the fixed effects approach is that it eliminates the need to control for time-invariant characteristics of the mother (like race, family background, or chronic health conditions). We do continue to control for observable characteristics that may change across births, like the mother's age, marital status, and child gender. We have estimated specifications including controls for employment status and family income at the time of each birth; the coefficients are very similar but are less precisely estimated because the sample size falls by about one-third. (We were unable to include controls for health insurance status because this information is unavailable for nearly two-thirds of the births in our sample.) Importantly, secular trends in (for example) health insurance coverage rates will be captured by our year-of-birth dummies, and life-cycle trends in (for example) income will be captured by our controls for mother's age.

For our fixed effects estimates, we show results for the full sample and separately by family size, to determine whether any relationship between birth order and investments is driven by large or small families. In all results, we use sampling weights to produce estimates that are nationally representative. Standard errors for the