Breast Is Best: Estimating the Long-term Consequences of Breastfeeding for Childhood Wellbeing Using Sister Comparisons

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Introduction

Since the 1970s, breastfeeding has witnessed an unsurpassed resurgence. It is now commonplace for expectant and new mothers to be counseled from a myriad of sources claiming "breast is best" for their infant. Besides being the most economical choice for feeding a newborn, it is thought that human breast milk offers infants a nutrient rich, easily digestible form of nourishment that will contribute to beneficial outcomes both during the perinatal period and for many years to come.

There is no question that in the short-term, human breast milk provides additional immunity; protection against respiratory infections, gastrointestinal illnesses, and sudden infant death syndrome (SIDS); and opportunities for the mother and baby to bond that artificially derived formula does not (Belfield and Kelly 2006; Hediger et al. 2001). Furthermore, breastfeeding contributes to maternal health by easing hormonal fluctuations, promoting postnatal weight loss, and providing protection against the development of certain types of reproductive cancers (Ip et al. 2009). Despite commonplace wisdom and anecdotal evidence among medical practitioners, public health professionals, and breastfeeding advocates, the empirical evidence concerning the effects of breastfeeding on long-term childhood wellbeing remains unclear (Der et al. 2007; Wise and Titus-Ernstoff 2010). This is primarily a function of the fact that, on average, children who are breastfed are distinctly different from their bottle-fed counterparts. These two groups tend to differ along several demographic dimensions that are simultaneously associated with infant feeding practices as well as long-term developmental and health trajectories. Thus, comparisons of breast- and bottle-fed infants are likely to capture endogenous factors such as exposure to poverty, substandard neighborhoods and housing, crime, ineffective schooling, etc. rather than reflect the true effect of breastfeeding on subsequent childhood wellbeing.

The overarching objective of this study is to estimate the extent to which breastfeeding positively influences developmental and health outcomes among children and adolescents in the United States. In order to tease out the influence of endogenous social and economic conditions from the "true" effects of breastfeeding we rely on a multipronged analytic strategy that includes multivariate regression techniques, propensity score matching, and fixed effects analyses based on sibling comparisons. Each additional statistical approach offers a more rigorous test of the hypothesis that breastfeeding contributes to enduring developmental and health trajectories by more closely approximating the counterfactual question – what would the health of this particular infant be like if he/she had not been breastfed.

We analyze data from the National Longitudinal Survey of Youth – Young Adults to investigate the impact of breastfeeding on the long-term childhood wellbeing of White, African American, and Hispanic children in the United States. The specific aims of this study are as follows:

1. To estimate the association between breastfeeding and subsequent mental health, physical health, and cognitive functioning among school aged children and adolescents.

2. To determine the extent to which the positive association between breastfeeding and long-term child wellbeing is attributable to endogenous social and economic factors that confound the relationship between infant feeding practices and childhood outcomes.
3. To examine whether or not the effect of breastfeeding on childhood wellbeing, after applying rigorous statistical controls such as propensity score matching and sibling comparisons, differs over time.
4. To examine whether or not the effect of breastfeeding on childhood wellbeing, after applying rigorous statistical controls such as propensity score matching and sibling comparisons, differs according to racial/ethnic group.

Background and Significance

In 2005, the American Academy of Pediatrics (AAP) updated its original policy statement concerning the benefits of breastfeeding. In doing so, it purported to reflect and summarize findings from a substantial body of research that employed "improved epidemiologic methods and modern laboratory techniques" to provide evidence for "diverse and compelling advantages for infants, mothers, families, and society from breastfeeding and use of human milk for infant feeding" (American Academy of Pediatrics 2005). The long list of child health benefits detailed in this document include infectious diseases common during the first year of life such as otitis media, diarrhea, and respiratory tract infections as well chronic illnesses that typically emerge in older children such as type I and II diabetes mellitus; lymphoma & leukemia; overweight and obesity; hypercholesterolemia; and asthma. The AAP also notes that breastfeeding has been associated with a lower risk of both sudden infant death syndrome (SIDS) and infant mortality.

Healthy People 2020, which provides *empirically based* population health objectives to improve wellbeing for all Americans, has once again declared breastfeeding to be a priority by hoping to increase the percent of mothers who report ever breastfeeding from 74% to 82% and report breastfeeding at 6 months from 44% to 61% (US Department of Health and Human Services 2010). Moreover, medical professionals and public health advocates, including the American College of Obstetrics and Gynecologists, American Academy of Family Physicians, the World Health Organization, and the United Nations Children's Fund, are not simply recommending that new mothers breastfeed their infants; rather, they are hoping to ensure that children exclusively receive only human milk (as opposed to formula, water, juice, or foods) during the first 6 months of life (Volpe Holmes et al. 2011).

Clearly, these recommendations are meant to promote the wellbeing of both mothers and their newborns. However, the conclusions upon which these policy initiatives are based (1) are overwhelmingly drawn from observational studies that cannot rigorously control for unobserved heterogeneity between children who are breastfed and those who are not and (2) tend to be inconclusive with regard to health conditions that emerge later in the lifecourse - for example, among school-age children or teenagers as opposed to infants.

On the whole, observational studies suggest that children who were breastfed are significantly less likely than their bottle-fed counterparts to be classified as obese (Armstrong et al. 2002;

Gilman et al. 2001; Hediger et al. 2001), develop juvenile diabetes (Young et al. 2002) or chronic asthma (Oddy 2004); and be diagnosed with childhood cancers (Davis 1998). Moreover, infant feeding practices appear to be significantly associated with cognitive ability during childhood, such that full-term infants who are breastfed tend, on average, score approximately 4 points higher on IQ tests administered to them during elementary school (Anderson, Johnson, and Remley 1999). However, these findings appear less conclusive upon more recent rigorous evaluation.

For example, Baker and Mulligan (2008) use reforms in Canadian maternity leave mandates to approximate a natural experiment and conduct difference in difference analyses to estimate the effect of breastfeeding on a wide range of infant health outcomes during the first 24 months post-partum. Although these policy initiatives led to significant increases in the duration of breastfeeding, the authors fail to find consistent evidence to support the notion that infant feeding practices influence subsequent child health outcomes such as ear infections, allergies, and asthma. Similarly, Evenhouse and Reilly (2005) rely on sibling comparisons from the National Longitudinal Survey of Adolescent Health (AddHealth) to better account for unobserved social and economic factors that are likely to confound the relationship between the likelihood that a child was breastfed and his/her subsequent wellbeing. Out of 15 possible disparate psychological, physical, and developmental outcomes that range from body mass index (BMI) to depression to grade point average (GPA), duration of breastfeeding appears to be significantly associated with only a single measure of school performance – the Peabody Picture Vocabulary Test. Even one of the most widely accepted notions concerning the positive effects of breastfeeding - its beneficial contributions to neurological and cognitive development – is being challenged by recent research. In their meta-analysis of the literature concerning breastfeeding and intelligence, Der et al. (2009) reveal that of 431 original citations, only 12 unique studies controlled for parental IQ. Furthermore, once potential confounders were more rigorously controlled, breastfeeding ceased to have an advantageous effect on childhood cognitive functioning.

Data & Methods

Description of the Data and Measures

The National Longitudinal Study of Youth (NLSY79) is a nationally representative cohort study that contains information from 12,686 young men and women who were 14-22 in 1979. Although this study was first commissioned to explore the labor market experiences of young adults as they transitioned from school to work, a great deal of data concerning the pre- and post-natal experiences of women as they became mothers has also been collected. In 1986, a separate survey of all children born to original NLSY79 female respondents was initiated, thus, dramatically expanding the amount of demographic, developmental, and health information available for analysis. The NLSY79 Children and Young Adult Survey (NLSY-CYA) has employed a wide variety of measures, including home observations carried out by the interviewer, to assess the cognitive, psychological, and physical functioning of respondents as they move through childhood and adolescence. For children younger than 10, much of these data are collected through maternal report. For children older than 10, a

majority of this information is obtained from the participants themselves. Respondents have been reinterviewed biennially since 1986, resulting in 12 waves of publically available data.

For the purpose of this study, children's wellbeing is defined along three separate dimensions – mental health, physical health, and cognitive ability. Mental health is quantified using a 7-item subset of the Center for Epidemiologic Study Depression Scale (CES-D), while physical health is determined by a general measure of self- or parent-rated health. Respondents or their parents are asked to rate the condition of their present health according to the following categories: poor, fair, good, very good, and excellent. We assess cognitive functioning by means of three individual measures: the Peabody Picture Vocabulary Test – Revised (PPVT-R), the Peabody Individual Achievement Test – Math (PIAT-M), and the Peabody Individual Achievement Test – Reading (PIAT-R). Question wording of all dependent variables remains consistent across the 12 waves of survey data.

The primary independent variable of interest concerns infant feeding patterns employed by the mother. We rely on two questions to assess breastfeeding practices. The first asks mothers to report if they ever breastfed (When {child} was an infant, did you breastfeed {him/her} at all?), while the second inquires about the duration of breastfeeding (How many weeks/months old was {he/she} when you quit breastfeeding {him/her} altogether?). We also include a number of demographic control variables, which capture the social and economic environment both at the time of the respondent's birth as well as over his/her early lifecourse, in multivariate analyses to control, at least in part, for characteristics that are likely to confound the relationship between likelihood of breastfeeding and subsequent child wellbeing.

Analytic Strategy

Consistent with the specific aims and theoretical underpinnings of this study, we estimate causal models, test hypotheses, and produce summary measures of risk conditioned on the likelihood of having been breastfed. Our analytic approach contains three types of models, each of which provides a more stringent method to control for the unobserved heterogeneity that is known to exist between children who are breastfed as opposed to bottle-fed. First, we rely on multilevel regression techniques with random coefficients for time (ie. growth curve models) with a set of statistical controls to estimate the long-term term effect of breastfeeding on childhood mental health, physical health, and cognitive ability. In the second set, we employ propensity score matching to identify pairs of children in the sample that most resemble one another on a wide range of demographic characteristics that are likely to confound the association between infant feeding practices and child wellbeing. Finally, we use sibling comparisons, in which one respondent was breastfed while the other was not; to more accurately capture the "true effect" of breastfeeding on long-term outcomes over the early lifecourse.

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