Non-marital Fertility, Child Health, and Marriage: Do Adverse Birth Outcomes Alter a Woman's Probability of Marriage?

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The past few decades have witnessed an ongoing rise in the rate of low birth weight (<2500 grams) deliveries (Arias et al. 2003; Martin et al. 2003) in the United States. At the same time, there has been a spectacular rise in non-marital fertility, both in absolute numbers and in the proportion of all births that occurred to unmarried women (Ventura and Bachrach 2000; Ventura et al. 1995). These developments have received extensive study. However, few researchers have explored the effects of early child health on marriage, and almost none have examined such effects on the probability of marriage for an unmarried mother.

Of particular concern to health-care workers and researchers, the annual percentage of U.S. births that were very low birth weight (VLBW: <1500 grams) rose from 1.15 to 1.45 between 1980 and 2002, an increase of more than 25 percent (Martin et al. 2002). Compared to normal or moderately low birth weight infants, these very small newborns have a greatly increased risk of early mortality, although the annual infant mortality rates of VLBW infants has continued to decrease (MacDorman et al. 2005). Surviving VLBW infants are more likely to suffer significant debilitating consequences (McCormick 1985; 1992) and to demand expenditures from their parents that are over 10 times greater than those of normal weight infants (Hack 1995; Rogowski 1998).

Non-marital childbearing has increased even more dramatically over the past three decades. Alongside other changes in marital patterns, this has generated a great deal of debate and a mix of opposing views. The percentage of all births to unmarried women rose from 12% in 1970 to 33% in 2000 (Martin et al. 2002; Sigle-Rushton and McLanahan, 1992). Certain groups have shown greater change; for example, over two-thirds (69%) of births to black women are non-marital, and women from more disadvantaged family backgrounds have higher risks of nonmarital childbearing. There have also been rises in the age at first marriage, the median age of childbearing, and non-marriage (Bramlett and Mosher 2002; Goldstein and Kenney, 2001; Graefe and Lichter, 2002; Waite et al. 2000). Much research has been conducted on the salient consequences of non-marital fertility on subsequent marital formation and dissolution (Upchurch et al., 2001; Carlson et al., 2004) and of changes in marital stability and economic well-being for early experiences of children (Bumpass and Lu, 2000). In contrast, very little attention has been directed toward the effects of poor child health on marital or family stability, especially on the marital prospects of unwed mothers.

Only several studies in the social science literature have explored this issue, mostly using earlier rounds of the National Health Interview Survey's (NHIS) Child Health Supplement (Mauldon, 1992; Corman and Kaestner,1992; Joesch and Smith, 1997). These studies have found that married couples are more likely to divorce when their child has a severe health problem. Corman and Kaestner (1992) also found that having an unhealthy child decreases the likelihood that a woman will be married, especially for white women who were married at the time of the child's birth and for black women who were unmarried at that time. More recently, Reichman et al. (2004) used data from the Fragile Families and Child Wellbeing Study from 20 U.S. cities (thereby over-representing children and families of low socioeconomic and health status) and found that the probability that the parents still lived together 12-18 months following a birth fell by 10 percentage points among those couples who had an unhealthy child.

This limited set of papers is handicapped by a few methodological limitations. In particular, all use child health information that is self-reported by the mother, a problem that we are able to overcome in the present study, as discussed further below. Moreover, the data from the NHIS and the Fragile Families surveys do not contain a sufficient number of VLBW babies for analysis. This sub-group of children is particularly relevant for our purposes because several studies have documented the negative health, educational, and earnings potential of these VLBW babies. We are also able to surmount this limitation in our study. In addition, we note that although psychologists have explored this topic, such studies continue to be plagued by small samples and limited multivariate techniques.

Focusing on non-marital births, we examine whether poor child health affects the likelihood of marriage. In particular, we focus on the extent to which VLBW babies resulting from non-marital fertility alter the future probability of marriage for these unwed mothers. Since VLBW is likely to capture only specific dimensions of child health, we also consider other measures of poor child health such as cerebral palsy, Apgar scores, child height, and congenital health problems.

*A*mong several hypotheses examined, we posit that non-marital childbearing of VLBW children reduces the marriageability of young mothers in the marriage market. Unwed childbearing of VLBW babies could, for example, reduce a woman's access to potential marital partners and cause her significant economic and psychological burdens. A male suitor would face additional emotional, economic and social costs of marrying a mother of a VLBW baby (as opposed to a mother of a normal birth weight baby). In short, unwed childbearing of VLBW children is likely to reduce a woman's probability of marriage relative to unwed childbearing of normal VLBW children. Yet, to our knowledge, no study has so far empirically established this as a fact.

In this paper, we attempt to establish the "causal" effect of VLBW children born to unwed mothers on the probability of marriage of these women. Because of the possibility that high risk mothers' are both likely to deliver VLBW children and also remain unmarried, it is important to distinguish between a merely associative relationship between VLBW children born to unwed mother's and probability of marriage, and a "causal" relationship whereby VLBW children may alter the probability of marriage.

DATA

We use data from the 1988 National Maternal and Infant Health Survey (NMIHS), which employed a stratified, systematic sampling scheme. The universe of the NMIHS sample included women between the ages of 15 and 49 who had a pregnancy outcome in 1988. Women that delivered VLBW babies were over sampled. Women were mailed questionnaires by the National Center for Health Statistics and nearly 70 percent of the women mailed back the completed questionnaires about 17 months after the birth of the baby in 1988. For live births, there were six sampling strata by race (black, non-black) and birth weight (<1500 grams, 1500-2499 grams, 2500+ grams). In order to assure a representative sample by variables such as age of the mother and marital status, implicit stratification was employed (i.e., after the live birth records were stratified, further sorting of the vital records was done by age of the mother and marital status within each of the live birth strata).

Our data hold at least two major advantages over the NHIS and the Fragile Families datasets. First, the NMIHS contains an adequate number of VLBW babies, whereas the NHIS and Fragile Families data lack a sufficient number of such cases. Moreover, because the NHIS information on VLBW status of the baby is derived directly from the birth certificate, it is less likely to be plagued by measurement error. A second problem with the NHIS or the Fragile Families data is that they use the mother's report of the child's health status. The existence and consequences of measurement error in health has been explicitly shown in recent work by Bound et al (2001). An advantage of our data is that for several child health indicators, we have information from both the mother as well as the medical provider. Treating the provider data as objective indicators of child health, we can alleviate the bias caused due to measurement error in the self-reported health indicators.

Since we are interested in analyzing marital transitions from an unmarried state to marriage, we selected only those women that were unmarried at the time of delivery. From this sample of 9000, we then restricted our sample to only those women (n=6580) that delivered a live birth infant (excluding those in the infant and fetal death files) in 1988. Recognizing that parity and the birth outcomes and health care needs of previously delivered children may significantly influence the probability of a divorce, we further reduced our sample to primiparous women in order to assure more precise control for these potentially confounding factors. This restricted our sample size from 6580 to 1993 women. Since this represented a significant drop in sample size, we tested for differences in the mean value of covariates across the two groups (primaparous versus not primaparous). We found no significant differences in any of the covariates except mothers' age at the time of interview where, as expected, the primaparous group was comprised of slightly younger women.

At the time these women (unmarried at baseline) responded to the "follow-back" survey (8 to 18 months after the delivery), they were again asked about their marital status. They could respond in one of the following ways: married, unmarried. The two categories are used in our discrete time hazard model discussed below. If they reported a marriage, the women were also asked to report the exact year and month of the event and this piece of information allows us to construct full event histories for each woman in our sample.

MODELLING STRATEGY

We use a discrete time hazard model for analysis (Singer and Willet 2003). The event history for a woman was recorded using a sequence of dummy variables, Y_{ij}, where i indexes woman and j indexes time period.

$$Y_{ij} = \begin{cases} 0 & \text{if woman is not married in month j after delivery of baby in 1988} \\ 1 & \text{if woman is married in period j after delivery of baby in 1988} \end{cases}$$

The sequence of Y values can take on one of two possible patterns. First, the Y's will be zero in every time period including the last, indicating that the woman was never divorced or separated during the time period through which we follow her. Second, if the woman was not censored, there will be a sequence of zeroes terminating in the value one. Once the value one occurs, no more data is used for this woman.

The proposed discrete time hazard model with the probit link is written as:

$$(Y_{ij}) = \alpha_8 D_8 + ...\alpha_{18} D_{18} + \beta_1 VLBW + \beta_2 VLBW * time + \beta_3^{'} X + u_{ij} \quad (1)$$

The hazards are conditional probabilities in the discrete time hazard model. The discrete time hazard model is modeled here as a series of probit regressions, one for each month from month 8 to 18. Thus, $D_8....D_{18}$ is a series of dummy variables for each month after delivery of the infant. The standard errors on the coefficients are corrected for the stratified sampling design.

Such a model implies a baseline hazard representing the probabilities of event occurrence at each period and a shift due to covariates. We allow for an interaction between time and the VLBW dummy variable, because we postulate that the effects of VLBW *may* vary over time. Thus, we assume that the effect of a VLBW child on the hazard of marriage either increases or decreases in a linear fashion. This is a reasonable assumption for the 18 month time span following birth, but analysis using a longer follow-up period must consider the possibility of non-linear VLBW-time interactions. While the model is here written with VLBW as the independent variable, we are also exploring alternate measures of child health (Apgar scores, child height, congenital health problems, and cerebral palsy).

We jointly model the VLBW/child health and marriage equations, to allow for the possibility that the poor child health variable could be jointly determined with the outcome (the probability of marriage). This could occur if for example, women who bear children out-of-wedlock find themselves considered to be less suitable for marriage due to such factors as poor emotional adjustment, interpersonal problems, or economic difficulties. Such characteristics may reduce the likelihood that they will marry regardless of whether they give birth to a VLBW child out-of-wedlock or not. Thus, to identify the model, we require instrumental variables. The mother's birth weight is a valid instrument in the VLBW/child health equation if we control for the mother's current weight in the marriage equation. In addition, another set of potential instruments include state level health infrastructure such as the per-capita number of obstetricians/gynecologists. The VLBW/child health equation is:

$$VLBW = \alpha_1 Mombw + \alpha_2 Hlth\inf ra + \alpha_3 X + u_{bw} \quad (2)$$

We jointly model equations 1 and 2 while accounting for correlation in the error terms. Equation 2 will be estimated as a probit when the outcome is discrete (such as for VLBW), but alternate models will be estimated depending on the nature of the outcome (negative binomial in case of a count of health limitations, or a continuous model in case of apgar scores). We estimate the model using Full Information maximum likelihood assuming joint normality of the error components. We will test for sensitivity of our estimates to the joint normality assumption by using the discrete factor method suggested by Mroz (1999).

INITIAL FINDINGS

Two of the authors have recently completed a study using the same data set. In particular, we have estimated the effect of the VLBW baby on the probability of marital dissolution conditional on the mother being married at the time of delivery. This paper assumed that VLBW is an exogenous variable in the hazard equation. We find that relative to a normal birthweight baby, the presence of a VLBW child elevates the risk of marital dissolution. In particular, only 90 percent of the marriages survive at 18 months after delivery of a VLBW infant, while about 99 percent of the marriages survive following the delivery of a normal birthweight baby. However, the adverse effect of VLBW reduces over time lending support to the view that families adapt over time. In particular, 18 months past delivery, no differences are observed in dissolution probabilities.

The present study analyzes the transition from the unmarried to married state, while simultaneously accounting for the endogeneity of VLBW/Child Health. In preliminary work for the present paper, we find that the probability of marriage at 18 months post-delivery is 18 percentage points higher for unwed mothers that deliver a normal birthweight baby than for those that deliver a VLBW baby. This finding suggests that an associative link might exist between VLBW and marriage probabilities. The goal of this paper is to understand how this difference in probability changes over time, when a more extensive set of control variables is included, and when VLBW is modeled as a potential endogenous variable.

We believe this work represents a significant conceptual and methodological advance over past research on this important topic, which remains woefully understudied to date.

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