Does Marriage Really Matter?
Investments in Prenatal Care and Birth Outcomes[⊗]

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Abstract

Nonmarital childbearing has increased dramatically in the United States in recent decades. A great deal of attention has been paid by both academics and policy makers to this increase, in part because of concerns that having a single mother negatively affects child outcomes. We use the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) to investigate whether marriage is associated with greater investments in prenatal care and better birth outcomes, and the extent to which this "marriage effect" is heterogeneous. Our results suggest that marriage is significantly and positively correlated with investments in prenatal care and birth outcomes. However, we find a great deal of heterogeneity in these relationships. Unmarried motherhood among educated mothers (those with a college degree or higher) is not associated with lower levels of investment in prenatal care nor with negative birth outcomes. There is also heterogeneity across racial and ethnic groups in the marital status effect that differs by which outcome is being examined. We also find that including observable characteristics and addressing unobserved characteristics reduces but does not eliminate the positive correlation between marital status and prenatal care investments, but that these remaining differentials in investments do not appear to translate into significant differences in infant health outcomes. This variation in marital status effects suggests that the benefits of marriage may be overstated, and that policy efforts to improve children's well-being through promoting marriage might be reexamined to take this into account.

Keywords: Marriage, Investments in Prenatal Care, Birth Outcomes, Maternal Education, Race and Ethnicity

I. Introduction

Nonmarital childbearing has increased dramatically in the United States in recent decades. In 1980, 18.4% of births occurring in the United States were to unmarried women. By 2004, this percentage had almost doubled, to 35.8%. For first births, the numbers are even more dramatic, as 43% of all first births in 2004 occurred to unmarried women. A great deal of attention has been paid by both academics and policy makers to this increase, in part because of concerns that having a single mother negatively affects child outcomes (e.g., McLanahan and Sandefur, 2004). These concerns are reflected by the current administration's Healthy Marriage Initiative, which provides federal funding for pro-marriage programs. Since states have a great deal of autonomy in designing these pro-marriage programs, understanding the role played by marriage in children's well-being has become increasingly important from a policy perspective.[1] However, one concern with many analyses of the relationship between marital status and children's well-being is that marital status is strongly correlated with a wide variety of other factors that might be expected to affect outcomes. These correlations make it difficult to assign causality to the relationship between marital status and outcomes.

In this paper, we use the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) to investigate whether marriage is associated with greater investments in prenatal care for all mothers, and whether it is associated with better early health outcomes for all children. We first document correlations between marriage and the use of prenatal care and protective prenatal behaviors by mothers, and between marriage and subsequent birth outcomes. We then examine the extent to which this "marriage effect" is heterogeneous. We explore whether the estimated effect of marriage varies significantly by the mother's educational attainment and by her race and ethnicity. We then analyze the degree to which these positive correlations between being

[1] See, for example, Gardiner et al., 2002.

married and outcomes can be "explained" by the inclusion of other factors correlated with both marital status and behaviors and birth outcomes, including household income, health insurance status, and pregnancy plannedness. Finally, we examine the extent to which the positive effects of marriage may be due to differences in unobservable characteristics between the married and unmarried by comparing married mothers to a more similar group: unmarried mothers who get married by their children's second birthday. Our regressions are purely descriptive and do not estimate causal effects. However, if the estimated "marriage effect" is not robust, and it varies widely along these dimensions, this may provide us with more information about how we should interpret the relationship between marriage and children's well-being.

Our results suggest that marriage is significantly and positively correlated with investments in prenatal care and birth outcomes. However, we find a great deal of heterogeneity in these relationships. Unmarried motherhood among educated mothers (those with a college degree or higher) is not associated with lower levels of investment in prenatal care nor with negative birth outcomes. There is also heterogeneity across racial and ethnic groups in the marital status effect that differs by which dependent variable is being examined. We find that including observable characteristics and addressing unobserved characteristics reduces but does not eliminate the positive correlation between marital status and prenatal care investments, but that these remaining differentials in investment do not appear to translate into significant differences in infant health outcomes. This variation in marital status effects suggests that the benefits of marriage may be overstated, and that policy efforts to improve children's well-being through promoting marriage might be reexamined to take this into account.

II. Background

Biblarz and Raftery (1999) summarize a number of theories that would predict a relationship between family structure and child outcomes. Both sociological and economic theories predict that children in single-parent families will receive fewer resources (social, economic, and cultural) and lower levels of investment than children in two-parent families. A significant amount of empirical research has examined potential effects of family structure on child outcomes (see Ribar (2003) and Sigle-Rushton and McLanahan (2004) for surveys of this literature), and generally finds unmarried motherhood to be correlated with a wide variety of negative child outcomes.

A subset of these papers specifically look at the relationship between maternal marital status and either prenatal care investments or infant health outcomes and tends to find that unmarried mothers invest less in prenatal care, and have infants with worse health outcomes (e.g., Abel, 1996; Ahmed, 1990; Albrecht et al., 1994; D'Ascoli et al., 1997; Warner, 1995). However, other papers find that the effects of marital status on investments in prenatal care and infant health outcomes vary significantly by maternal demographic characteristics such as race and ethnicity. Previous work by Bennett (1992) based on data from North Carolina from 1968 to 1985 suggests that differentials in birthweight and infant mortality by marital status are generally smaller for African-American women compared to non-Hispanic White women. Bennett et al. (1994) examine infant mortality from 1983 to 1985 using nationally linked birth and death data files, and find the effects of single motherhood on infant mortality vary systematically by both race and age. For Black teenage mothers, marital status does not seem to affect infant mortality, but marital status played a role that was increasingly important as Black mothers age. However, Albrecht et al. (1994) use data from the 1988 National Maternal and Infant Health Survey and

find much smaller effects of family structure for both non-Hispanic Black and non-Hispanic White families on both adequacy of prenatal care and infant birthweight. Albrecht et al. (1994) do find that married Hispanic women are significantly more likely to receive adequate prenatal care. Thorburn Bird et al. (2000) use data from the 1995 National Survey of Family Growth, and find that among non-Hispanic Black women, marital status is not a significant predictor for low birthweight. However, they find that Hispanic unmarried women are at higher risk of delivering low birthweight infants than their married counterparts, and that for non-Hispanic White women, unmarried women were *less* likely to have low birthweight infants than their married counterparts.[2] In sum, these papers provide mixed evidence on racial and ethnic differences in the effect of marriage.

Most recently, a paper by Osborne (2007) uses data from the Fragile Families and Child Well-Being Study (FFCWS) to examine the relationship between family structure and children's early exposure to a wide range of 21 risks including low birthweight, living in a household less than 150% of the poverty line, maternal age less than 21 years, and presence of children from previous relationships. In addition to examining racial and ethnic differences in the effect of marriage, Osborne also allows for differential effects of marital status by maternal educational attainment. This paper finds that for each educational level and each racial and ethnic group, children born to married mothers are exposed to fewer risks as compared to children born to cohabiting or single parents. Further, marriage is more protective for children born to non-Hispanic White mothers compared to non-Hispanic Black and Hispanic mothers. Osborne (2007) therefore concludes that while the effects of marriage are heterogeneous across groups,

[2] A related literature exists examining racial differences in the effects of marriage on economic outcomes and relationship stability (e.g., Manning and Brown, 2006; Osborne, Manning and Smock, 2007), and finds that the advantages of marriage are generally smaller for African-American women, and can often be explained by controlling for individual characteristics.

marriage is a protective environment for all children. However, the FFCWS is a sample of urban, primarily unmarried, mothers that oversamples low income and minority populations, so Osborne (2007) is faced with small sample sizes in some cells.

One problem with much of the existing literature is that unmarried mothers come disproportionately from disadvantaged populations. As a result, it may be difficult to disentangle the effects of marital status from a number of other factors, either observed or unobserved, that are correlated with both marital status and child health outcomes.[3] There is an ongoing debate regarding how to interpret the estimates of the effects of single parenthood on children's well-being. They can not be interpreted as causal if family structure is endogenous, that is, if there are unobserved characteristics that are correlated with both family structure and child outcomes (Ginther and Pollak, 2004). Papers that use either sibling comparisons or instrumental variables techniques to estimate the effects of family structure on outcomes have found mixed results, with some papers estimating negative effects of family structure, and other papers finding no effects.[4]

Because studies that use sibling comparisons or instrumental variables produce mixed findings, in this paper, we build on the insights of previous work by Bennett (1992), Albrecht et al. (1994), Bennett et al. (1994), Thorburn Bird et al. (2000), and Osborne (2007) in examining the heterogeneity of the marriage effect. We use a recent nationally representative data set with large sample sizes for subgroups of interest including maternal education and race and ethnicity, which allow for more precise estimates of marriage effects for these subgroups. We also have information on a comprehensive set of outcome variables, which we examine individually, and

[3] Geronimus and Korenman (1993) make this same argument regarding teen motherhood. They show that teen motherhood is correlated with lower investments in prenatal care as well as worse infant health outcomes. However, when they use a sisters-based regression framework to control for family background, they find that the negative "teen" effect is largely eliminated.

[4] See Björklund and Sunsdström (2006), Case, Lin and McLanahan (2001), and Ginther and Pollak (2004) for sibling-comparison models, and Finlay and Neumark (2008), Gruber (2004), Gertler et al. (2004), and Lang and Zagorsky (2001) for instrumental variables and natural experiment approaches.

control variables such as health insurance status and pregnancy plannedness. Finally, we investigate how the relationship between marital status and our outcomes of interest is mediated by both observable and unobservable characteristics. However, despite our attention to these characteristics, our regressions should still be thought of as descriptive. They are not meant to imply a causal relationship between marriage and our outcomes of interest. Instead, they are aimed at investigating how much of the observed relationships can be explained by other variables that are correlated with both marital status and outcomes, as well as how robust the estimated "marital status effect" is across subgroups.

III. Data

The ECLS-B is a longitudinal data set collected by the National Center for Education Statistics (NCES). The baseline sample of approximately 10,700 out of 14,000 selected children was designed to be nationally representative of children born in 2001 with an over-sample of Asian and American Indian children, twins, and low and very low birthweight children.[5] The ECLS-B follows children from birth through kindergarten with data collection occurring when the child is 9 months of age, 2 years of age (2003), approximately 4 years of age (at pre-school, Fall 2005), and at kindergarten entry. The 9-month data collection also includes variables from infants' birth certificates. To date, the first three waves (9-month, 2-year, and 4-year data collection) of survey data are available. With the exception of marital status at two years after birth and maternal country of birth, data from the first wave are used in the analysis.[6]

[5] The reported sample sizes have been rounded to the nearest 50 per NCES restrictions regarding disclosure of restricted use data. However, the analyses and statistics presented in the tables and text are generated using all observations in each subsample.

[6] For additional information on the ECLS-B, see the survey instruments available from NCES at http://nces.ed.gov/ecls/Birth.asp.

The ECLS-B data are ideal to use for this study. Given the broad motivations of the ECLS-B which include understanding children's health care and outcomes, growth and development, transitions to child care and early childhood education programs, and school readiness, these data are quite rich. In the first wave of data, information is collected from children and both parents, including non-residential fathers. Information from birth certificates is included with the first wave of data. Relevant to this study, information is collected about prenatal care behaviors and birth outcomes as well as maternal and household characteristics such as household income, health insurance status, and pregnancy plannedness. Variables used in this study come from the birth certificate data, the nine-month survey, or are derived from both sources. Appendix Table 1 outlines the source of each variable used.

To perform our analysis we construct an analysis sample of approximately 8,300 births that contain non-missing values for any of our dependent or independent variables. We exclude approximately 2,400 births with missing values for the following variables: maternal education, maternal race and ethnicity, maternal age at birth, first birth, pregnancy plannedness, health insurance status, weeks at pregnancy recognition, adequacy of prenatal care, tobacco and vitamin consumption during the prenatal period, birthweight status, prematurity, and whether the infant spent any days in the hospital after birth due to medical problems. While most variables have a small number of missing values, over two-thirds of the observations excluded are missing information on whether it is a first birth or not or whether the pregnancy was planned. The first birth variable is partially derived from a self-administered questionnaire that some women in the sample did not complete; while the pregnancy plannedness variable is completely reliant on information from this questionnaire. We have examined differences in demographic characteristics between those respondents who have answered the self-administered

questionnaire and those who have not (and are omitted from our analysis sample). While there are some differences in educational status (less educated women are less likely to have completed the self-administered questionnaire), there is no statistical difference in marital status among the women who are excluded from our sample and those that we retain.[7]

IV. Methods

We first document the negative correlations between unmarried motherhood and investments/outcomes that have been discussed in much of the existing literature. We estimate ordinary least squares (OLS) regression models of the effects of being married at birth on the outcomes of interest including a limited set of control variables.[8] We group our dependent variables of interest into two categories – measures that capture investments in prenatal care, and measures that reflect infant birth outcomes. Outcomes representing investments in prenatal care include the number of weeks at which the respondent realized she was pregnant (i.e., number of weeks at pregnancy recognition) and an indicator variable for whether she received inadequate prenatal care. This variable is based on the Adequacy of Prenatal Care Utilization Index (Kotelchuck, 1994), which is a function of the month prenatal care began (i.e,. adequacy of initiation of prenatal care) and the proportion of the number of visits recommended by the American College of Obstetricians and Gynecologists that a mother received from the time prenatal care began until the time of delivery (i.e., adequacy of received services). We also

[7] Results available from authors.
[8] Results from logit models for the binary dependent variables are qualitatively similar to those presented. These results are available from the authors.

examine indicators for whether the mother drank alcohol in the last trimester of her pregnancy,[9] whether she smoked cigarettes in the last trimester of her pregnancy, and whether she took vitamins and/or mineral supplements at least three days per week for the three months after recognition of her pregnancy.

Our birth outcomes include indicators for whether the infant was moderately low birthweight (MLBW), defined as birthweight greater than or equal to 1500 grams and less than 2500 grams, and very low birthweight (VLBW), defined as birthweight less than 1500 grams.[10] Birthweight is one of the most commonly used measures of infant health in the existing literature, and has been shown to be correlated with negative outcomes for both children and adults. (e.g., Currie and Hyson, 1999; Behrman and Rosenzweig, 2004; Johnson and Schoeni, 2007).[11] We also examine whether the infant was born prematurely, which is defined as being born less than 37 weeks after conception, as well as an indicator for whether the infant spent any days in the hospital after birth due to medical problems.

These models include a limited set of control variables. We include indicators for maternal education, race and ethnicity, and region of residence. We also include indicators for whether the infant is the first born, since there is likely to be a relationship between birth order and both prenatal care investments and birth outcomes. Finally, we include an indicator for

[9] Since very few women consume more than one alcoholic beverage in an average week the definition of this variable includes both individuals who drank heavily during their last trimester as well as those who drank very little (i.e., less than one drink in an average week). While the effects of heavy drinking on health outcomes are well-documented, there is less consensus on the effects of light or moderate drinking during pregnancy (see Russell (1991) and Henderson et al. (2007) for reviews of this literature). Therefore, women may be receiving different advice from their doctors. Our variable definition may therefore bias our study against finding large effects of marriage on the consumption of alcohol during the last trimester of pregnancy.

[10] We specify birthweight as two separate indicator variables instead of using a continuous variable (in grams), because cutpoints of 1500 grams and 2500 grams are commonly used in the literature and therefore allow comparison of our findings with existing studies.

[11] However, work by Almond, Chay, and Lee (2005) and Datar and Jacknowitz (2008) suggests that the existing literature substantially overestimates the effects of birthweight on outcomes.

whether the mother gave births to twins or other multiple births, since infants in multiple births are generally smaller and in worse health than singletons.[12]

We next examine whether the effects of marital status vary systematically by the educational attainment of the mother. Research suggests that unmarried motherhood may be a different phenomenon among highly educated women than among less educated women. Specifically, educated women become single parents significantly later in life than less educated women and have more resources available to them (Schmidt, 2007), which would be expected to improve parenting (McLanahan, 2004). Therefore, we believe there would be fewer benefits of marriage to children born to well-educated mothers. We test this hypothesis by stratifying our regressions by maternal educational attainment and include the control variables discussed previously with the exception of maternal education. We do a similar analysis where we stratify by the mother's race and ethnicity. As described earlier, the existing literature provides mixed findings on how the effect of family structure differs by race and ethnicity. Therefore, it is unclear how the marriage effect will change by race and ethnicity.

One concern with these analyses is that marital status is highly correlated with a number of other factors that are expected to strongly affect both prenatal care investments and infant health outcomes. Therefore, our fourth set of models examine to what extent correlations found in our baseline models can be "explained" by the inclusion of other factors correlated with both marital status and prenatal behaviors and birth outcomes. These factors include household income, health insurance status, and pregnancy plannedness. We expect that the inclusion of these variables will reduce the effect of marriage on our outcomes. Single parent families have significantly lower levels of household income (McLanahan and Sandefur, 1994), which could prevent families from receiving adequate prenatal care. Similarly, marital status may be

[12] We report the exact specification of each variable in Table 2.

correlated with health insurance status – married women may be more likely to have private health insurance, while single women may be more likely to have Medicaid. These differences could also affect health care utilization.[13] Finally, pregnancy plannedness is defined as stopping or never using birth control because the pregnancy was wanted.[14] Single mothers may be less likely to have planned their pregnancies, and this could also be associated with lower levels of investment in prenatal care.

Finally, we examine the role played by unobservable characteristics by comparing married mothers at birth to a sample that is more similar – mothers who are unmarried at their child's birth, but who indicate a higher propensity for marriage by getting married by their child's second birthday.[15] Women who were married at birth but later divorced are excluded from this analysis. We expect that the comparison of women who are married at birth to those who eventually become married will reduce the effect of marriage on our outcomes of interest.

All OLS regressions are weighted using weights accompanying the ECLS-B. Standard errors are adjusted to account for multiple children to the same mother.

V. Results

Table 1 indicates that in our sample, 31.5% of the births were to unmarried women. This fraction is consistent with a published estimate from the National Center for Health Statistics (2002), that suggests that in 2001, 33.5% of all births were to unmarried women. This table also illustrates variation in maternal education and race and ethnicity, both for the entire ECLS-B

[13] Health insurance status is captured by the payment source for prenatal care with mothers who did not receive prenatal care coded as no prenatal care received.
[14] This definition of pregnancy plannedness is based on the one used in Brown and Eisenberg (1995).
[15] While data are available for the mother's marital status four years after birth, extending the analysis to those who become married by four years after birth would include women whose desire to get married may have changed over time. We therefore limit our comparison to those married by Wave 2.

sample (Column 1), and separately for married (Column 2) and unmarried women (Column 3) at the time of birth. Our sample has significant variation in maternal education, as slightly more than one quarter of births are to mothers with a college degree or higher. Further, non-Hispanic Black and Hispanic mothers constitute a significant portion of our sample (13.7% and 19.5%, respectively). As expected, the unmarried mothers in our sample are less educated than the married mothers (43.7% of the unmarried mothers have less than a high school degree, compared with 16.0% of the married mothers). However, almost 5% of the unmarried mothers in our sample have a college degree or higher, which is a significantly larger proportion than in many other data sets. We also have a relatively large amount of variation in race and ethnicity by marital status in our sample. Among married mothers, 6.5% are non-Hispanic Black and 16.6% are Hispanic. In contrast, 29.3% of unmarried mothers are non-Hispanic Black and 25.7% are Hispanic.

Table 2 provides summary statistics for all women (Column 1) and separately by marital status of the mother (Columns 2 and 3). For most variables, mothers who are married invest in significantly greater levels of prenatal care, and have infants with significantly better health outcomes than their unmarried counterparts.[16] Married mothers realize they are pregnant more quickly, are less likely to have received inadequate prenatal care, are less likely to have smoked during their third trimester, and are more likely to have taken vitamins. Infants born to married mothers are significantly less likely to be either MLBW or VLBW, significantly less likely to be born prematurely, and less likely to have spent days in the hospital after birth due to medical problems.

[16] The one exception is that married mothers are 1.1 percentage points more likely to consume alcohol during their last trimester of pregnancy than unmarried mothers. This finding could be explained by our definition of the outcome or the mixed advice given to mothers on moderate consumption of alcohol.

Table 2 also provides summary statistics for our control variables, and indicates that marital status is correlated with a number of other variables that might be expected to affect both prenatal care and birth outcomes. As illustrated by Table 2, married mothers have significantly higher levels of education than unmarried mothers, and are less likely to be African-American or Hispanic. In addition, they also tend to be older, have higher household income, and are more likely to have had their prenatal care paid for by private health insurance. In contrast, unmarried mothers are more likely to have had public health insurance pay for their prenatal care. Finally, our married mothers are significantly more likely to have planned their pregnancy. Sixty-four percent of married women in our sample reported that their pregnancy was planned, compared with 20 percent of the unmarried women.

Table 3 presents results from descriptive regressions of our measures of prenatal care investments on marital status and a limited number of other control variables, including indicators for educational attainment, race and ethnicity, age of the mother at the time of birth, region of residence, whether the birth was the first birth to the woman, and whether the observation is a twin or part of another form of multiple birth. These regressions show that, controlling for these observable characteristics, married mothers invest in significantly higher levels of prenatal care than their unmarried counterparts. Married mothers realize they are pregnant 0.7 weeks earlier (compared with a mean value of 5.4 weeks) and are 6.4 percentage points less likely to have received inadequate prenatal care (compared with a baseline probability of 10.4%). For example, this translates into married mothers being approximately 62 percent less likely to have received an inadequate level of prenatal care. Married mothers are also 1.3 percentage points less likely to report alcohol consumption in the last trimester of their pregnancies (baseline probability of 3.3%), 8.6 percentage points less likely to have smoked

cigarettes during that same time period (baseline probability of 11.3%), and 3.0 percentage points more likely to have taken vitamins for the 3 months after pregnancy recognition (baseline probability of 90.8%) than their unmarried counterparts. Findings from this table are consistent with previous studies in that marriage positively influences investments in prenatal care. Further, not only are all of the marital status coefficients statistically significant at conventional levels, they, for the most part, suggest large marriage effects when placed in context of baseline means and probabilities.

Table 4 shows results from a similar analysis examining the relationship between marital status and infant health outcomes. Again, consistent with previous studies, the strong correlations between marital status and outcomes are clearly visible in the data. However, the relationship between marital status and birth outcomes is weaker than that between marital status and investments in prenatal care. Married mothers are 1.6 percentage points less likely to have babies who are MLBW (baseline probability of 5.9%), 0.2 percentage points less likely to have babies who are VLBW (baseline probability of 1.2%), and 2.5 percentage points less likely to have premature births (baseline probability of 11.1%). They also have infants who were 1.7 percentage points less likely to have spent days in the hospital after birth because of medical problems (baseline probability of 12.2%), although this estimated coefficient is not statistically different from zero.[17]

Tables 3 and 4 also provide some interesting findings regarding how the included covariates influence investments in prenatal care and birth outcomes. Mothers with less education invest less in prenatal care, engage in less healthy behaviors, and experience worse birth outcomes than more educated mothers. Younger mothers typically make fewer investments

[17] In results not reported here, the effects of marriage on both investments in prenatal care and birth outcomes did not vary systematically by the gender of the child (results available from authors).

in prenatal care and healthy behaviors, but tend to experience better birth outcomes than older mothers. While non-Hispanic White mothers typically engage in more prenatal investments than mothers of other races and ethnicities; [18] there is no relationship between Hispanic ethnicity and birth outcomes. Mothers who are having their first births typically make greater investments in prenatal behaviors yet tend to experience worse birth outcomes. Finally, as expected, being a twin or higher-order birth is strongly related to having worse birth outcomes.

Dividing our sample of women into two categories – married versus unmarried at birth – masks a great deal of variation within these two groups. Unmarried women could include those with committed, involved partners, who look more like married women, as well as those without such partners. Married women could be married happily, with a supportive spouse, or married unhappily, with a spouse that hinders their investments in prenatal care and healthy behaviors. In Table 5, we regress our prenatal care and birth outcomes on variables that indicate the partnership status (i.e., cohabitation status) of the unmarried mothers. The key independent variables of interest in each regression model are unmarried without partner and unmarried with partner (compared to the omitted category of married at birth). For the majority of our dependent variables, those unmarried women who report having a partner (Column 2) experience smaller negative effects of being unmarried than those who do not have a partner (Column 1). However, there is still a negative correlation between being unmarried and the majority of our outcome variables, even for the partnered women in the sample. The finding is consistent with that of Osborne (2007); children born to unmarried mothers are exposed to more risks than

[18] One exception to this is that non-Hispanic White mothers are significantly more likely to smoke cigarettes during the last trimester of the pregnancy. These results are consistent with published means from the National Center for Health Statistics (2002), which show that non-Hispanic White women are the most likely to smoke during pregnancy.

children born to cohabitating mothers, yet the real risk differences are between children born to unmarried and married mothers.

In Table 6, we do a similar analysis where we divide the married variable into "married very happily" and "not married very happily" compared to unmarried mothers (the omitted category) to test whether relationship quality affects the results.[19] The results suggest that those women who are not married very happily (Column 2) invest less in prenatal care than very happily married women, but invest more than unmarried women. Further, there are few differences between women who are not married very happily and unmarried women in terms of birth outcomes.[20] One limitation of these analyses is that the partnership status and relationship quality variables are measured nine months after birth; however, our key independent variable is marital status measured at birth. To the extent that there are changes in marital status between birth and the nine-month survey, this could introduce bias into our results. Therefore, we continue our analysis using the more limited categorization of married versus unmarried at birth.

In Table 7, we estimate regressions that are similar to those in Tables 3 and 4, except that we now allow for the effects of marital status to vary by the educational attainment of the mother, by stratifying our regressions by education level. Each row is for a separate dependent variable. Column 1 presents results from a regression on the subsample of women with less than a high school diploma, Column 2 for women with a high school diploma or the equivalent, Column 3 for women with some college or a vocational/technical program, and Column 4 for women with a college degree. As mentioned above, research suggests that nonmarital childbearing may be a different phenomenon among college-educated women. It is likely to

[19] The relationship quality question was not asked of unmarried women who are cohabitating, so we are not able to analyze them along this dimension.

[20] The sample size for these regressions is lower than others. We did not select the analysis sample based on the relationship quality variable; therefore, some of our observations are missing values for the relationship quality variable.

happen later in life, when women have access to greater resources. Our results suggest that our baseline regressions presented in Tables 3 and 4 mask a great deal of heterogeneity across mothers by their educational level. Marital status is still significantly associated with higher levels of investments and better birth outcomes for the three groups with lower levels of educational attainment – high school dropouts, high school graduates, and those with some college. However, for the women with college degrees in the sample, the magnitude of the estimated coefficient on marriage falls dramatically and is no longer statistically different from zero. Essentially, for this group of women, there are no remaining significant effects of marital status on either prenatal care or on infant health outcomes.[21] This finding is inconsistent with Osborne (2007) and may be due to the differences in composition of sample, methodology, and outcomes studied. For example, the most common risk faced by unmarried college-educated mothers in the Osborne (2007) study is the presence of children from a prior union, which we do not consider.

One exception is cigarette smoking, where the marital status effect on smoking is not eliminated for the highly-educated women. This is similar to results found by McCrary and Royer (2006), who find no causal effect of maternal education on prenatal smoking. They argue that the literature that finds effects of education on smoking is focused on the full population

[21] Our interest in college-educated unmarried mothers may seem misplaced, given recent work by Ellwood and Jencks (2004) that argues that the increase in nonmarital births was confined to the bottom two thirds of the education distribution. However, Schmidt (2007) uses Vital Statistics Detail Natality Data, and shows that nonmarital birth rates for college-educated women have been increasing at a much faster rate than those for less-educated women. The analysis by Ellwood and Jencks (2004) using the Current Population Survey March Supplement does not capture this, for three main reasons. First, they examine stocks of single mothers rather than flows, which are slower to reflect changes in trends. Second, by looking at single motherhood, they cannot disentangle never-married motherhood from single motherhood caused by divorce. Their trends are therefore influenced by differential divorce rates by education category. Finally, they exclude women 35 and older. For women with lower levels of education, this is not likely to significantly affect trends, since only 1.3% of all first births to high school dropouts and 5.8% of all first births to high school graduates occur after the age of 34. However, for college-educated women this could be more important, as 15.1% of all first births occur to women 35 and older.

instead of pregnant women, and that women who smoke during pregnancy are more likely to be addicted and less likely to be affected by interventions.

In Table 8, we stratify by race and ethnicity instead of educational attainment. Column 1 presents results for Non-Hispanic White mothers, Column 2 for Non-Hispanic Black, Column 3 for Hispanic, and Column 4 for mothers who identify as another racial or ethnic group. The results from this set of regressions tell a less consistent story than those examining maternal education. For most measures, marriage has a larger estimated effect for non-Hispanic Black women than for non-Hispanic White women (with the exceptions of prenatal smoking and the likelihood of having a VLBW infant). For Hispanic women, the results are more mixed. Similar to Albrecht et al. (1994), we find that marriage is associated with a lower probability of receiving inadequate prenatal care for Hispanic women than non-Hispanic Black and non-Hispanic White women. However, for infant health outcomes, there are no statistical differences by marital status among infants born to Hispanic mothers. This could be related to the well-known Hispanic Health Paradox (e.g., Markides and Coreil, 1986; Franzini et al., 2001; Antecol and Bedard, 2006), that Hispanics tend to have better health than would be predicted by their socioeconomic status and demographic characteristics. Table 9 examines this issue in more detail, by looking separately at Hispanic mothers born in the US versus those born abroad.[22] Some evidence (e.g., Antecol and Bedard, 2006) suggests that immigrants to the US retain eating and other health patterns of their home nations, while first-generation US born tend to converge to (less healthy) US habits. Our results are largely consistent with this interpretation – for Hispanics born in the US, marital status has a significant effect on prenatal care investments,

[22] The sample size for this regression is lower than the sample size for regressions using the Hispanic subsample because information on country of birth was collected in Wave 2 of the ECLS-B.

while this is not the case for immigrant mothers. However, there are no significant effects of marital status on infant health outcomes for either group of Hispanic mothers.

In Table 10, we again return to our baseline models in Tables 3 and 4, but we now add controls for additional observable characteristics that we expect to be correlated with both marital status and outcomes. Again, each row represents a separate dependent variable. Column 1 reprints the coefficients on marital status from Tables 3 and 4 for comparison. Column 2 presents the coefficient on marital status after the addition of a control for household income, Column 3 adds health insurance status to the original regression, and Column 4 adds a control for whether the pregnancy was planned. Column 5 adds all three variables to the original regressions.

For the majority of our prenatal care outcomes, inclusion of these variables reduces both the magnitude and the statistical significance of the marital status variable. Inclusion of all three variables reduces the effect of marital status on weeks at pregnancy recognition, on inadequate prenatal care, and on cigarette smoking by roughly half. However, despite the inclusion of all three of these variables, the effect of single motherhood on our measures of prenatal care is still negative and statistically significant.

Interestingly, the results for infant health outcomes are different. For most of the infant health outcomes, adding these controls eliminates the statistical significance of the marital status effect. We still see a negative and statistically significant correlation between marital status and the likelihood of having an infant who is MLBW. But, for the more severe health outcomes – VLBW, prematurity, and days in the hospital due to a medical problem – the marital status coefficients are no longer statistically different from zero. While the inclusion of these three additional variables does not eliminate the negative effect of single parenthood on prenatal care,

these differences in prenatal care by marital status do not seem to translate into differences in birth outcomes.

Appendix Table 2 shows results that add all three covariates to the education-stratified regressions found in Table 7, and Appendix Table 3 shows results with the three covariates added to the race and ethnicity-stratified regressions found in Table 8. These results again suggest that the inclusion of these variables reduces but does not eliminate the effects of marital status on investments and outcomes. Interestingly, however, the inclusion of these variables reduces the effects of marital status more for prenatal care investments than for birth outcomes. For example, comparing Table 7 Column 1 (results for less-educated women without the additional covariates) to Appendix Table 2 Column 1 (results for the same group including the additional covariates), the inclusion of these three covariates reduces the effect of marriage on prenatal care, but does not translate into major changes in infant outcomes. Both the results from Table 10, as well as the Appendix Tables 2 and 3, appear to be consistent with the interpretation that prenatal care does not necessarily translate into improved birth outcomes (Fiscella (1995) provides a summary of literature related to this point).

Finally, in Table 11, we present results that attempt to examine the issue of unobserved heterogeneity by comparing married mothers to a comparison group that we expect to be more similar – women with a higher propensity to marry in the years immediately after the child's birth. We do this by using Wave 2 data to identify those women who were not married at their child's birth but were married by Wave 2 (i.e,. by the child's second birthday). One limitation of this strategy is that it changes the sample size, making it difficult to determine if changes in estimated coefficients are due to unobservable factors or the change in the size of the sample. To deal with this, we randomly selected a sample of births equal to the sample size of the

regressions that compare married mothers at birth to those who are married by Wave 2.[23] The first column of Table 11 presents the marital status coefficients from Tables 3 and 4. Moving from our full, larger sample size to the smaller random sample presented in Column 2 changes some of our coefficients slightly, but the main results of the previous analysis hold. The effect of marital status using a more similar comparison group, shown in Column 3, falls in magnitude when compared to results for the random sample, but is not eliminated. The reductions in the estimated benefits of being married suggest that unobserved heterogeneity plays a role in the estimation of the effects of marriage on selected outcomes. However, the remaining positive correlation between marriage and investments in prenatal care and birth outcomes suggests that unobserved heterogeneity does not explain the entire effect.

VI. Conclusion

In this paper, we use data from the ECLS-B to examine the role played by a mother's marital status in both her investments in prenatal care as well as in her infant's health outcomes. Like much of the existing literature, we document large positive correlations between marital status and both investments and outcomes. However, we show that there exists a great deal of heterogeneity among mothers with respect to the effect of marital status. First, a simple distinction between married and unmarried does not seem to be sufficient to explain patterns in the data. Unfortunately, one limitation of the ECLS-B is that it did not allow us to control for cohabitation status and relationship quality throughout our analysis. Second, the effects of marital status appear to be different depending on the educational achievement of the mother.

[23] Observation identification numbers were randomly generated therefore we selected births with identification numbers less than or equal to 5,200.

Most notably, the prenatal investments and infant health outcomes of college-educated mothers appear to be independent of marital status.

We also find significant heterogeneity in the role of marriage by racial and ethnic group. For most of our variables, we find that marriage has a larger estimated effect for non-Hispanic Black women than non-Hispanic White women, which is contrary to some of the previous research (e.g., Bennett (1992)). Marriage is associated with a lower probability of receiving inadequate prenatal care for Hispanic women, but that this does not seem to translate into differences in infant health outcomes. In addition, we also find that including observable characteristics and addressing unobserved characteristics reduces but does not eliminate the positive correlation between marital status and prenatal care investments, but that these remaining differentials in investment do not appear to translate into significant differences in infant health outcomes.

Two main interpretations can be drawn from our findings. First, there appears to be a great deal of heterogeneity in the relationship between marital status and both prenatal care investments as well as infant health outcomes. Therefore targeting unmarried women for policy interventions may need to be reconsidered as the negative marriage effect appears to be proxying for other factors. Second, our results generally show that factors that significantly affect prenatal care investments do not appear to translate into effects on the four infant health outcomes we analyze. Overall, our findings suggest that the benefits of marriage for children's well-being may be overstated, particularly for well-educated mothers, and that policy efforts to improve children's well-being through marriage promotion might be reexamined to take this into account.

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Tables and Figures

Table 1. Distribution of Maternal Education and Race and Ethnicity by Marital Status at Birth

	[1]	[2]	[3]
		Marital status	
	All	Married	Unmarried
Education			
Less than high school degree	24.7%	16.0%	43.7%
High school diploma or equivalent	21.5%	18.4%	28.4%
Some college or vocational/technical program	28.0%	30.2%	23.0%
College graduate	25.8%	35.4%	4.9%
Race and ethnicity			
Non-Hispanic White	61.4%	70.8%	40.8%
Non-Hispanic Black	13.7%	6.5%	29.3%
Hispanic	19.5%	16.6%	25.7%
Other race and ethnicity	5.5%	6.1%	4.2%
Overall		31.5%	68.6%

Notes: Estimates are weighted. Percentages may not add up to 100 due to rounding. The sample size, rounded to the nearest 50 per NCES regulations, is 8,300.

Table 2. Descriptive Statistics (Means and Proportions) for All Women and by Marital Status at Birth

	[1]	[2]	[3]
		Marital status	
	All women	Married	Unmarried
Number of weeks at pregnancy recognition	5.380 (0.050)	4.922* (0.052)	6.377 (0.110)
Received inadequate prenatal care	0.104	0.064*	0.193
Drank alcohol in last trimester of pregnancy	0.033	0.037*	0.026
Smoked cigarettes in last trimester of pregnancy	0.113	0.085*	0.174
Took vitamins for 3 months after pregnancy recognition	0.908	0.927*	0.865
Moderately low birthweight	0.059	0.050*	0.078
Very low birthweight	0.012	0.010*	0.016
Premature	0.111	0.100*	0.136
In hospital after birth because of medical problem	0.122	0.112*	0.145
Less than high school degree	0.247	0.160*	0.437
High school diploma or equivalent	0.215	0.184*	0.284
Some college or vocational/technical program	0.280	0.302*	0.230
College graduate	0.258	0.354*	0.049
Non-Hispanic White	0.614	0.708*	0.408
Non-Hispanic Black	0.137	0.065*	0.293
Hispanic	0.195	0.166*	0.257
Other race and ethnicity	0.055	0.061*	0.042
Less than 20 years	0.109	0.036*	0.268
Age 20-24 years	0.253	0.178*	0.416
Age 25-29 years	0.264	0.309*	0.166
Age 30-34 years	0.238	0.301*	0.099
Age 35 years or older	0.136	0.176*	0.051
Northeast	0.164	0.164	0.164
Midwest	0.237	0.238	0.235
South	0.384	0.378	0.398
West	0.215	0.220	0.203
First birth	0.415	0.366*	0.521
Birth is twin or higher-order birth	0.030	0.033*	0.024
Household income less than $20000	0.241	0.134*	0.472
Household income between $20001 and $40000	0.291	0.266*	0.344
Household income between $40001 and $75000	0.252	0.303*	0.140
Household income between $75001 and $100000	0.107	0.145*	0.025
Household income $100001 or higher	0.110	0.151*	0.019
Prenatal care paid by private insurance	0.605	0.761*	0.264
Prenatal care paid by Medicaid	0.322	0.176*	0.641
Prenatal care paid by other	0.063	0.057*	0.075
No prenatal care received	0.011	0.006*	0.020
Planned pregnancy	0.502	0.643*	0.196

Sample size	8,300	5,550	2,750

*indicates statistically significant from unmarried at a 5 percent level using a two-tailed test.
Notes: Estimates are weighted. Standard errors are in parentheses for continuous variables. Sample sizes are rounded to the nearest 50 per NCES regulations. Planned pregnancy is defined as stopping or never using birth control because the pregnancy was wanted.

Table 3. Effects of Being Married at Birth on Investments in Prenatal Care

	[1] Number of weeks at pregnancy recognition	[2] Received inadequate prenatal care	[3] Drank alcohol in last trimester of pregnancy	[4] Smoked cigarettes in last trimester of pregnancy	[5] Took vitamins for 3 months after pregnancy recognition
Married at birth	-0.731**	-0.064**	-0.013*	-0.086**	0.030**
	(0.142)	(0.014)	(0.006)	(0.014)	(0.011)
Less than high school degree	0.924**	0.066**	-0.015	0.204**	-0.063**
	(0.176)	(0.015)	(0.010)	(0.016)	(0.014)
High school diploma or equivalent	0.563**	0.005	-0.026**	0.141**	-0.030*
	(0.138)	(0.012)	(0.009)	(0.014)	(0.012)
Some college or vocational/technical program	0.426**	0.013	-0.038**	0.067**	-0.014
	(0.117)	(0.010)	(0.008)	(0.010)	(0.010)
Non-Hispanic White	-0.600**	-0.047**	0.007	0.024	0.035**
	(0.159)	(0.014)	(0.010)	(0.017)	(0.013)
Non-Hispanic Black	0.402+	0.016	-0.014	-0.135**	0.012
	(0.218)	(0.020)	(0.010)	(0.020)	(0.017)
Hispanic	-0.439*	0.037+	-0.008	-0.151**	0.028+
	(0.202)	(0.019)	(0.010)	(0.018)	(0.016)
Less than 20 years	0.799**	0.089**	-0.072**	-0.032	-0.041*
	(0.252)	(0.023)	(0.014)	(0.021)	(0.019)
Age 20-24 years	0.206	0.053**	-0.049**	0.031*	-0.064**
	(0.171)	(0.015)	(0.013)	(0.016)	(0.014)
Age 25-29 years	0.094	0.009	-0.042**	0.021	-0.027*
	(0.146)	(0.012)	(0.012)	(0.013)	(0.012)
Age 30-34 years	0.057	0.001	-0.036**	0.005	-0.026*
	(0.142)	(0.012)	(0.013)	(0.013)	(0.012)
Northeast	0.026	0.030+	0.007	0.048**	-0.032*
	(0.160)	(0.016)	(0.011)	(0.015)	(0.014)
Midwest	-0.177	-0.003	-0.006	0.054**	-0.028*
	(0.139)	(0.012)	(0.008)	(0.013)	(0.012)
South	0.136	0.001	-0.007	0.040**	-0.013
	(0.138)	(0.012)	(0.008)	(0.011)	(0.011)
First birth	-0.020	-0.035**	0.007	-0.044**	0.051**
	(0.102)	(0.009)	(0.006)	(0.009)	(0.009)
Birth is twin or higher-order birth	-0.030	0.010	-0.023**	-0.003	-0.005
	(0.145)	(0.013)	(0.006)	(0.013)	(0.015)

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Omitted categories are the following: college graduate, other race and ethnicity, age 35 years or older, and West. Standard errors in parentheses are adjusted to account for multiple children to the same mother. The sample size, rounded to the nearest 50 per NCES regulations, is 8,300.

Table 4. Effects of Being Married at Birth on Birth Outcomes

	[1]	[2]	[3]	[4]
	Moderately low birthweight	Very low birthweight	Premature	In hospital after birth because of medical problem
Married at birth	-0.016**	-0.002+	-0.025*	-0.017
	(0.006)	(0.001)	(0.011)	(0.012)
Less than high school degree	0.017*	0.007**	0.026+	0.048**
	(0.007)	(0.002)	(0.014)	(0.015)
High school diploma or equivalent	0.023**	0.005**	0.014	0.036**
	(0.007)	(0.002)	(0.012)	(0.013)
Some college or vocational/technical program	0.009+	0.003*	0.008	0.024*
	(0.005)	(0.001)	(0.011)	(0.012)
Non-Hispanic White	-0.017*	-0.002	-0.022+	-0.013
	(0.008)	(0.002)	(0.013)	(0.014)
Non-Hispanic Black	0.017+	0.013**	0.031+	0.015
	(0.010)	(0.003)	(0.017)	(0.018)
Hispanic	-0.012	0.000	-0.006	-0.008
	(0.009)	(0.002)	(0.016)	(0.017)
Less than 20 years	-0.024*	-0.006*	-0.017	-0.040+
	(0.011)	(0.003)	(0.020)	(0.021)
Age 20-24 years	-0.027**	-0.006**	-0.046**	-0.030+
	(0.008)	(0.002)	(0.015)	(0.016)
Age 25-29 years	-0.028**	-0.002	-0.028+	-0.016
	(0.007)	(0.002)	(0.014)	(0.015)
Age 30-34 years	-0.021**	0.001	-0.020	-0.013
	(0.007)	(0.002)	(0.014)	(0.014)
Northeast	-0.006	0.000	-0.003	-0.003
	(0.007)	(0.002)	(0.013)	(0.015)
Midwest	0.000	0.000	0.006	-0.002
	(0.006)	(0.001)	(0.012)	(0.013)
South	0.002	0.001	0.012	0.010
	(0.005)	(0.001)	(0.011)	(0.012)
First birth	0.027**	0.008**	0.003	0.044**
	(0.004)	(0.001)	(0.008)	(0.010)
Birth is twin or higher-order birth	0.402**	0.069**	0.476**	0.230**
	(0.018)	(0.007)	(0.021)	(0.019)

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Omitted categories are the following: college graduate, other race and ethnicity, age 35 years or older, and West. Standard errors in parentheses are adjusted to account for multiple children to the same mother. The sample size, rounded to the nearest 50 per NCES regulations, is 8,300.

Table 5. Effects of Being Unmarried at Birth by Partner Status Compared to Being Married

	[1] Unmarried without partner	[2] Unmarried with partner
Investments in Prenatal Care Outcomes		
Number of weeks at pregnancy recognition	1.027**	0.505**
	(0.194)	(0.167)
Received inadequate prenatal care	0.086**	0.046**
	(0.019)	(0.016)
Drank alcohol in last trimester of pregnancy	0.008	0.017*
	(0.006)	(0.008)
Smoked cigarettes in last trimester of pregnancy	0.084**	0.087**
	(0.018)	(0.016)
Took vitamins for 3 months after pregnancy recognition	-0.033*	-0.028*
	(0.015)	(0.014)
Birth Outcomes		
Moderately low birthweight	0.018*	0.015*
	(0.008)	(0.006)
Very low birthweight	0.002	0.003
	(0.002)	(0.002)
Premature	0.030*	0.021+
	(0.014)	(0.013)
In hospital after birth because of medical problem	0.019	0.016
	(0.015)	(0.014)

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions. Standard errors in parentheses are adjusted to account for multiple children to the same mother. The sample size, rounded to the nearest 50 per NCES regulations, is 8,300.

Table 6. Effects of Being Married at Birth by Relationship Quality Compared to Being Unmarried

	[1] Married and very happy	[2] Married and not very happy
Investments in Prenatal Care Outcomes		
Number of weeks at pregnancy recognition	-0.846**	-0.456**
	(0.146)	(0.170)
Received inadequate prenatal care	-0.075**	-0.037*
	(0.014)	(0.017)
Drank alcohol in last trimester of pregnancy	-0.014*	-0.014+
	(0.007)	(0.008)
Smoked cigarettes in last trimester of pregnancy	-0.099**	-0.055**
	(0.014)	(0.016)
Took vitamins for 3 months after pregnancy recognition	0.040**	0.012
	(0.012)	(0.015)
Birth Outcomes		
Moderately low birthweight	-0.017**	-0.016*
	(0.006)	(0.007)
Very low birthweight	-0.002+	-0.002
	(0.001)	(0.002)
Premature	-0.032**	-0.009
	(0.011)	(0.014)
In hospital after birth because of medical problem	-0.028*	0.013
	(0.012)	(0.016)

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions. Standard errors in parentheses are adjusted to account for multiple children to the same mother. The sample size, rounded to the nearest 50 per NCES regulations, is 8,200.

Table 7. Effects of Being Married at Birth by Maternal Education on Outcomes

	[1] Less than high school degree	[2] High school diploma or equivalent	[3] Some college or vocational/technical program	[4] College graduate
Investments in Prenatal Care Outcomes				
Number of weeks at pregnancy recognition	-0.645*	-0.955**	-0.659**	-0.278
	(0.288)	(0.252)	(0.244)	(0.393)
Received inadequate prenatal care	-0.063*	-0.041+	-0.094**	-0.047
	(0.026)	(0.022)	(0.025)	(0.043)
Drank alcohol in last trimester of pregnancy	-0.012	-0.009	-0.009	-0.014
	(0.013)	(0.01)	(0.009)	(0.032)
Smoked cigarettes in last trimester of pregnancy	-0.041	-0.105**	-0.122**	-0.053+
	(0.025)	(0.027)	(0.025)	(0.028)
Took vitamins for 3 months after pregnancy recognition	0.050*	0.025	0.019	-0.016
	(0.023)	(0.022)	(0.018)	(0.031)
Birth Outcomes				
Moderately low birthweight	-0.025**	-0.022+	-0.006	0.004
	(0.009)	(0.012)	(0.009)	(0.018)
Very low birthweight	-0.006*	-0.004	0.000	0.006
	(0.003)	(0.003)	(0.002)	(0.004)
Premature	-0.050*	-0.020	0.004	-0.044
	(0.02)	(0.017)	(0.019)	(0.042)
In hospital after birth because of medical problem	-0.036	-0.015	-0.008	0.012
	(0.022)	(0.021)	(0.022)	(0.036)
Sample size	2,000	1,800	2,250	2,250

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions with the exception of those capturing maternal education. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.

Table 8. Effects of Being Married at Birth by Race and Ethnicity on Outcomes

	[1] Non-Hispanic White	[2] Non-Hispanic Black	[3] Hispanic	[4] Other race and ethnicity
Investments in Prenatal Care Outcomes				
Number of weeks at pregnancy recognition	-0.649**	-1.209**	-0.627*	-0.552
	(0.196)	(0.333)	(0.31)	(0.466)
Received inadequate prenatal care	-0.045*	-0.077**	-0.085**	-0.094+
	(0.018)	(0.028)	(0.031)	(0.056)
Drank alcohol in last trimester of pregnancy	-0.011	-0.010	-0.014	-0.017
	(0.01)	(0.01)	(0.012)	(0.032)
Smoked cigarettes in last trimester of pregnancy	-0.114**	-0.069**	-0.043**	-0.084
	(0.024)	(0.021)	(0.014)	(0.061)
Took vitamins for 3 months after pregnancy recognition	0.037*	0.027	0.014	0.038
	(0.016)	(0.029)	(0.023)	(0.037)
Birth Outcomes				
Moderately low birthweight	-0.018*	-0.028+	-0.014	0.043*
	(0.008)	(0.016)	(0.011)	(0.018)
Very low birthweight	-0.003+	0.000	-0.003	0.005
	(0.002)	(0.005)	(0.003)	(0.005)
Premature	-0.033*	-0.058*	-0.001	0.012
	(0.015)	(0.027)	(0.021)	(0.03)
In hospital after birth because of medical problem	-0.014	-0.035	-0.015	0.041
	(0.017)	(0.026)	(0.025)	(0.033)
Sample size	4,100	1,350	1,300	1,500

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions with the exception of those capturing race and ethnicity. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.

Table 9. Effects of Being Married at Birth for Hispanics by Country of Birth

	[1]	[2]
	Born in the US	Born outside of US
Investments in Prenatal Care Outcomes		
Number of weeks at pregnancy recognition	-0.991*	-0.244
	(0.498)	(0.428)
Received inadequate prenatal care	-0.139**	-0.062
	(0.047)	(0.043)
Drank alcohol in last trimester of pregnancy	-0.028	0.007
	(0.019)	(0.011)
Smoked cigarettes in last trimester of pregnancy	-0.093**	-0.002
	(0.034)	(0.003)
Took vitamins for 3 months after pregnancy recognition	0.045	-0.013
	(0.036)	(0.031)
Birth Outcomes		
Moderately low birthweight	-0.006	-0.009
	(0.016)	(0.016)
Very low birthweight	-0.003	-0.003
	(0.005)	(0.004)
Premature	0.009	0.019
	(0.03)	(0.029)
In hospital after birth because of medical problem	-0.023	0.031
	(0.035)	(0.034)
Sample size	600	600

+ significant at 10%, * significant at 5%, ** significant at 1%
Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.

Table 10. Effects of Being Married at Birth on Outcomes including Additional Covariates

	[1] Married coefficients from Tables 3 and 4	[2] Column 1 plus household income	[3] Column 1 plus health insurance status	[4] Column 1 plus planned pregnancy	[5] Column 1 plus household income, health insurance status, and planned pregnancy
Investments in Prenatal Care Outcomes					
Number of weeks at pregnancy recognition	-0.731**	-0.649**	-0.622**	-0.500**	-0.396*
	(0.142)	(0.145)	(0.149)	(0.149)	(0.155)
Received inadequate prenatal care	-0.064**	-0.054**	-0.047**	-0.054**	-0.036*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
Drank alcohol in last trimester of pregnancy	-0.013*	-0.015*	-0.012+	-0.015*	-0.014*
	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Smoked cigarettes in last trimester of pregnancy	-0.086**	-0.074**	-0.058**	-0.073**	-0.046**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Took vitamins for 3 months after pregnancy recognition	0.030**	0.031**	0.025*	0.028*	0.024*
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
Birth Outcomes					
Moderately low birthweight	-0.016**	-0.014*	-0.015*	-0.014*	-0.012*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Very low birthweight	-0.002+	-0.002	-0.002	-0.002+	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Premature	-0.025*	-0.021*	-0.021+	-0.021+	-0.016
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
In hospital after birth because of medical problem	-0.017	-0.01	-0.009	-0.012	-0.003
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Planned pregnancy is defined as stopping or never using birth control because the pregnancy was wanted. Independent variables listed in Tables 3 and 4 are included in these regressions. Standard errors in parentheses are adjusted to account for multiple children to the same mother. The sample size, rounded to the nearest 50 per NCES regulations, is 8,300.

Table 11. Effects of Being Married at Birth Compared to Being Married Two Years after Birth on Outcomes

	[1]	[2]	[3]
	Married coefficients from Tables 3 and 4	Married coefficients from a random sample of births	Comparison of married at birth to married by 2 years after birth
Investments in Prenatal Care Outcomes			
Number of weeks at pregnancy recognition	-0.731**	-0.830**	-0.428
	(0.142)	(0.169)	(0.291)
Received inadequate prenatal care	-0.064**	-0.059**	-0.070**
	(0.014)	(0.017)	(0.026)
Drank alcohol in last trimester of pregnancy	-0.013*	-0.010	0.001
	(0.006)	(0.007)	(0.012)
Smoked cigarettes in last trimester of pregnancy	-0.086**	-0.089**	-0.064**
	(0.014)	(0.017)	(0.025)
Took vitamins for 3 months after pregnancy recognition	0.030**	0.030*	0.059*
	(0.011)	(0.015)	(0.023)
Birth Outcomes			
Moderately low birthweight	-0.016**	-0.017*	-0.011
	(0.006)	(0.007)	(0.010)
Very low birthweight	-0.002+	-0.003+	-0.005+
	(0.001)	(0.002)	(0.003)
Premature	-0.025*	-0.028*	-0.031
	(0.011)	(0.013)	(0.021)
In hospital after birth because of medical problem	-0.017	-0.021	-0.015
	(0.012)	(0.015)	(0.022)
Sample size	8,300	5,200	5,200

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.

Appendix 1. Variables from the ECLS-B

Variables from birth certificate

- Received inadequate prenatal care
- Moderately low birthweight
- Very low birthweight
- Premature
- Maternal age
- Birth is twin or higher-order birth

Variables from nine-month survey

- Number of weeks at pregnancy recognition
- Drank alcohol in last trimester of pregnancy
- Smoked cigarettes in last trimester of pregnancy
- Took vitamins for 3 months after pregnancy recognition
- In hospital after birth because of medical problem
- Race and ethnicity
- Region of residence
- Household income
- Health insurance
- Planned pregnancy

Variables based on birth certificate and nine-month survey data

- Maternal education
- First birth

Appendix 2. Effects of Being Married at Birth by Maternal Education on Outcomes Including Additional Covariates

	[1] Less than high school degree	[2] High school diploma or equivalent	[3] Some college or vocational/technical program	[4] College graduate
Investments in Prenatal Care Outcomes				
Number of weeks at pregnancy recognition	-0.364	-0.359	-0.516*	0.061
	(0.322)	(0.255)	(0.254)	(0.413)
Received inadequate prenatal care	-0.032	0.000	-0.071**	-0.040
	(0.028)	(0.024)	(0.025)	(0.045)
Drank alcohol in last trimester of pregnancy	-0.012	-0.006	-0.010	-0.034
	(0.012)	(0.011)	(0.012)	(0.032)
Smoked cigarettes in last trimester of pregnancy	-0.011	-0.039	-0.083**	-0.046
	(0.025)	(0.029)	(0.024)	(0.03)
Took vitamins for 3 months after pregnancy recognition	0.058*	0.008	0.010	-0.040
	(0.024)	(0.024)	(0.018)	(0.026)
Birth Outcomes				
Moderately low birthweight	-0.022*	-0.019	0.000	0.009
	(0.01)	(0.013)	(0.01)	(0.02)
Very low birthweight	-0.007*	-0.003	0.001	0.008*
	(0.003)	(0.003)	(0.003)	(0.004)
Premature	-0.040*	-0.009	0.009	-0.026
	(0.021)	(0.019)	(0.022)	(0.041)
In hospital after birth because of medical problem	-0.033	0.016	-0.001	0.057
	(0.024)	(0.023)	(0.024)	(0.038)
Sample size	2,000	1,800	2,250	2,250

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions with the exception of those capturing maternal education. Additional covariates include household income, health insurance status, and planned pregnancy. Planned pregnancy is defined as stopping or never using birth control because the pregnancy was wanted. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.

Appendix 3. Effects of Being Married at Birth by Race and Ethnicity on Outcomes Including Additional Covariates

	[1]	[2]	[3]	[4]
	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other race and ethnicity
Investments in Prenatal Care Outcomes				
Number of weeks at pregnancy recognition	-0.196	-1.046**	-0.454	-0.246
	(0.207)	(0.348)	(0.344)	(0.457)
Received inadequate prenatal care	-0.018	-0.051+	-0.055	-0.032
	(0.019)	(0.03)	(0.034)	(0.037)
Drank alcohol in last trimester of pregnancy	-0.012	-0.010	-0.02	-0.009
	(0.011)	(0.009)	(0.013)	(0.028)
Smoked cigarettes in last trimester of pregnancy	-0.057*	-0.041*	-0.039**	-0.029
	(0.025)	(0.02)	(0.013)	(0.046)
Took vitamins for 3 months after pregnancy recognition	0.023	0.012	0.026	0.022
	(0.017)	(0.03)	(0.024)	(0.036)
Birth Outcomes				
Moderately low birthweight	-0.012	-0.023	-0.016	0.053*
	(0.008)	(0.016)	(0.012)	(0.021)
Very low birthweight	-0.002	-0.002	-0.003	0.006
	(0.002)	(0.005)	(0.003)	(0.005)
Premature	-0.016	-0.061*	0.006	0.009
	(0.016)	(0.031)	(0.022)	(0.032)
In hospital after birth because of medical problem	0.007	-0.043	-0.007	0.054+
	(0.019)	(0.028)	(0.025)	(0.031)
Sample size	4,100	1,350	1,300	1,500

+ significant at 10%, * significant at 5%, ** significant at 1%

Notes: Estimates are weighted. Independent variables listed in Tables 3 and 4 are included in these regressions with the exception of those capturing race and ethnicity. Additional covariates include household income, health insurance status, and planned pregnancy. Planned pregnancy is defined as stopping or never using birth control because the pregnancy was wanted. Standard errors in parentheses are adjusted to account for multiple children to the same mother. Sample sizes are rounded to the nearest 50 per NCES regulations.