When Does Baby Make Three? The Influence of Pregnancy Intentions on Marital Transitions

Isaac Maddow-Zimet

Laura Lindberg

Kathryn Kost

This study was supported by grant R40 MC 25692 from the Maternal and Child Health Research Program, Maternal and Child Health Bureau (Title V, Social Security Act), Health Resources and Services Administration, Department of Health and Human Services and the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R01HD068433. Additional support was provided by the Guttmacher Center for Population Research Innovation and Dissemination under award [xxxx]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Department of Health and Human Services. This paper is dedicated to the memory of Cynthia Dailard, who championed the need for this research question.

ABSTRACT

CONTEXT: Beyond consequences for health**,** pregnancy intentions may have consequences on social outcomes, including marital transitions.

METHODS: Data from the 2004-2008 Oklahoma Pregnancy Risk Assessment Monitoring System (PRAMS) survey and The Oklahoma Toddler Survey (TOTS) from 2006-2010 were used to examine associations between a four category measure of pregnancy intentions (intended, mistimed<2 years, mistimed>=2 years, unwanted) and changes in marital status between conception, birth and age two. Analyses were stratified by marital status at conception, and propensity score methods were used to control for confounding.

RESULTS: Intention status was associated with mothers' transitions into and out of marriage by child's age two, both in bivariate analyses and estimates adjusting for background characteristics using propensity score analysis. In the adjusted models, among women married at conception, those with a birth resulting from an unwanted pregnancy were more than twice as likely (OR=2.23) as those with an intended pregnancy to transition out of marriage by the time their child was two years old. Among women unmarried at conception, those with an unwanted pregnancy were about half as likely (OR=.46) as those with an intended pregnancy to marry by the time the child was age two. Mistimed pregnancies, regardless of extent of mistiming, were not significantly associated with marital dissolution or stability.

CONCLUSIONS: Programs and policies focused on reducing unintended pregnancy may help increase marriage formation and stability. Given significant associations between unwanted childbearing and marital transitions, helping women successfully stop childbearing after achieving their desired number of children may be particularly beneficial.

Introduction

National public health policy and research on reproductive behaviors has been strongly influenced by the premise that unintended childbearing has significant negative consequences (Institute of Medicine, 2011; U.S.Department of Health and Human Services, 2010). Much research has focused on health consequences of unintended childbearing, particularly its effect on the behavior of mothers both during pregnancy and afterward, such as use of prenatal care or breastfeeding (Gipson, Koenig, & Hindin, 2008; Logan, Holcombe, Manlove, & Ryan, 2007; Kost K. & Lindberg L, 2015). In contrast, far less attention has been given to the potential social consequences of unintended childbearing. In 1995, the National Academy of Science's watershed report *The Best Intentions* reviewed research on the consequences of unintended pregnancy and concluded that "Such consequences undoubtedly impede the formation and maintenance of strong families."(Institute of Medicine, 1995). However, in the twenty years since this report, there has been limited research attention to these types of social consequences. Intention status is most often excluded from the substantial research and policy focus on marriage formation and stability associated with childbearing. Yet transitions into or out of marriage may be influenced by the experience of having a birth that is unintended. With unintended births comprising about 37% of all births that occur each year in the United States (Mosher, Jones, & Abma, 2012), research is needed to enhance efforts to understand on the influence of unintended childbearing on marital transitions.

In this paper, we examine the role of childbearing intentions on women's transitions into and out of marriage using a unique representative longitudinal dataset of mothers giving birth in Oklahoma that includes information about formal marital status at conception, birth and when the child is age two, as well as a detailed measure of intention status. Beyond providing high-

quality data about childbearing and marriage transitions, Oklahoma offers an interesting setting to study the influence of intention status on both marriage formation and stability. The share of births to unmarried mothers has increased in Oklahoma, rising from 34% in 2000 to 42% in 2007, a level that has been stable through 2012 (National KIDS COUNT, 2012). In addition, although the divorce rate has been declining in Oklahoma (by about 25% from 2000 to 2013) (Oklahoma State Department of Health, 2013), it still has the third highest divorce rate in the nation (CDC, 2014). Unintended childbearing rates are also high in the state, accounting for about half of all live births in 2008, as compared with 39% nationally (Sonfield & Kost, 2013). When faced with an unintended pregnancy, about two-thirds of women in Oklahoma carry to term, a share amongst the highest in the country (Kost, 2013). Childbearing women in Oklahoma also face relatively severe economic challenges. For example, in 2008, 61% of deliveries in Oklahoma were paid for with public funding (through programs such as Medicaid and the Indian Health Service), compared to 48% of US births overall (Sonfield & Kost, 2013). In response to these statistics, Oklahoma has made marriage promotion a state-level priority. Understanding the potential role of pregnancy intentions in the choices women and their partners make about marriage following a birth could inform these policies, as well as suggest other potential responses to these concerns.

Background

Research on the associations between childbearing and marital transitions tends to examine marital and nonmarital conceptions separately. For married couples, there is strong evidence that childbearing is associated with increased marital stability (Heaton, 1990; Waite & Lillard, 1991). In contrast, for couples unmarried at conception, childbearing generally does not

lead to the formation of marriages. For example, in an analysis of recent national data, Lichter (2012) found that few nonmarital conceptions resulted in marriages before the time of the birth. Even after the birth, few of these women marry; research from the Fragile Families and Child Wellbeing Study found that only 16% of women with nonmarital births married the father by the time their child was five years old (Fragile Families Research Brief, 2007). However, whether the birth had been intended, mistimed or unwanted was not considered in any of these analyses. In fact, the Fragile Families study, a highly influential survey of nonmarital childbearing, has no measure of the intention status of births.

Only a handful of studies directly examine the influence of pregnancy intentions on marriage transitions following childbirth. Among women experiencing a nonmarital birth, there is some evidence of an association between marriage formation and pregnancy intentions. In the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), a nationally representative sample of children born in 2001, cohabiting women with intended births were more likely to marry within two years of the birth than were cohabiting women with unintended births, after controlling for background characteristics; similarly, women outside of a union at the time of conception were more likely to be cohabiting or married at 2 years postpartum if the pregnancy had been intended than unintended (National Campaign to Prevent Teen and Unplanned Pregnancy, 2008). Other studies examined marital formation following a birth exclusively among cohabiting unions and found mixed results. Using data from the 2002 National Survey of Family Growth (NSFG), Manlove et al. (2012) found a significant positive association between pregnancy intentions and marriage among cohabitors in multivariate regressions controlling for other background factors, but only for white mothers. In contrast, using the same data, Guzzo and Hayford (2014) estimated that marriage following a birth was more likely among cohabiters

with an intended than an unintended birth in a bivariate model, but after controlling for confounding background characteristics this association was no longer significant.

There also is limited evidence that pregnancy intentions are associated with marital stability. In analyses of the 2002 NSFG, unintended first births were associated with an increased likelihood of marriage dissolution relative to intended first births among married women, even when accounting for stable unobserved characteristics using fixed-effects models (Guzzo & Hayford, 2012). In the ECLS-B, women married at conception were more likely to remain married when the child was two years old if the pregnancy had been intended than if it had been unintended (National Campaign to Prevent Teen and Unplanned Pregnancy, 2008). Other analyses have not differentiated between cohabiting and marital relationships, but still suggest that unintended births have a negative influence on the stability of unions generally as compared to intended births (Manning, Smock, & Majumdar, 2004; Wu & Musick, 2008).

Studies of marital transitions associated with childbearing, regardless of whether intention status was examined, find significant relationships between a range of background characteristics, including age, race/ethnicity, parity, education, income (Carlson, McLanahan, & England, 2004; Harknett & McLanahan, 2004; Heaton, 1990; Waite & Lillard, 1991), and intimate partner violence (Carlson et al., 2004; DeMaris, 2000), and the odds of both marital formation and dissolution after the birth of a child. Studies have used a variety of statistical approaches to adjust for potential confounding between intention status and these demographic variables; these variables may also have a direct and independent association with marital transitions beyond their relationship with intention status.

This paper addresses a number of research and methodological gaps in the study of marital formation and stability. First, existing studies refer to births in 2001 or earlier, and since

that time, the proportion of childbearing occurring outside of marriage has increased substantially, rising from 34% of all births in 2001 to 41% in 2013 (CDC, 2013): the majority of these nonmarital births are unintended (Finer & Zolna, 2014). Second, although recent studies show that meaningful distinctions can be made between unintended pregnancies by the length of mistiming (Mosher et al., 2012; Kost K. & Lindberg L, 2015), the few prior studies on intention status and marital transitions either do not identify the extent of mistiming (2008; Manlove et al., 2012), or group mistimed births with either intended or unintended births (Guzzo & Hayford, 2012; Guzzo & Hayford, 2014), and thus cannot examine differences in the association between the extent of mistiming and union transitions. For example, the likelihood of marriage in the period between conception and birth—"shotgun" marriages—may be more likely among women with only modestly mistimed nonmarital conceptions if this mistiming simply hastens longer-term marriage plans. Third, and perhaps most importantly, to identify the role of pregnancy intentions in marital transitions, there is a need to further address the potential confounding of pregnancy intention and other demographic and socioeconomic characteristics. Pregnancy intentions are strongly related to many of women's demographic characteristics found to be associated with marriage transitions after a birth—age, marital status, race/ethnicity and parity—as well as socioeconomic characteristics—educational attainment, and poverty status among others (Kost K. & Lindberg L, 2015). Thus, it is essential to disentangle pregnancy intentions from other characteristics that also affect transitions into and out of marriage.

To address these gaps, this study capitalizes on longitudinal data from the 2004–2008 Oklahoma Pregnancy Risk Assessment Monitoring System (PRAMS) and The Oklahoma Toddler Survey (TOTS) for 2006–2010 to investigate the association between pregnancy intentions and marriage formation and stability, by examining the mothers' formal relationships

at three points in time: conception, birth and when the child is two years old. We employ a four-category measure of intention status: intended, mistimed by less than two years, mistimed by two or more years, and unwanted. We find that mothers of births in each of these intention status groups differ significantly on a wide range of demographic and life course factors, and we adjust for these potentially confounding influences through propensity score methods to examine the effects of intention status on marital transitions.

Data and Methods

Data

The annual Oklahoma PRAMS survey is a random sample of postpartum women who delivered live births in Oklahoma. The TOTS survey was sent to PRAMS respondents when their child was two years old. Both the PRAMS and TOTS surveys are mixed-mode surveillance systems; in each case two mail surveys are sent, followed by telephone follow-up for nonrespondents. A detailed explanation of the methodology has been documented elsewhere (Centers for Disease Control and Prevention, 2009; Oklahoma State Department of Health, 2012). Oklahoma is one of only four states with data available from follow-up interviews of PRAMS mothers.

From 2004 to 2008, 9,829 mothers completed the Oklahoma PRAMS questionnaire within 2-4 months of the birth of their child; 6,648 of these (68%) completed the TOTS survey two years later. We found no significant differences in the distributions of sociodemographic measures and intention status among the PRAMS and TOTS respondents, suggesting loss to follow-up was not selective for the variables included in our analyses.

Measures

Pregnancy intentions: All state-level PRAMS surveys include a question that allows births to be characterized as intended, mistimed or unwanted: "Thinking back to *just before* you got pregnant with your *new* baby, how did you feel about becoming pregnant?" The response categories are, 1) "I wanted to be pregnant sooner," 2) "I wanted to be pregnant later," 3) "I wanted to be pregnant then," and 4) "I didn't want to be pregnant then or at any time in the future." If the mother responded that she wanted to become pregnant sooner than she did or "then," the birth is considered "intended." Births to mothers who did not want to become pregnant are considered unwanted, and those who desired a pregnancy later than it occurred are mistimed. The Oklahoma PRAMS added a follow-up question for women reporting they wanted to be pregnant later: "How much later did you want to become pregnant?" Response categories were less than 1 year, 1 year to less than 2 years, 2 years to less than 3 years, 3 years to less than 4 years, 4 years or more. We combined responses to these two questions into a four-category measure of intention status: intended, mistimed by less than two years, mistimed by two or more years, and unwanted.

Marital status: Using the linked responses to the PRAMS and TOTS surveys provides indicators of formal marital status (married, unmarried) at three points in time: at conception (measured retrospectively in the PRAMS survey), at birth (taken from the birth certificate as reported in the PRAMS data set), and when the child is two years old (measured in the TOTS survey).

Analyses

We excluded 75 births in the linked PRAMS-TOTS dataset from the analysis because of missing data on intention status, as well as 34 births with missing data on marital status at one point in

time or more. Additional births were excluded due to missing values on key covariates, resulting in an analytical sample of 5,740 women with births during the survey period. All of the analyses were stratified by the mother's marital status at conception (married, N=3,617; unmarried, N=2,123), in order to examine separately the odds of marital dissolution and marital formation after a birth.

We first examined bivariate associations between pregnancy intentions and marital status at conception, birth and child's age 2. We then investigated the extent to which mothers differed in their background characteristics across the four intention status groups, stratified by marital status at conception. This informs the motivation for controlling for these distributional differences in order to isolate the effects of pregnancy intentions on marriage transitions that are not attributable to the background characteristics.

Next, we employed inverse propensity weights, an adaptation of propensity score analysis. Generally, propensity score methods are used for adjusting the distribution of characteristics of two groups (a treatment and a control group) so that they are matched, or balanced with respect to observed characteristics that are relevant to group assignment but which also affect the outcome of interest (Rosenbaum & Rubin, 1983; Stuart, 2010). Since our "treatment"—intention status—has four categories, we used an alternate approach of inverse probability weighting (IPW) (Imbens, 2000). This methodology requires a multi-stage process of first estimating, and then applying, inverse probability weights to create balanced comparison groups (McCaffrey et al., 2013). These series of steps were done separately by marital status at time of conception.

First, we calculated the propensity scores—that is, the probability of "treatment" given the observed covariates—using a multinomial logistic regression model with pregnancy intention

status (intended, mistimed by less than two years, mistimed by two or more years, unwanted) as the dependent variable. We used a nonparsimonious approach and included all available covariates in the model that are known to be related to both pregnancy intentions and marital transitions—and which temporally preceded the pregnancy —regardless of statistical significance; propensity score models conducted with only a few covariates are unlikely to yield unbiased estimates (Lunceford & Davidian, 2004). We then constructed weights using the inverse of the propensity score, multiplying each observation's inverse propensity weight by the population weight in order to obtain unbiased effects based on the population of all births in the state (Dugoff, Schuler, & Stuart, 2013). We assessed the quality of the propensity score estimation process by calculating a measure of standardized bias in the balanced samples. We considered the adjusted distributions of characteristics across intention status groups adequately balanced once all estimates of standardized biases fell below .25 (Stuart, 2010). In addition, in order to reduce the influence of outliers in our analysis, we trimmed inverse propensity weights at the 99th percentile so that the large weights of only a few outliers did not have a strong influence on the analysis (Lee, Lessler, & Stuart, 2011).

Finally, we estimated logistic regression models of transitions in marital status using the balanced samples, with observations weighted by the inverse of their propensity score to control for observed variance in background characteristics between the intention groups. Controlling for these distributional differences allows us to isolate the effects of pregnancy intentions on the marriage transitions that are not attributable to the sociodemographic background characteristics. Among women unmarried at conception (N=2,123), the outcome of interest is whether the mother married by the time of the birth and by child's age 2 (0=unmarried at birth or age 2, 1= married at birth or age 2). Among women married at conception, the outcome of interest is

marital dissolution by child's age 2 (0=stayed married, 1=ended marriage); too few mothers ended their marriage between conception and birth to estimate a robust model of this transition. For each outcome we estimated two multivariate models with different sets of independent variables. Model 1 included only the four-category measure of intention status, to test the direct effect of intention status on marital transitions in the balanced sample. Model 2 adds sociodemographic variables that may have a direct influence on marriage transitions, as well as an indicator of reported intimate partner violence during pregnancy. This last measure is a potential mediating factor that occurred temporally between the pregnancy—when intention status was determined—and birth that might influence marriage transitions directly.

We performed all analyses using *svy* commands in Stata 13.1 to account for the complex sampling designs of the surveys.

Results

Descriptive Analysis

Two-thirds of births to married mothers were reported as intended (67%) compared to less than one-third of births to unmarried mothers (31%). In contrast, mothers unmarried at conception were significantly more likely than married mothers to report their births as greatly mistimed (38% vs. 10%) or unwanted (13% vs. 8%; Table 1). Among mothers married at conception, few women transitioned out of marriage, either by the time of the birth or by the time their child was two years old. Only 1% of women married at conception were divorced or separated by the time of the birth, while 7% were no longer married to the father two years after the birth. Marital transitions were more common among women unmarried at conception; overall

16% married before their child was born. By the time their child was two years old, nearly one in three (30%) had transitioned into marriage.

[INSERT TABLE 1]

These overall patterns, however, mask significant differences by the intention status of the birth, as further evidenced in Figure 1. Among women married at conception, all of those with an intended birth remained married at birth, with small declines among the other intention groups; those with a pregnancy mistimed by 2 or more years were significantly less likely to remain married at birth than women with an intended birth (97% vs. 100%). Differences in marital stability by age two increased, as women with a birth resulting from an unwanted pregnancy or a pregnancy mistimed by two or more years were significantly less likely than women with intended pregnancies to remain married (85%, 89%, and 94% respectively). Similarly, among women unmarried at conception, transition to marriage by birth or age two was significantly more likely among women with an intended pregnancy than women with a pregnancy mistimed by two or more years or one that was unwanted (21% versus 14% and 10% , respectively at birth; 37% vs. 26% and 24% by age two). The differences by intention status increased over time. Regardless of marital status at conception, there were no significant differences in marital status at birth or age two between women with births mistimed by less than two years and those with intended births.

[INSERT FIGURE 1]

These patterns of marital transitions may reflect underlying differences in the sociodemographic characteristics of mothers across intention status groups; that is, the characteristics may influence transitions, not pregnancy intentions. Table 2 shows selected

sociodemographic characteristics by the intention status of the birth, stratified by marital status at conception. These are the distributions in the unadjusted sample, before any attempt to balance the groups using propensity scores.

Overall, there are stark differences between women who were unmarried and married at conception. As compared to those unmarried at the time of conception, married women were more likely to be white (78% vs. 60%), older (39% vs. 15% aged 30-44), have higher educational attainment (61% vs. 25% with some college or more) and have incomes above the federal poverty line (83% vs. 42%). Within each marital status group, most characteristics varied significantly by intention status. Among women married at conception, mothers with births resulting from a mistimed or unwanted pregnancy were less likely to be having their first birth, and less likely to have completed college or to live above the federal poverty line, than those with an intended birth. Mothers of unwanted births were more likely to be older than those with intended births, while mothers of mistimed births (regardless of the extent of mistiming) were more likely to be aged 15-24. Among married mothers, only those with greatly mistimed births varied significantly by race/ethnicity; these women were significantly more likely to be Hispanic and significantly less likely to be Non-Hispanic white.

Among women unmarried at conception, slightly different patterns emerge. As compared to mothers of intended births, mothers of unwanted births were more likely to have had previous children; women with greatly mistimed births, however, were more likely to be having their first birth. In part, this is due to the fact that these women were often much younger: 27% of women with greatly mistimed births were under age 20 at the time of the birth, compared to only 12% of women with intended births. In addition, unmarried mothers with unwanted or greatly mistimed

births were more likely to be Non-Hispanic black, and less likely to be Hispanic, than unmarried mothers with intended births.

We compared the standardized bias of the distributions of sociodemographic characteristics of mothers within the four intention status groups both before inverse probability weighting and again afterward, to determine whether the adjusted sample was balanced with respect to these characteristics. Again, we wanted groups balanced across these characteristics because these same factors are also likely to impact marital transitions. In the unbalanced data, large standardized bias estimates for many of the covariates indicate large and potentially meaningful differences in the distribution of these characteristics by intention status.

After weighting the observations by the inverse of the propensity scores derived from multinomial regression, the measures of standardized bias fell below .25 for each variable examined (see Appendix 1). We used this cutoff to indicate adequate balance across the intention status groups with respect to these covariates. The only exception to this rule was that, in the group of mothers married at conception, whether or not the child was the first birth to the mother was slightly above the .25 cut-off (.26). In order to test whether this slight imbalance affected our results, we conducted a sensitivity analysis with this measure, including it as a control in all models; all results were unaffected.

Intention status and marital stability in the balanced sample

By limiting the sample to only those mothers who were married at conception, we can investigate whether marital stability is negatively influenced by a birth resulting from an unintended pregnancy. Table 3 shows the results of logistic regression models estimating the association between intention status and marriage dissolution by the time the child is 2 years old,

among mothers married at conception; again, too few women transitioned out of marriage between birth and conception to estimate a robust model for marital dissolution by the time of the birth. Each model adjusts for observed variation in women's background characteristics using inverse probability weighting. Model 1, which includes only the four-category measure of intention status, shows that married women with a birth resulting from an unwanted pregnancy were more than twice as likely (OR=2.23) as those with an intended pregnancy to transition out of marriage by the time their child was two years old. Marital dissolution among women with mistimed births, regardless of the extent of mistiming, did not differ significantly from those with intended births. In model 2, we add sociodemographic measures, as well as women's report of abuse by partner during the pregnancy, to examine whether these factors have any direct association with marital dissolution. Mothers with at least a college education were significantly less likely to have their marriage end by the time the child was two years old (OR=.22) as compared with mothers with only a high school degree. However, there were no significant differences in the likelihood of marital dissolution by age, parity or race. Intimate partner violence during the pregnancy, however, has a large positive association with marital dissolution (OR=5.0).

[INSERT TABLE 3]

Intention status and marital formation in the balanced sample

Similarly, by limiting our sample to only those women unmarried at conception, we can examine whether the odds of marital formation are associated with the intention status of the birth. Table 4 shows the results of logistic regressions estimating the association between intention status and marriage at two time points (birth and child's age 2) for mothers unmarried

at conception, adjusting for variation in background characteristics using inverse probability weights. As in Table 3, for each outcome, Model 1 includes only intention status, while Model 2 adds controls for sociodemographic measures and partner abuse during pregnancy. In the unadjusted data, we found that among women unmarried at conception intention status was significantly associated with marriage between conception and the child's birth (Table 1). After balancing the sample with the inverse probability weights, we find no significant differences between the intention status groups in the likelihood of being married by the time the child is born (Model 1, Table 4). However, unmarried women with an unwanted pregnancy were around half as likely (OR=.46) as those with an intended pregnancy to marry by the time the child was age two. Women with mistimed births (whether greatly or slightly mistimed) did not differ significantly from those with intended births on the odds of becoming married, either at the child's birth or two years later.

For both outcomes, in Model 2, non-Hispanic Black mothers were significantly less likely than non-Hispanic White mothers to transition to marriage. The differences between non-Hispanic Black and Hispanic women were also statistically significant. Additionally, mothers with less than a high school education were only half as likely as those with a high school degree to marry between conception and the birth of the child; they were also significantly less likely than college educated mothers to marry during this time period. In contrast, there was no significant association between education and marriage by age 2, although the direction of associations was the same for both outcomes. None of the other sociodemographic variables were associated with marriage at either point in time.

Unmarried women who reported partner abuse during pregnancy had no differential likelihood of marrying by the child's birth; however, these women had a significantly reduced likelihood (OR=.33) to marry by the time their child was two years old.

[INSERT TABLE 4]

Discussion

In this analysis of women having a birth from Oklahoma, intention status –particularly an unwanted pregnancy--was associated with mothers' transitions both into and out of marriage by the time the child was age two, even when differences in underlying background characteristics were accounted for using propensity score analysis. This is similar to the general pattern of findings in research on the 2001 ECLS-B, which found fewer transitions to marriage and more marital dissolution among women with unintended births as compared to intended births (2008). Here, by distinguishing between unintended births that were mistimed or unwanted, we find that the effects are limited to births resulting from unwanted pregnancies. This concentration of effects among unwanted births mirrors patterns found in recent analyses on the health consequences of unintended pregnancy nationally (Kost K. & Lindberg L, 2015) as well as in Oklahoma specifically.(Lindberg, Maddow-Zimet, Kost, & Lincoln, 2014), An unwanted birth is one that occurs after a woman has reached her desired completed fertility. Thus, greater efforts are needed to help women and their partners not exceed their desired fertility; for example, access to both long-acting contraceptive methods (LARCs) and contraceptive sterilization—both female and male—should be facilitated, especially for low-income individuals where cost and insurance regulations may be barriers (Baldwin, Rodriguez, & Edelman, 2012; Borrero, Zite, Potter, & Trussell, 2014).

Fewer than one in five women unmarried at conception engaged in what are commonly referred to as "shotgun marriages" – in other words, married between the conception and birth of their child. In the unadjusted data, shotgun marriages were less common among women with greatly mistimed and unwanted births than women with intended births; but, after adjusting for confounding background characteristics, there was no association between intention status and transition to marriage by the time of the child's birth. Of particular interest is the lack of an association between having a birth reported as mistimed by less than two years and the likelihood of marriage by birth or child's age two; if these modestly mistimed births represent a failure to achieve a specific and short-term set of reproductive and life goals, we might have expected to observe an increased likelihood of marriage in response to this pregnancy mistiming. Like other studies, we did find strong racial and education variations in the likelihood of marrying prior to birth, which appear to be far more influential determinants than intention status during this period between conception and birth.

Many studies that purport to show that marriage is the best setting for children do not address the intention status of the birth (Waldfogel, Craigie, & Brooks-Gunn, 2010; McLanahan, Haskins, Garfinkel, Mincy, & Donahue, 2010)— which itself is significantly associated with a variety of child outcomes (Lindberg et al., 2014; Kost K. & Lindberg L, 2015; Gipson et al., 2008). The intention status of a birth is, unsurprisingly, strongly influenced by the union in which it occurs (Finer & Zolna, 2014). We found substantial variation in intention status by marital status at conception, with one-third of births to married mothers, as compared to more than two-thirds of births to unmarried mothers, reported as unintended. Accordingly, it is possible that some of the observed positive associations between marriage and child well-being may be due to the intention status of the birth itself. Future work should further investigate these

relationships, particularly as this has relevance for family formation and stability promoting policies.

Additionally, it is important to recognize that unintended childbearing is not limited to unmarried women, but is an issue for a substantial share of married women as well. Nor is nonmarital childbearing synonymous with unintended childbearing. And although within these marital status groups there remained substantial sociodemographic differentials in unintended childbearing, no group of women we identified was immune from this experience. Our research findings suggest that programs focused on reducing unintended pregnancy may help to increase marriage formation and stability by reducing the number of unintended births, which seem to have negative effects on both of these outcomes. Greater opportunities for building collaborations between marriage promotion and family planning communities should be sought, such as building communication skills between women and their partners around desired fertility, and contraceptive preferences and behaviors (Kavanaugh, Lindberg, & Frost, 2012).

Similar to earlier studies (Carlson et al., 2004; DeMaris, 2000), we found strong evidence that women experiencing intimate partner violence during pregnancy had weakened marital stability if already married, and greatly decreased odds of transitioning to marriage if unmarried at conception. This retreat from marriage exists regardless of intention status. However, other research has suggested that unintended pregnancies themselves may be a risk factor for abuse by a partner (Moore, 1999). Indeed, the influences work in both directions, as intimate partner violence also has been identified as a risk factor for unintended pregnancy through a variety of individual and partner specific mechanisms, including reproductive control by the abusive partner (Coker, 2007; Moore, Frohwirth, & Miller, 2010). Efforts to promote women's well-being, whether marriage promotion programs, family planning programs, programs to identify

and treat partner abuse, or others, need to be responsive to the interrelationships between these factors.

Limitations

Our study has several limitations. The analysis investigates only the experiences in Oklahoma, and more research is needed to determine if similar patterns are observed in national data. The available data allow us to only examine marital transitions only in the two years following a birth. However, previous work has found that rates of both union formation and union dissolution are highest during this early period (Guzzo & Hayford, 2014; 2007), and there is substantial evidence that early patterns of marriage have influences on child well being extending far beyond the first two years of life (Waldfogel et al., 2010; McLanahan et al., 2010). The data also limited the analysis to formal marriages, leaving us unable to identify specifically any transitions in cohabitation associated with intention status, as cohabitors are included among unmarried women. Although current cohabitation status is collected as part of the PRAMS survey at 4-6 months postpartum, there is no retrospective report of cohabitation at conception, nor does the follow-up TOTS survey measure cohabitation when the child is two years old. Future data collection efforts should include measures of informal union status to help distinguish any differential patterns of marriage formation and stability between cohabiting and non-cohabiting women. However, given work on the relative instability of cohabiting unions (Manning et al., 2004; Rackin & Gibson-Davis, 2012), and mixed research on the benefits for children of even stable cohabitation (Schmeer, 2011; Waldfogel et al., 2010), we feel this focus on transitions into and out of marriage is a useful contribution.

While our analyses were stratified by marital status at conception, and our use of propensity score methods helped to disentangle women's intentions from their other

sociodemographic traits, there are probably still associations between marital status at the time of conception and intention status that we have not been able to uncouple. Women reporting a pregnancy as mistimed or unwanted are likely reflecting on the quality and status of their partnership at the time. Indeed, intention status and marital status at time of conception are inextricably linked – the characterization of a birth as unintended at conception may be a direct result of the absence of a formal relationship between the mother and the father. More stable or higher quality unions may be more likely to plan a birth, suggesting a selection effect (Lawrence, Rothman, Cobb, Rothman, & Bradbury, 2008). Future efforts should focus on incorporating measures of union quality, which were not available in the PRAMS and TOTS data, into analysis of the consequences of intention status for marriage formation and stability.

This research demonstrates the necessity of adjusting for confounding variables. Given that we can only adjust for measured variables, there may still be unobserved confounding. If we have failed to measure important characteristics of mothers that are predictive of intention status and that also affect marriage transitions or stability, then our findings may be biased. Notably, many factors contribute to couples' decisions to marry, stay together or divorce and the measures available in the Oklahoma PRAMS and TOTS data provide only a limited perspective on these decision-making processes. Nonetheless, this investigation constitutes an important step towards documenting whether preventing unintended childbearing may lead to more stable marriages.

References

Parents' relationship status five years after a non-marital birth. (2007). [39], 1-3. Princeton, NJ, Woodrow Wilson School of Public and International Affairs, Princeton University. Fragile Families Research Briefs: Relationship Quality and Marriage.

Unplanned Pregnancy and Family Turmoil. (2008). 1-6. National Campaign to Prevent Teen and Unplanned Pregnancy. Science Says: Research Briefs.

Baldwin, M. K., Rodriguez, M. I., & Edelman, A. B. (2012). Lack of insurance and parity influence choice between long-acting reversible contraception and sterilization in women postpregnancy. *Contraception, 86,* 42-47.

Borrero, S., Zite, N., Potter, J. E., & Trussell, J. (2014). Medicaid policy on sterilization -- Anachronistic or still relevant? *New England Journal of Medicine, 370,* 102-104.

Carlson, M., McLanahan, S., & England, P. (2004). Union formation in fragile families. *Demography, 41,* 237-261.

CDC, N. N. V. S. S. (2013). Data Brief 162: Recent declines in nonmarital childbearing in the United States. 2014.

CDC, N. N. V. S. S. (2014). Divorce rates by state: 1990, 1995, and 1999-2001.

Centers for Disease Control and Prevention (2009). PRAMS model surveillance protocol, 2009 CATI version. Centers for Disease Control and Prevention [On-line]. Available: http://www.cdc.gov/prams/PDF/ProtocolFiles/ProtocolZipFile.zip

Coker, A. L. (2007). Does physical intimate partner violence affect sexual health? A systematic review. *Trauma, Violence, and Abuse: A Review Journal, 8,* 149-177.

DeMaris, A. (2000). Till discord do us part: The role of physical and verbal conflict in union disruption. *Journal of Marriage and Family, 62,* 683-692.

Dugoff, E. H., Schuler, M., & Stuart, E. A. (2013). Generalizing Observational Study Results: Applying Propensity Score Methods to Complex Surveys. *Health Services Research*.

Finer, L. B. & Zolna, M. R. (2014). Shifts in intended and unintended pregnancies in the United States, 2001-2008. *American Journal of Public Health, 104 Suppl 1,* S43-S48.

Gipson, J. D., Koenig, M. A., & Hindin, M. J. (2008). The effects of unintended pregnancy on infant, child, and parental health: a review of the literature. *Studies in Family Planning, 39,* 18-38.

Guzzo, K. B. & Hayford, S. R. (2012). Unintended fertility and the stability of coresidential relationships. *Social Science Research, 41,* 1138-1151.

Guzzo, K. B. & Hayford, S. R. (2014). Fertility and the stability of cohabiting unions: Variation by intendedness. *Journal of Family Issues, 35,* 547-576.

Harknett, K. & McLanahan, S. S. (2004). Racial and ethnic differences in marriage after the birth of a child. *American Sociological Review, 69,* 790-811.

Heaton, T. B. (1990). Marital stability throughout the child-rearing years. *Demography, 27,* 55-63.

Imbens, G. W. (2000). The role of the propensity score in estimating dose-response functions. *Biometrika, 87,* 706-710.

Institute of Medicine (1995). *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families* Washington, DC: National Academy Press.

Institute of Medicine (2011). *Clinical preventive services for women: Closing the gaps* Report of the Committee on Preventive Services for Women, Washington, DC: National Academy of Sciences Press.

Kavanaugh, M. L., Lindberg, L. D., & Frost, J. (2012). Factors influencing partners' involvement in women's contraceptive services. *Contraception, 85,* 83-90.

Kost K. & Lindberg L (2015). Pregnancy intentions, maternal behaviors, and infant health: Investigating relationships with new measures and propensity score analysis. *Demography, 52,* 83-111.

Kost, K. (2013). *Unintended pregnancy rates at the state level: Estimates for 2002, 2004, 2006, and 2008* New York, NY: Guttmacher Institute.

Lawrence, E., Rothman, A. D., Cobb, R. J., Rothman, M. T., & Bradbury, T. N. (2008). Marital satisfaction across the transition to parenthood. *Journal of Family Psychology, 22,* 41-50.

Lee, B. K., Lessler, J., & Stuart, E. A. (2011). Weight trimming and propensity score weighting. *PLoS ONE, 6,* 1-6.

Lichter, D. T. (2012). Childbearing among Cohabiting Women: Race, Pregnancy, and Union Transitions. In A.Booth, S. L. Brown, N. S. Landale, W. D. Manning, & S. M. McHale (Eds.), *Early Adulthood in a Family Context* (pp. 209-219). New York, NY: Springer.

Lindberg, L., Maddow-Zimet, I., Kost, K., & Lincoln, A. Pregnancy intentions and maternal and child health: An analysis of longitudinal data in Oklahoma. *Maternal and Child Health Journal,* (in press).

Logan, C., Holcombe, E., Manlove, J., & Ryan, S. (2007). *The consequences of unintended childbearing: A white paper* Washington, DC: Child Trends and The National Campaign to Prevent Teen and Unplanned Pregnancy.

Lunceford, J. K. & Davidian, M. (2004). Stratification and weighting via the propensity score in estimation of causal treatment effects: a comparative study. *Statistics in Medicine, 23,* 2937-2960.

Manlove, J., Wildsmith, E., Ikramullah, E., Ryan, S., Holcombe, E., Scott, M. et al. (2012). Union transitions following the birth of a child to cohabiting parents. *Population Research and Policy Review, 31,* 361-386.

Manning, W. D., Smock, P. J., & Majumdar, D. (2004). The relative stability of cohabiting and marital unions for children. *Population Research and Policy Review, 23,* 135-159.

McCaffrey, D. F., Griffin, B. A., Almirall, D., Slaughter, M. E., Ramchand, R., & Burgette, L. F. (2013). A tutorial on propensity score estimation for multiple treatments using generalized boosted models. *Statistics in Medicine, 32,* 3388-3414.

McLanahan, S., Haskins, R., Garfinkel, I., Mincy, R. B., & Donahue, E. (2010). Strengthening fragile families. *The Future of Children, 20,* 1-8.

Moore, A., Frohwirth, L., & Miller, E. (2010). Male reproductive control of women who have experienced intimate partner violence in the United States. *Social Science & Medicine, 70,* 1737-1744.

Moore, M. (1999). Reproductive health and intimate partner violence. *Family Planning Perspective, 31,* 302-306.

Mosher, W. D., Jones, J., & Abma, J. C. (2012). *Intended and unintended births in the United States: 1982-2010* (Rep. No. 55). Hyattsville, MD: National Center of Health Statistics.

National Campaign to Prevent Teen and Unplanned Pregnancy. (2008). Unplanned Pregnancy and Family Turmoil. 1-6. National Campaign to Prevent Teen and Unplanned Pregnancy. Science Says: Research Briefs.

National KIDS COUNT. (2012). Kids Count Data Center. Annie E.Casey Foundation.

Oklahoma State Department of Health. (2012). TOTS 2012 Protocol.

Oklahoma State Department of Health. (2013). Marriage and Divorce Statistics 1990-2013, By County of Issuance. Oklahoma State Department of Health.

Rackin, H. & Gibson-Davis, C. (2012). The role of pre- and postconception relationships for first time parents. *Journal of Marriage and Family, 74,* 526-539.

Rosenbaum, P. R. & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70,* 41-55.

Schmeer, K. K. (2011). The child health disadvantage of parental cohabitation. *Journal of Marriage and Family, 73,* 181-193.

Sonfield, A. & Kost, K. (2013). *Public costs from unintended pregnancies and the role of public insurance programs in paying for pregnancy and infant care: Estimates for 2008* New York: Guttmacher Institute.

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science, 25,* 1-21.

U.S.Department of Health and Human Services (2010). Healthy People 2020 topics & objectives. ealthy People 2020 topics & objectives [On-line]. Available: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=13

Waite, L. J. & Lillard, L. A. (1991). Children and marital disruption. *American Journal of Sociology, 96,* 930-953.

Waldfogel, J., Craigie, T. A., & Brooks-Gunn, J. (2010). Fragile families and child wellbeing. *The Future of Children, 20,* 87-112.

Wu, L. L. & Musick, K. (2008). Stability of marital and cohabiting unions following a first birth. *Population Research and Policy Review, 27,* 713-727.

Table 1. Percent distribution of intention status, and proportion of women married at conception, birth and two years after the birth, by intention status and marital status at conception, Okahoma PRAMS 2004-2008 and TOTS 2006-2010.

Intention status	Percent distribution	Percent married at: Conception	Birth	Two years
Women married at conception				
Total	**100%**	**100%**	**99%**	**93%**
Intended	67%	100%	100%	94%
Mistimed< 2 years	16%	100%	99%	93%
Mistimed>= 2 years	10%	100%	97% *	89% *
Unwanted	8%	100%	98%	85% *
Women unmarried at conception				
Total	**100%**	**0%**	**16%**	**30%**
Intended	31% ^	0%	21%	37%
Mistimed< 2 years	18%	0%	15%	31%
Mistimed>= 2 years	38% ^	0%	14% *	26% *
Unwanted	13% ^	0%	10% *	24% *

^ Significantly different between women married and unmarried at conception at p<.05

* p<.05 vs. intended.

Figure 1. Proportion of women married at conception, birth and two years after the birth, by intention status and marital status at conception

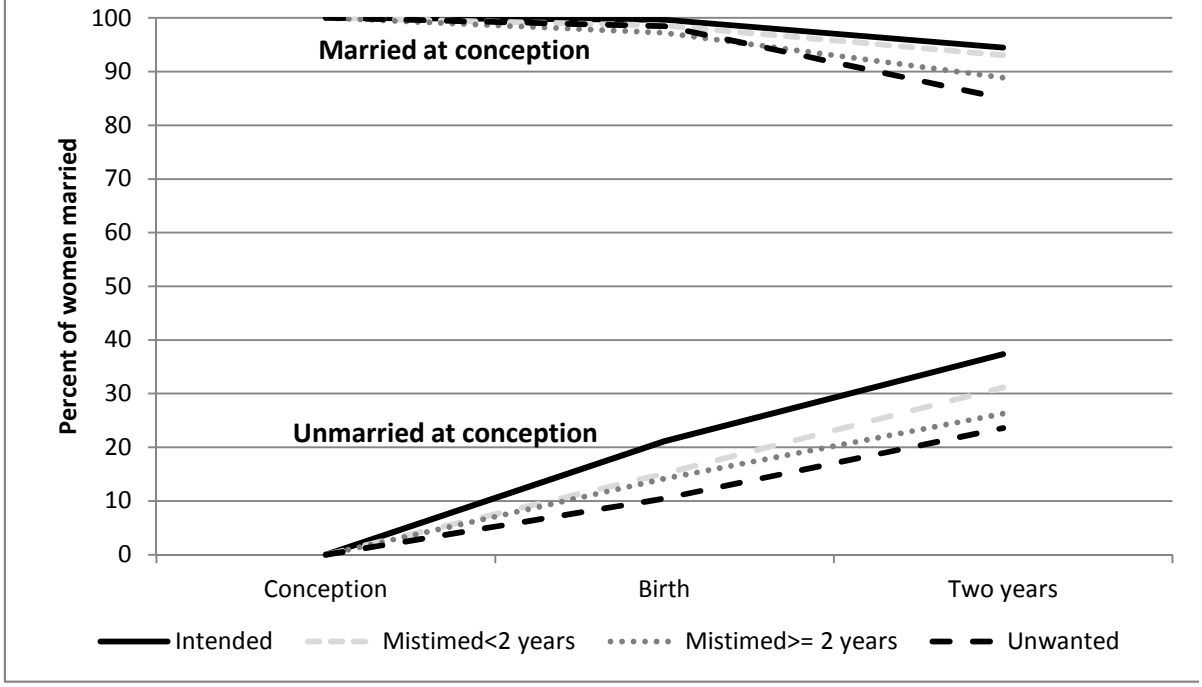

Table 2. Percentage distribution of background characteristics of mothers of births, by intention status and marital status at conception, Okahoma PRAMS 2004-2008 and TOTS 2006-2010.

	All women	**Married at conception**					**Unmarried at conception**				
Characteristic	**Total**	**Total**	Intended	Mistimed <2 years	Mistimed >=2 years	Unwanted	**Total**	Intended	Mistimed <2 years	Mistimed >=2 years	Unwanted
N	**5,740**	**3,617**	2,516	511	314	276	**2,123**	702	383	753	285
Age at index birth											
15-24	**38%**	**23%**	20%	34% *	36% *	8% *	**58%**	51%	57%	73% *	38%
(15-19)	**8%**	**1%**	NA	NA	NA	NA	**17%**	12%	11%	27% *	9%
(20-24)	**30%**	**21%**	19%	31% *	32% *	8% *	**41%**	38%	46%	46%	29%
25-29	**33%**	**39%**	39%	38%	45%	32%	**26%**	29%	34%	19% *	31%
30-44	**28%**	**39%**	41%	28% *	19% *	60% *	**15%**	21%	9% *	8% *	31%
First birth	**42%**	**33%**	39%	30% *	21% *	6% *	**53%**	50%	49%	64% *	32% *
Race											
Non-Hispanic white	**70%**	**78%**	79%	76%	70% *	79%	**60%**	58%	62%	62%	53%
Hispanic	**10%**	**9%**	8%	10%	15% *	6%	**12%**	19%	11% *	6% *	11% *
Non-Hispanic black	**8%**	**4%**	3%	5%	5%	6%	**13%**	9%	11%	16% *	18% *
Non-Hispanic other	**13%**	**10%**	11%	9%	10%	9%	**15%**	14%	16%	15%	18%
Education											
Less than high school	**17%**	**9%**	7%	10%	18% *	9%	**28%**	35%	25% *	27%	16% *
High school	**38%**	**30%**	28%	33%	37% *	36%	**47%**	43%	51%	47%	53%
College or more	**45%**	**61%**	66%	57% *	45% *	55% *	**25%**	22%	25%	26%	31%
Above federal poverty line [a]	**65%**	**83%**	87%	77% *	64% *	79% *	**42%**	39%	43%	43%	46%

* p<.05 vs. intended.

[a] in 12 months before baby was born

Notes: NA - results not shown due to small sample sizes. All differences in totals between women married and unmarried at conception are significant at the p<.05 level

Table 3. Logistic regression of association between intention status and marital dissolution at child's age 2, among women married at conception; using inverse probability weights, Okahoma PRAMS 2004-2008 and TOTS 2006-2010.

Characteristic	**Unmarried at age 2**	
	Model 1	**Model 2**
Intention Status		
Intended (reference)	1.00	1.00
Mistimed< 2 years	1.07	1.08
Mistimed>= 2 years	1.33	1.34
Unwanted	2.23*	3.01**
Age at index birth		
15-24		1.38
25-29 (reference)		1.00
30-44		1.51
First birth		1.60
Race		
Non-Hispanic white (reference)		1.00
Hispanic		0.71
Non-Hispanic black		2.52
Non-Hispanic other		0.99
Education		
Less than high school		1.06
High school (reference)		1.00
College or more		0.22**
Intimate partner violence during pregnancy		5.04**

* p <.05 ** p<.01 *** p<.001

Table 4. Logistic regression of association between intention status and marital formation at birth and child's age 2, among women unmarried at conception; using inverse probability weights, Okahoma PRAMS 2004-2008 and TOTS 2006-2010.

Characteristic	Married at birth		Married at age 2	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Intention Status				
Intended (reference)	1.00	1.00	1.00	1.00
Mistimed< 2 years	1.01	1.00	0.79	0.76
Mistimed>= 2 years	0.92	0.93	0.77	0.77
Unwanted	0.56	0.53	0.46*	0.45*
Age at index birth				
15-19		0.66		0.54
20-24		0.83		0.68
25-29 (reference)		1.00		1.00
30-44		0.76		0.64
First birth		1.04		0.70
Race				
Non-Hispanic white (reference)		1.00		1.00
Hispanic		0.78		1.30
Non-Hispanic black		0.08**		0.06**
Non-Hispanic other		0.57		0.66
Education				
Less than high school		0.48*		0.61
High school (reference)		1.00		1.00
College or more		1.53		1.18
Intimate partner violence during pregnancy		0.76		0.33**

* p<.05 ** p<.01 ***p<.001

Appendix Table 1: Standardized bias estimates for unbalanced and balanced samples, by union status at conception; intended births compared to each of the other three intention status groups.

	Married at conception						Unmarried at conception					
	Intended vs. mistimed < 2 years		Intended vs. mistimed >= 2 years		Intended vs. unwanted		Intended vs. mistimed < 2 years		Intended vs. mistimed >= 2 years		Intended vs. unwanted	
	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced
Age at index birth												
15-19	0.13	0.03	0.24	0.05	0.07	0.07	0.04	0.07	0.41	0.06	0.10	0.03
20-24	0.32	0.02	0.34	0.16	0.27	0.11	0.16	0.02	0.15	0.04	0.19	0.14
25-29	0.02	0.01	0.14	0.01	0.15	0.07	0.13	0.03	0.22	0.01	0.06	0.03
30-44	0.27	0.04	0.45	0.14	0.37	0.17	0.32	0.01	0.33	0.01	0.27	0.11
First birth	0.18	0.06	0.36	0.05	0.68	0.26	0.03	0.00	0.28	0.02	0.36	0.16
Race												
Non-Hispanic white (reference)	0.07	0.10	0.23	0.19	0.01	0.09	0.09	0.02	0.09	0.08	0.10	0.16
Hispanic	0.09	0.06	0.27	0.19	0.07	0.10	0.26	0.04	0.43	0.10	0.28	0.17
Non-Hispanic black	0.10	0.07	0.13	0.02	0.16	0.01	0.05	0.08	0.20	0.02	0.25	0.06
Non-Hispanic other	0.05	0.04	0.02	0.07	0.05	0.03	0.05	0.09	0.04	0.01	0.12	0.14
Education												
Less than high school	0.14	0.09	0.45	0.07	0.10	0.02	0.24	0.02	0.19	0.07	0.45	0.06
High school	0.11	0.02	0.21	0.09	0.19	0.12	0.15	0.08	0.08	0.04	0.20	0.17
College or more	0.18	0.03	0.44	0.12	0.23	0.10	0.06	0.06	0.09	0.02	0.21	0.14
*Above federal poverty line**	0.29	0.06	0.64	0.08	0.24	0.02	0.08	0.05	0.08	0.04	0.14	0.06

*In 12 months before baby was born

Note: Other factors also varied significantly by intention status and were therefore included in the mulivariate regression used to calculate propensity scores: on Medicaid before pregnancy (yes/no), abuse by partner in 12 months prior to birth (yes/no), Spanish questionnaire (yes/no), all sources of income, stressful life events in year before birth, number of dependents in household, cigarettes smoked per day in 3 months previous to pregnancy, drinks per week in 3 months previous to pregnancy, frequency of binge drinking in 3 months previous to pregnancy, visited dentist in past year (yes/no), dieting in order to lose weight 3 months prior to pregnancy (yes/no), heard or read about benefits of folic acid (yes/no), and tested for HIV (yes/no). Interaction terms between several of the above variables, as well as for the year of survey administration, were also included in the propensity model but are not listed here due to space constraints. However all of the variables listed above had estimated standardized bias values of less than .25 in the balanced sample.