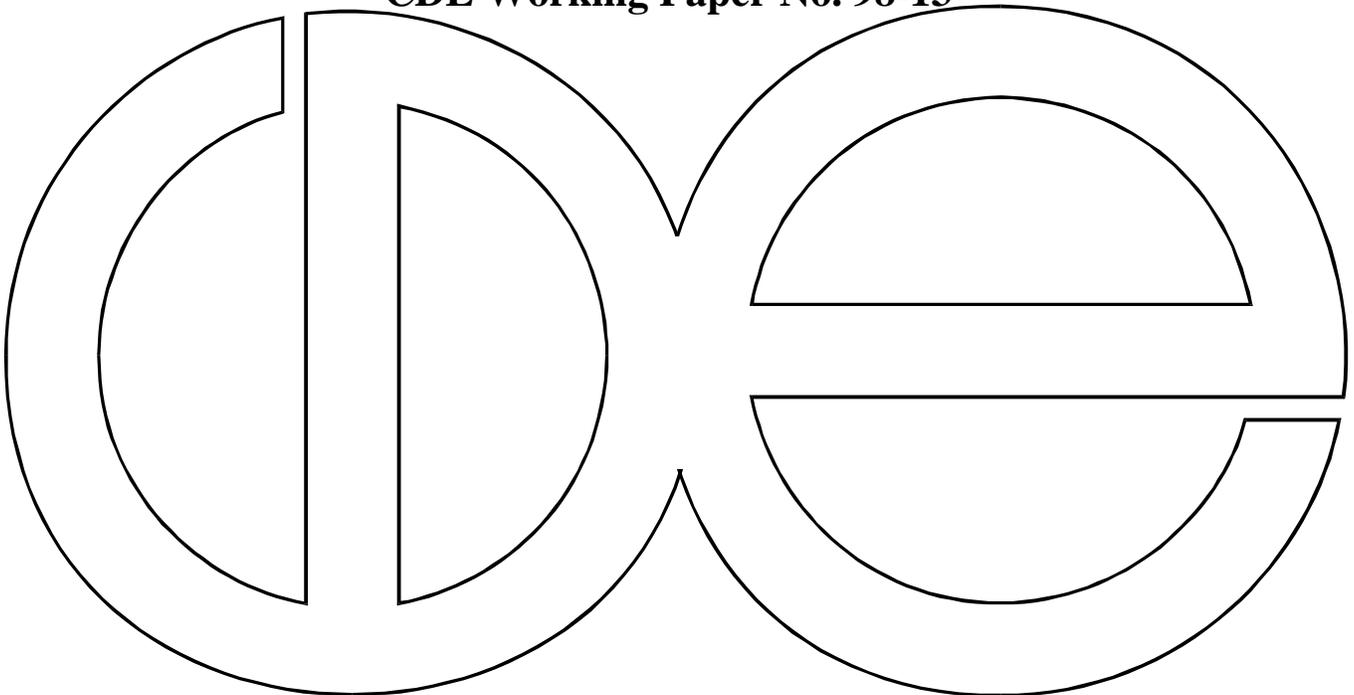


**Center for Demography and Ecology
University of Wisconsin-Madison**

**Survey Estimates of the Contraceptive Effect
of Breastfeeding in the United States**

Steven P. Martin

CDE Working Paper No. 98-13



**SURVEY ESTIMATES OF THE CONTRACEPTIVE EFFECT
OF BREASTFEEDING IN THE UNITED STATES**

Steven P. Martin
University of Wisconsin-Madison

June 1998

Direct all correspondence to Steven P. Martin, Department of Sociology, 1180 Observatory Drive, University of Wisconsin, Madison, WI 53706, smartin@ssc.wisc.edu. The author gratefully acknowledges research funding from NICHD (HD 29550), the William T. Grant Faculty Scholars Program and the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services, to the Institute for Research on Poverty. Additional research support was provided by a NICHD core grant to the Center for Demography and Ecology (HD 05876).

ABSTRACT

This study uses survey data to estimate the overall contraceptive effect of breastfeeding in the United States. In the six months following a first birth, repeat pregnancy rates are low for most U.S. women, but they are lowest for women with a nonteen first birth who are currently breastfeeding. A multivariate analysis shows that only a small part of the association between repeat pregnancy rates and breastfeeding is explained by background characteristics. However, certain circumstances, such as a teen first birth or breastfeeding beyond six months, negate or reverse the contraceptive benefit of breastfeeding. Supplementing or stopping breastfeeding may also increase the risk of a repeat pregnancy but these factors do not produce statistically significant effects in this analysis. In addition, a possible association between breastfeeding and postpartum sexual abstinence might explain away part of the net contraceptive effect of breastfeeding.

INTRODUCTION

Recent research has identified many benefits of breastfeeding for infants, mothers, and the societies they live in. In the United States, the American Academy of Pediatrics recently released a policy statement offering recommendations about breastfeeding and outlining its benefits (AAP, 1997). Among those benefits, the AAP guidelines mention the contraceptive effect of breastfeeding that helps increase child spacing. Researchers have studied the biological basis of this contraceptive effect and have identified its potential efficacy as well as its effects at the population level in developing nations (see Bender et al., 1998; Ford and Kim, 1993). However, the contraceptive value of breastfeeding at the individual level, and in the context of a society with extensive access to modern contraceptives, is still uncertain. At the same time, the AAP's new policy recommends that a higher proportion of U.S. women should breastfeed and encourages women to breastfeed for a longer time (12 months or more). If both of those objectives are achieved, the contraceptive effect of breastfeeding in the United States could become a more important issue than it has been in the past.

Why is close child spacing a concern?

When a mother becomes pregnant again immediately after her first birth, both she and her children could suffer adverse effects. Infants conceived within 12 months of a previous birth, and especially within 6 months, often have lower birth weights because the physiological stress on the mother retards fetal development (Miller, 1991; Lang et al., 1990). Largely through the effects of low birth weight, short pregnancy intervals cause poorer birth outcomes in general (Hollander, 1995). However, even though close birth spacing increases risks for infants, extremely closely spaced births are relatively uncommon. Also, even women with closely spaced births have a low

overall incidence of low birth weight babies in the U.S., so close birth spacing is generally not a critical health concern there (see Adams et al., 1997).

Perhaps more important than the health consequences of closely spaced births are the social consequences (see Heer, 1986). Compared to more “spaced out” siblings, closely spaced siblings experience worse educational outcomes (Marjoribanks, 1994; Powell and Steelman, 1993) and have less access to the economic resources of their parents (Powell and Steelman, 1995). However, one must be careful interpreting the correlation between birth spacing and social disadvantage because women who have closely spaced pregnancies often come from disadvantaged backgrounds. For example, adolescent mothers in the U.S. have relatively high rates of closely spaced births (Martin and Wu, 1998; Namerow and Kalmuss, 1994; Mott, 1986).

Several studies indicate that close birth spacing can exacerbate the social disadvantages of adolescent mothers. Among women with a teen first birth in the United States, closely spaced second births increase economic disadvantages (Polit and Kahn, 1986), increase the likelihood of infant health problems (Jekel et al., 1975), and apparently increase the chance that the children will be maltreated (Flanagan et al., 1995; Zuravin, 1991). For these reasons, and because a repeat pregnancy is such a visible event, repeat pregnancy rates are often used to gauge the success of social programs for adolescent mothers (Balassone, 1988; examples include Maynard and Rangarajan, 1994; Erickson, 1994).

The contraceptive efficacy and contraceptive effects of breastfeeding

Breastfeeding protects women from a repeat pregnancy via at least two biological mechanisms (see McNeilly, 1993). First, breastfeeding delays the return of ovulation and menstruation after a birth. This interval of lactational amenorrhoea lasts from a few months to a

few years postpartum, depending on breastfeeding intensity, a number of other factors, and individual variation. During lactational amenorrhoea, a woman is almost fully protected from a repeat pregnancy, although the return of ovulation precedes the return of menstrual bleeding for a majority of breastfeeding women. This small contraceptive “gap” involving a first unprotected ovulation is normally offset by the second contraceptive mechanism of breastfeeding – its disruptive effect on the hormonal profile of the first ovulatory cycle. Regular breastfeeding also affects the hormonal profiles of subsequent cycles, but not enough to provide reliable contraceptive protection (Diaz et al., 1992)

While breastfeeding provides direct contraceptive benefits, it also introduces complications for women who wish to use other contraceptive methods (see Hatcher et al, 1994; Kennedy, 1996). Combined oral contraceptives which contain estradiol (e.g. “the pill”) interfere with milk production and are not recommended for breastfeeding women. Progestin-only contraceptives, which include inserted or injectable contraceptives, do not interfere with milk production, but they increase progestin concentrations in the mother’s milk supply. Such hormone exposure has an uncertain effect on infant health, but most studies recommend that a breastfeeding mother wait at least six weeks postpartum before initiating progestin-based contraceptive methods (c.f. Visness and Kim, 1995). With intrauterine devices rarely used in the United States, barrier methods such as condoms are left as the contraceptives most recommended for breastfeeding women. Some of the direct contraceptive benefit of breastfeeding may thus be offset if breastfeeding women wait longer to resume other contraceptive methods and use less effective methods, compared to women who do not breastfeed.

Numerous studies have evaluated the direct contraceptive benefit of breastfeeding. Based on data from developing and developed countries, researchers have reached a consensus about the

potential efficacy of breastfeeding as a contraceptive (Kennedy et al., 1989; Perez et al., 1992).

This consensus specifies a protocol called the Lactational Amenorrhoea Method for use in developing nations with limited access to contraception. The lactational amenorrhoea method has also gained attention in developed nations as a potentially effective natural family planning method (Labbok et al., 1997; Hight-Laukaran et al., 1997). Under the lactational amenorrhoea method, a woman who is fully breastfeeding, breastfeeds at least every four to six hours, and has not experienced a return of menstrual bleeding, has less than a 2 percent chance of experiencing a repeat pregnancy during the first six months postpartum. This protection may extend to women who use supplements or breastfeed beyond six months, but the lactational amenorrhoea method definitely loses its effectiveness after menses resume.

For women in developed nations such as the United States, the lactational amenorrhoea method is sometimes promoted as a means of spacing births and an interim contraceptive method to be replaced by other methods once it is no longer effective (e.g. Georgetown University, 1996; Saarikoski, 1993; Kennedy and Visness, 1992). Some medical researchers have also proposed that breastfeeding might have a contraceptive benefit for groups of women with high rates of close birth spacing and low rates of breastfeeding, such as black women (see Williams, 1995; Rawlings et al, 1995a, 1995b). However, this possibility has not been investigated. At the same time, some researchers still argue that breastfeeding is not a reliable contraceptive at the individual level in developed nations (e.g. Rogers, 1997).

The 2 percent repeat pregnancy rate claimed for the lactational amenorrhoea method identifies the *efficacy* (potential effectiveness under perfect use) of breastfeeding as a contraceptive, but it does not capture the overall contraceptive *effect* of breastfeeding. All forms of contraception have a failure rate associated with their “typical” use which reflects user failure

as well as method failure (see Steiner et al., 1996). In the case of breastfeeding, “user failure” rates depend on the increased risk associated with breastfeeding less than full time, more than six months postpartum, or after a return of menses. User failure rates also depend on exposure rates; that is, on the proportions of breastfeeding women who deviate from the lactational amenorrhoea method, and on the relative durations of amenorrhoeic breastfeeding and total breastfeeding. High user failure rates might limit the contraceptive effect of breastfeeding despite the high perfect-use efficacy of the lactational amenorrhoea method.¹

While the contraceptive efficacy of breastfeeding is well established, little is known about its overall contraceptive effect in developed societies. Existing research on the contraceptive efficacy of breastfeeding has generally focused on controlled clinical studies of volunteer women predisposed to full and extended breastfeeding,² often from favorable age and social strata. These studies lack a true comparison group, so the 2 percent failure rate of the lactational amenorrhoea method is often compared (favorably) to first-year failure rates for other contraceptive methods. Such comparisons almost certainly exaggerate the contraceptive benefits of the lactational amenorrhoea method. A truer comparison should account for the fact that all women have low repeat pregnancy rates during the first few months postpartum, as well as the fact that women who breastfeed have lower coital frequency than women who do not breastfeed (Visness and Kennedy, 1997).

Researchers have not measured the gap between the contraceptive efficacy and effect of breastfeeding in the United States, but that gap could be substantial. High levels of nourishment

¹ It is somewhat inaccurate to define breastfeeding as a contraceptive method, because many women who breastfeed do not consider it a contraceptive method. However, most women breastfeed during intervals when they wish to avoid pregnancies, and breastfeeding limits women’s choices of other contraceptive methods, so breastfeeding is necessarily linked to questions of contraceptive effectiveness.

² Indeed, many studies of the lactational amenorrhoea method included only test subjects who had already fully breastfed successfully for two or more months (e.g. Perez et al., 1992).

generally reduce woman's duration of lactational amenorrhoea; in most studies in developed nations, the median duration of lactational amenorrhoea for fully breastfeeding women is less than 6 months (Gray et al., 1990; Campbell and Gray, 1993; France, 1997). Thus, even among women who commit to using the lactational amenorrhoea method and manage to breastfeed fully, a return of menses will still force more than half to switch to another contraceptive method before 6 months postpartum. Furthermore, the length of lactational amenorrhoea varies by parity. In the United States, women often limit their family size to two children, so the contraceptive effect of breastfeeding at parity one is most important (because breastfeeding is a contraceptive method for spacing births instead of stopping births). Unfortunately, women usually have the shortest durations of breastfeeding and of lactational amenorrhoea when breastfeeding their first babies (Hill et al., 1997). Another potential concern involves the "stopping" interval; some researchers have expressed concerns about how efficiently women will switch to longer-term contraceptive methods after they stop breastfeeding or after their return to menses (see Bracher, 1992). A contraceptive gap associated with stopping breastfeeding is a special concern in nations with little access to contraceptives, but it could also be a problem in places like the United States, especially among socially disadvantaged groups of women with limited access to health care.

One socially disadvantaged group of special interest to this study is women with a teen first birth. In the United States and elsewhere, teen mothers are a category of women with notably low breastfeeding rates (Thau et al., 1996), so if health care providers hope to increase breastfeeding rates in the United States, women with a teen first birth are an important target group. Teen mothers in the U.S. also have relatively high rates of closely spaced second births, so a contraceptive benefit of breastfeeding would be especially valuable among such women.

However, one should not assume that all groups of women experience the same contraceptive effects of breastfeeding, and teen mothers are a case in point. The circumstances of breastfeeding for women with a teen first birth are often different than for other women, both socially (Ineichen et al., 1997) and biologically (e.g. Motil et al., 1997). Because teen mothers typically breastfeed for short durations, any contraceptive protection afforded by the lactational amenorrhoea method would be brief on average. In addition, some biological circumstances of young women's fertility imply that the lactational amenorrhoea method might be less effective for women with an adolescent first birth. As mentioned earlier, the lactational amenorrhoea method requires women to stop relying on breastfeeding as a contraceptive after the return of menses, which usually means that a woman practicing that method will have one "unprotected" ovulation. Holman and Wood (1996) have found evidence suggesting that fecundability is partly a function of the genetic viability of ova, and that women have the highest proportions of viable ova at their youngest ages. Thus, exposure to one unprotected ovulation could be more risky for a teen mother than for an older mother. Research indicates that this "unprotected" first ovulation is not really unprotected because the luteal phase of the first hormonal cycle usually cannot support implantation and pregnancy (Diaz, *op. cit.*). Again, however, teen mothers may be at a disadvantage if they have lower rates of luteal insufficiency than other women.³

Even in durations when it is effective and among women for whom it is effective, the lactational amenorrhoea method can be difficult to practice. Full breastfeeding is the only contraceptive method that requires six or more lengthy applications per day, including the middle

³ Some studies have indicated substantial individual variation in biological components of fecundability (see Wood et al., 1994), and luteal sufficiency is one such component. If some women are more likely to experience an unplanned teen pregnancy because (in part) they are more fecundable than other women, then biological characteristics associated with high fecundability should be more common among teen mothers. Because repeat pregnancies while breastfeeding involve only one or a few ovulation events, this could be a rare circumstance where individual variation in fecundability has measurable demographic consequences.

of the night. Breastfeeding women who introduce supplements may not substantially decrease the effectiveness of lactational amenorrhoea, but supplementation hastens the return of menses and can thereby impel women to discontinue the lactational amenorrhea method. The many other health benefits of breastfeeding certainly justify the effort required of the mother, and for women who are already fully breastfeeding for other reasons, contraceptive protection could be a free bonus. However, because the lactational amenorrhoea method places significant demands on the user and usually discontinues itself even under correct use, the remarkable perfect-use efficacy of that method does not automatically translate into a typical-use contraceptive benefit of breastfeeding. Thus, before health care providers promote breastfeeding for child spacing, they should know its contraceptive effect as well as its efficacy.

The goals of this study

In this study, I evaluate the net contraceptive effect of breastfeeding in the United States. This study uses national sample surveys to identify rates of closely spaced second births for women of different breastfeeding status, including full breastfeeding, breastfeeding with supplements, breastfeeding at more than 6 months postpartum, and discontinuing breastfeeding. In addition, this study explores the possibility that the contraceptive effect of breastfeeding might be different for women with a teen first birth versus a nonteen first birth. To emphasize the value of breastfeeding as a contraceptive for child spacing, I only examine the contraceptive effect of breastfeeding at parity one.⁴ Lastly, women do not decide to breastfeed at random, so I include

⁴ Because breastfeeding and lactational amenorrhoea last longer at higher parities, this study of the contraceptive effect of breastfeeding at parity one should provide a *minimum* estimate of the contraceptive effect of breastfeeding across all parities.

controls for background factors that might predispose breastfeeding women to lower or higher repeat pregnancy rates.⁵

Compared to clinical data of breastfeeding and repeat pregnancies, large-scale surveys offer a few advantages. Unlike previous clinical studies of the lactational amenorrhoea method, this study has a ready-made comparison group – a national sample of first-time mothers who did not choose to breastfeed. Also, women who participate in clinical studies could benefit from extra instruction or care, but retrospective survey data are free from this potentially biasing effect.⁶ The large sample size of a survey can also improve the estimates of covariate effects. Finally, while statistical controls for background variables are never perfect, such controls show roughly how much of the contraceptive effect of breastfeeding might be attributed to the characteristics of women who choose to breastfeed.

The survey format also has numerous disadvantages in comparison to clinical studies. Most importantly, surveys miss critical information. For example, no available surveys ask the date at which breastfeeding women experience a return of menses, the most important criterion for continuing the lactational amenorrhoea method. Surveys also often gather inaccurate data, especially when women are asked to recall not only an event but also the exact month of the event. Lastly, surveys tend to cover long spans of time, so some apparent “treatment” effects could actually be period effects, or at least period-dependent effects. Trends in repeat pregnancy

⁵ Selection bias is usually a weakness of survey research in comparison to clinical studies. In this case, however, clinical studies offer no special advantage. It would not be ethical or practical to randomly assign women to breastfeed or not breastfeed. Indeed, clinical studies of the lactational amenorrhoea method are especially vulnerable to selection bias because they often study not only volunteers willing to fully breastfeed, but volunteers who have already successfully breastfed for one or more months (see Labbok et al., 1997, Perez et al., 1992)

⁶ In clinical studies of the lactational amenorrhoea method, health care providers carefully explain contraceptive issues to participants. This contrasts with the real-world experience of new mothers who seldom receive adequate postpartum contraceptive advice (Glasier et al., 1996; Rojnik et al., 1995).

rates might correlate with breastfeeding because breastfeeding rates in the U.S. have fluctuated over recent decades (Ryan et al, 1991; Smith, 1985).

In this study, I will attempt to address most of the methodological shortcomings of the available survey data. Where possible, I insert controls into the main analysis or conduct parallel analyses to test for spurious results. In other cases, however, I can only provide descriptive representations of important but flawed data.

DATA AND METHODS:

This study used three data sources. The primary analysis combined the National Survey of Family Growth (NSFG) cycles IV (1988) and V (1995). I then replicated that analysis using the 1979–1994 waves of the National Longitudinal Survey of Youth (NLSY). The NSFG 1988 gathered fertility, social, economic, and family background data from a national sample of 8450 women in the United States age 15 to 44 at interview, and the NSFG 1995 gathered somewhat more extensive information from 10847 women age 15 to 44 at interview. The NLSY is a national probability sample of 12,686 men and women in the United States who were 14 to 22 years old in 1979, and who were thus 29 to 37 years old by the 1994 interview. In the NLSY analysis, I excluded males, a poor white subsample, and a military subsample. In both the NSFG and NLSY analyses I retained oversamples of minority groups and used statistical controls for these oversampled categories. Response rates in the 1988 and 1995 NSFG were about 80 percent; the retention rate through the 1994 wave of the NLSY was almost 90 percent.

Because this analysis conditions on a first birth, I restricted the samples to women with a singleton first birth (no twin or triplet first births). For the combined NSFG 1988 and 1995 samples, I also excluded all women whose first birth occurred before 1980. I further excluded from the NSFG samples 4 cases who reported a spacing of 9 months or less between the first two births, and 96 cases who did not report the breastfeeding status of the first child, leaving a total of 6335 cases. The NLSY sample of women with a first birth is much smaller, but the fertility history may be more accurate because the interviewer verifies the birth dates of all children at each interview. From the NLSY I excluded 3 cases with an ambiguous fertility history and 253 cases missing breastfeeding status of the first child, leaving a final sample size of 3358.⁷

⁷The NLSY did not gather breastfeeding information in the 1979–1982 waves. Most of the NLSY women with missing breastfeeding information dropped out of the study before 1983.

I estimated the effects of breastfeeding status and other variables on rates of closely spaced, live birth pregnancies using a Cox proportional hazards model. In this model the monthly hazard of a second live birth pregnancy is represented by the following equation:

$$h(t) = h_o(t) \exp (b_1x_1 + \dots + b_kx_k)$$

where b_1, \dots, b_k represent the effects of each variable on the monthly risk of a second live birth pregnancy. Because the Cox model provides no estimate of the baseline hazard $h_o(t)$, I preface the full analysis with nonparametric life table estimates of the conditional second pregnancy rates for women of different breastfeeding status and age at first birth.

The main outcome variable in this study is a closely spaced second pregnancy that leads to a second live birth. To measure the pregnancy interval, I used respondents' reports of the date of the first birth, as well as the date of the second birth and duration of the second pregnancy where applicable. The time frame of the study is twelve months following the first live birth.

Some live births from pregnancies in the first twelve months postpartum are intended, so live birth pregnancies are an imperfect measure of contraceptive effects.⁸ To address this concern, I wrote a parallel data set in which the outcome variable was an unintended repeat pregnancy. However, this alternative outcome variable uses questionable data. Some unintended repeat pregnancies end in abortions, and abortions are apparently underreported by at least 40 percent in the NSFG (NCHS 1997; see also Kelly et al., 1997). In addition, interview programming errors resulted in missing data on intention status in about 5% of NSFG 1995 cases. Because of these weaknesses in the data, I analyze unintended repeat pregnancy rates only to support the analyses of live birth pregnancies.

⁸ NSFG respondents reported that 69 percent of live birth second pregnancies in the six months postpartum were not wanted or not wanted that soon. The proportion of unintended live birth pregnancies declined to under 50 percent by ten months postpartum.

The key explanatory variables define each respondent's breastfeeding status over time. The first time-varying covariate identifies all months in which a woman was currently breastfeeding. The NSFG but not the NLSY analyses also include a variable for currently breastfeeding while supplementing with formula or other food.⁹ Both the NLSY and the NSFG analyses include variables to identify breastfeeding durations after 6 months postpartum. Yet another time-varying variable identifies the stopping interval, defined as the three months after a woman stops breastfeeding.¹⁰ The final breastfeeding variable is a fixed variable that identifies each woman who breastfed at all, no matter what the duration. The purpose of this variable is to capture some of the selection effect on repeat pregnancy rates attributable to otherwise unmeasurable characteristics of women who decide to breastfeed. For example, women who choose to breastfeed may be more careful about avoiding a closely spaced pregnancy, or conversely, they may be more oriented toward childbearing.¹¹

Other variables in the main analysis act as controls. These controls include the respondent's age at first birth, marital status at first birth, and intention status of the first birth. I controlled family background with dichotomous variables for the respondent's mother's age at first birth, the respondent's mother's educational status, and whether the respondent lived with both parents at age 14. To accommodate oversampling on racial groups, I included race and ethnicity variables in all models. I also estimated a period effect identifying the five-year span in

⁹ NLSY gathered some information about breastfeeding supplements, but only in the 1983 to 1990 waves.

¹⁰ The stopping variable is somewhat unsatisfactory in two ways. First, my choice of three months as a stopping period was arbitrary. An effect of stopping might be more noticeable in the first month postpartum, but the estimates for such a brief interval would produce very large standard errors. Second, the effect of contraceptive switching might be better measured from the time of introduction of supplements, or even better, from the return of menses if such information were available.

¹¹ In addition to capturing prior orientations toward certain contraceptive or childbearing behavior, the "ever breastfed" variable would also capture any effect of breastfeeding which causes women to permanently alter their contraceptive or childbearing behavior. For example, married mothers who stay home with a child become more likely to desire another child right away (Miller and Pasta, 1995).

which each first birth occurred. Lastly, all models contain controls for the effects of imputed values for the variables.

The NSFG 1988 and 1995 gathered information about contraceptive use and periods during which the respondents had no sexual intercourse. This information could help explain any relationship between breastfeeding and repeat pregnancies, but I excluded it from the main analysis for two reasons. First of all, the NSFG gathered contraceptive and sexual intercourse histories for less than five years preceding each interview – only a fraction as long as the fertility and breastfeeding histories. Second, this data is of questionable accuracy. For example, among 1027 women in the 1995 NSFG who had first live birth from late 1991 to early 1995, 53 (5 percent) conceived those second births in months when they reported *no* sexual intercourse. Similarly, among 1270 women with a first live birth from 1991 to early 1995, 52 (4 percent) reported using a hormonal contraceptive the month *before* they had their first baby. These rates of discoverable errors suggest true error rates that are much higher.

Despite their inaccuracy, however, contraceptive use and sexual intercourse data are still potentially valuable, so I included such data in separate descriptive analyses. For women in the 1995 NSFG with a first birth from 1991 to 1995, I gathered data on contraceptive use for each of the first six months postpartum. To determine which women reported a period of postpartum sexual abstinence, I identified women who reported an interval of *no* sexual intercourse in the month of their first birth or in either of the subsequent two months. Lastly, I combined women's birth histories, contraceptive use histories, and sexual intercourse histories to identify women who had unprotected sexual intercourse in the first six months postpartum.

RESULTS:

Overall patterns of breastfeeding and repeat pregnancies.

Figure 1 presents women's rates of pregnancies within six months after a first birth which led to a second live birth. The sample includes women in the NSFG 1988 and 1995 who had a first birth in 1980 or later. The solid and dashed curves identify women according breastfeeding status of the first child, and the two sides of the figure separate women according to age at first birth. With only a few births per month in most groups, the monthly rates were quite variable, so Figure 1 displays the repeat pregnancy rates as moving averages.¹²

< Figure 1 about here >

The results in Figure 1 show strong differences in repeat pregnancy rates by age at first birth, and notable differences within each group by breastfeeding status.¹³ For women with a teen first birth, repeat pregnancy rates increase rapidly during the first six months postpartum to more than 2 percent per month. The average live birth pregnancy rate for teen mothers is about 1.5 percent at 3 or 4 months postpartum, and the combined rate for the six months sums to about 8 percent. Breastfeeding appears to offer no net contraceptive protection to women with a teen first birth; if anything, teen mothers who are currently breastfeeding have slightly higher repeat pregnancy rates than teen mothers who never breastfed.

Among women with a nonteen first birth, breastfeeding appears to have a net contraceptive effect. Especially during the first four months postpartum, nonteen mothers who are currently breastfeeding have an extremely low rate of repeat pregnancies that led to a second

¹² The moving average for each month is weighted by 25% for the previous month, 50% for the current month, and 25% for the following month.

¹³ Women who were formerly breastfeeding are not included in this figure because the additional sets of data points would make the patterns difficult to interpret.

live birth. Summed across the first six months, the repeat birth rate for breastfeeding nonteen mothers comes to about 3.5 percent. Note that this group contains women who are supplementing with other foods and women who are no longer amenorrheic, and that this study is restricted to breastfeeding at parity 1 (the least effective parity for lactational amenorrhoea). Given such real-world conditions, the 3.5 percent overall repeat pregnancy rate is fairly close to the Bellagio consensus value of 2 percent under the lactational amenorrhoea method. Live birth pregnancy rates for all breastfeeding women appear to increase during the fifth and sixth months postpartum. A diminishing contraceptive effect of breastfeeding in months 5 and 6 would be consistent with a declining proportion of women experiencing lactational amenorrhoea. However, month-to-month interpretations are unreliable because of the relatively low number of monthly events, especially in the fifth and sixth months when fewer women are still breastfeeding.

In Figure 2, the outcome of interest has been changed from a second pregnancy leading to a live birth to any unintended second pregnancy. The overall pregnancy rates in Figure 2 are similar to the rates in Figure 1 because most live births in this interval are unintended, and because most reported pregnancies in this interval resulted in a live birth. The patterns by age and breastfeeding status are also basically the same in Figures 1 and 2. This similarity reinforces the assumption that the associations between breastfeeding and postpartum repeat pregnancy rates are due to the contraceptive effects of breastfeeding rather than the desire for additional children.

< Figure 2 about here >

Parametric Analysis of Repeat Pregnancies

I now turn to hazard analyses in an attempt to explain the overall relationship between breastfeeding and low pregnancy rates among women with a nonteen first birth. Table 1 shows the proportions of women in the NSFG samples with various background and other characteristics. The descriptive statistics in Table 1 show that age at first birth and the decision to breastfeed are systematically associated with such social factors as race, family background, and marital status at first birth. In general, the better off a woman is socioeconomically, the less likely she is to have a teen birth and the more likely she is to breastfeed her first child.

< Table 1 about here >

Table 2 shows the estimated effect of breastfeeding under various specifications, the simplest of which is shown in Model 1. Model 1 in Table 2 includes four variables for breastfeeding, plus a set of controls for race to account for oversampling on racial groups. The four breastfeeding variables are for currently breastfeeding, breastfeeding with supplementation, breastfeeding beyond six months postpartum, and for the three months after a woman stops breastfeeding. When estimated in conjunction with the other breastfeeding variables, the “currently breastfeeding” variable measures the contraceptive effect of breastfeeding when at least two of the lactational amenorrhoea method criteria are met (no supplements, first six months). In Model 1, the effect of currently breastfeeding on repeat pregnancy rates is negative and statistically significant. Supplementation has a nonstatistically significant positive effect on repeat pregnancy rates, but currently breastfeeding women who are supplementing still have repeat pregnancy rates well below the rates for nonbreastfeeding women. Breastfeeding for durations beyond six months has a statistically significant positive effect on repeat pregnancy rates which at least offsets the overall contraceptive benefit of breastfeeding. Lastly, there may be a small

increase in repeat pregnancy rates associated with stopping breastfeeding, although this apparent effect could easily be caused by random variation in the survey sample.

< Table 2 about here >

Model 2 in Table 2 introduces controls for background factors which might explain the negative association between breastfeeding and repeat pregnancy rates.¹⁴ Some of these controls, especially age at first birth, show a direct relationship between social disadvantage and higher repeat pregnancy rates. However, the controls for marital status at first birth, family structure at age 14, and whether the woman ever breastfed all suggest an inverse association between social disadvantage and repeat pregnancy rates. Altogether, the controls only explain a very small part of the contraceptive effect of breastfeeding; from Model 1 to Model 2, the coefficient for currently breastfeeding changes from $-.38$ to $-.34$ and remains statistically significant.¹⁵

Model 3 in Table 2 includes interaction terms specifically for the breastfeeding status of women with a teen first birth. These interaction terms increase the standard errors of the estimates, so most of the interaction effects are unclear. However, one interaction effect stands out; currently breastfeeding is significantly more likely to involve a repeat pregnancy for teen mothers than for nonteen mothers. With effects for teen mothers estimated separately, the overall effect for “currently breastfeeding” on repeat pregnancy rates for nonteen mothers becomes stronger ($-.58$ in Model 3, compared to $-.34$ in Model 2). This result indicates a powerful contraceptive benefit of breastfeeding among women with a nonteen first birth, but no such benefit for women with a teen first birth. If one combines the various main and interaction effects to compare repeat pregnancy rates among teen mothers, teen mothers who breastfeed have a

¹⁴ This model also estimates effects for imputed values of covariates and for the five-year period of the first birth. Coefficients for these variables are available on request from the author.

¹⁵ Note that while background controls explain little of the association between breastfeeding and repeat pregnancies, those controls seem to explain a fair proportion of the race differentials in repeat pregnancy rates.

slightly higher repeat pregnancy rate than teen mothers who do not, but the difference is not statistically significant.

The final model in Table 2 is a replication of Model 3, but with an unintended pregnancy as the outcome instead of a live birth pregnancy. This “Model 3B” has somewhat different coefficients than Model 3, but three main findings about breastfeeding are consistent with the findings from the “live birth” models. First, currently breastfeeding has a substantial contraceptive effect for nonteen mothers. Second, of the several possible contraceptive liabilities of breastfeeding (supplementation, breastfeeding beyond six months, and stopping), all have positive signs but only breastfeeding beyond six months negates the contraceptive benefit of currently breastfeeding at a statistically significant level. Third, the contraceptive benefits of breastfeeding are negated and perhaps reversed for women who have a teen first birth.

Table 3 shows several attempts to verify the results in Table 2. The first column in Table 3 has a model similar to Model 3 in Table 2, and for the same NSFG samples. However, the NSFG model in Table 3 omits controls for supplementation (unavailable in the NLSY) and intention status at first birth (not calculated from the NLSY). The second column in Table 3 shows an identical model from the smaller NLSY 1979-1994 data set. I included this model to test the possibility that the statistically significant effects in the NSFG models might be idiosyncratic to the NSFG samples. In the NLSY model, the standard errors are larger than in the NSFG data set, but many of the results are comparable. Of the three effects of breastfeeding noted in the NSFG, two stand up in the NLSY sample. As in the NSFG, currently breastfeeding has a significant negative overall effect on repeat pregnancies in the NLSY. Again as in the NSFG, the NLSY data indicate that the contraceptive effect of currently breastfeeding is eliminated or reversed if the woman has a teen first birth. The third finding from the NSFG, that

breastfeeding beyond six months postpartum at least cancels its contraceptive effect, is not fully supported by the NSLY results. However, the NLSY model has a positive sign (+.19) and a large standard error for the “more than 6 months” variable, so the NLSY estimate for that variable is consistent with the NSFG estimate.

< Table 3 about here >

The final three columns in Table 3 estimate the same model for nonhispanic white women, nonhispanic black women, and hispanic women in the NSFG. When the three racial groups are evaluated separately, the standard errors are much larger, especially for hispanics (because of the small sample) and for nonhispanic blacks (because of low breastfeeding rates among black women). Given this limitation of large standard errors, the estimated coefficients for whites and for hispanics are consistent with the coefficients for the model with all races combined. For black women, however, the contraceptive effects of breastfeeding may be different than for other groups of women. Bearing in mind the very large standard errors, the overall coefficient for currently breastfeeding among blacks is small and positive. In other words, this study finds no evidence for a contraceptive effect of breastfeeding for black nonhispanic women of any age at first birth.¹⁶

The Models in Tables 2 and 3 show which coefficients have statistically significant effects, but interactions across both breastfeeding and age categories make it difficult to interpret the net effects of breastfeeding for women under different conditions. To address this problem, I present the estimates from Model 3 in Table 2 in a graphic fashion in Figure 3. Figure 3 shows repeat

¹⁶ I experimented with several other alternative model specifications not included in Table 3. Some models respecified a “teen” first birth to include only first births at age 17 or younger, other models assigned all women a median duration of breastfeeding, others varied the postpartum interval from 6 months to 15 months, and still others imposed various functional forms on the baseline hazard rate. These alternative specifications affected the coefficient estimates, but not to a great extent and not in any consistent direction. Readouts for the supplementary runs are available on request from the author.

pregnancy rates not as actual percentages across months, but as relative rates across breastfeeding circumstances. The moving lines represent the changing relative pregnancy risk for a hypothetical woman who begins breastfeeding, then introduces supplements at some point, then continues breastfeeding beyond six months, then stops breastfeeding altogether, then continues to the end of her first year postpartum.¹⁷ The values are based on the breastfeeding, age at first birth, and interaction coefficients from Table 2, Model 3, with all other factors statistically controlled.

Figure 3 shows parametric estimates for repeat pregnancy risks by women's age at first birth and whether they breastfed her first child. The comparison group with a relative rate of 1 is women with a nonteen first birth who never breastfed their first child. Women with a teen first birth who never breastfed their first child have a relative pregnancy rate of about 1.6, which reflects the covariate effect of a teen first birth from Model 3 in Table 2. For the two age categories of women who breastfeed, the repeat pregnancy rates vary (partly due to chance) as the circumstances of breastfeeding change.

The most important result in Figure 3 is at the far left, in the condition that corresponds to full breastfeeding without supplementation. While fully breastfeeding, women with a nonteen first birth have a relative repeat pregnancy rate about 0.6 X the rate of their nonbreastfeeding counterparts. However, fully breastfeeding women with a teen first birth have a relative risk slightly above that of nonbreastfeeding women with a teen first birth.

The effects of breastfeeding on repeat pregnancy rates are less clear in other parts of Figure 3. At more than six months postpartum (including supplementation in this example), and also during the interval immediately after they stop breastfeeding, women of all ages who breastfeed experience relative repeat pregnancy rates slightly higher than the rates of women of

¹⁷ This exercise may be somewhat misleading because only a fraction of women who breastfeed pass through all these steps in this order. The estimate for stopping is the most misplaced; for most women who breastfeed in the U.S., the stopping interval begins before the sixth month postpartum.

the same age who do not breastfeed. Although the coefficients which generate these patterns are not statistically significant in all models from Tables 2 and 3, the patterns suggest that a repeat pregnancy could be slightly more likely when a woman has breastfed for more than six months or has recently stopped breastfeeding.

< Figure 3 about here >

Postpartum Contraceptive Use and Sexual Intercourse

As a supplementary exercise to the main analysis above, I present some descriptive statistics to investigate why the contraceptive effect of breastfeeding seems to vary with the mother's age at first birth. The NSFG collects information on women's contraceptive use and sexual activity in the most recent years before the interview. This information could not be integrated into the full hazard analyses above, is of much lower quality than the fertility and breastfeeding data, and cannot address all the possible explanations for the differential contraceptive effect of breastfeeding by age.¹⁸ Bearing all that in mind, the following is an attempt to consider some possible mechanisms underlying the statistically significant effects in the main analysis.

Figure 4 shows the proportion of women who reported that they did not use any contraceptive device or medication in a given month during the first six months postpartum. As one might expect, contraceptive nonuse is most prevalent in the month immediately after the first birth. In addition, for both categories of age at first birth, women who are currently breastfeeding are more likely than women who have never breastfed to be not using any contraceptive device or

¹⁸ In the methods section I mentioned some identifiable reporting errors in the contraceptive and sexual activity calendars. Women who did not breastfeed were perhaps more likely to report such errors. Age at first birth did not seem to be associated with the likelihood of a reporting error.

medication. This result appears to indicate that, at least among women with a nonteen first birth, breastfeeding has a net contraceptive benefit even though breastfeeding women often do not use other contraceptive methods. However, the results in Figure 4 do not explain why the contraceptive effects of breastfeeding vary by age at first birth.

< Figure 4 about here >

Table 4 analyzes women's self-reports of whether they had sexual intercourse at all during a given month, matched against the timing of their first birth. In Table 4, the association of breastfeeding with reported sexual intercourse varies by age. Women with a nonteen first birth who breastfeed their first child are the most likely to report an interval of postpartum sexual abstinence. Conversely, women with a teen first birth who breastfeed their first child are the *least* likely to report an interval of postpartum sexual abstinence. The patterns in Table 4 thus suggest that some of the apparent contraceptive effect of breastfeeding, as well as the age differences in that contraceptive effect, might simply reflect an association between breastfeeding and exposure to sexual intercourse. Note, however, that women's self-reports of periods of sexual intercourse are somewhat unreliable. For instance, well over half of all women report *no* interval of sexual abstinence after their first birth, a surprising result that casts some doubt on the accuracy of the data in Table 4.

< Table 4 about here >

The final figure in this series, Figure 5, integrates information about contraceptive use and sexual intercourse. Figure 5 shows the proportions of women who are not using a contraceptive method or device and are having sexual intercourse in a given month postpartum. Many (but not all) of the repeat pregnancies leading to a second live birth occurred to women in this category. The patterns in Figure 5 are not dissimilar from the patterns in Figure 4; women who breastfeed

are more likely than women who do not breastfeed to have sex without protection from modern contraceptives. However, women with a teen first birth who breastfeed do not exhibit strikingly different contraceptive behavior from women with a nonteen first birth who breastfeed. Thus, the teen-nonteen difference in the contraceptive effect of breastfeeding does not appear to be explained by exposure to unprotected sexual intercourse.¹⁹

< Figure 5 about here >

¹⁹ There might be differences in the types of contraceptives used by breastfeeding teen and nonteen mothers, but the sample sizes are too small (and the data too iffy) to draw any conclusions. If anything, though, NSFG data suggest that the teen mothers are more likely than the nonteen mothers to use the more reliable modern contraceptives, such as injectables.

DISCUSSION:

This study finds that breastfeeding appears to help women in the United States avoid closely spaced repeat births. In the initial months following a first birth, repeat pregnancy rates are low for all women, but they are lowest for women with a nonteen first birth who are currently breastfeeding. A multivariate analysis showed that part of the association between repeat pregnancy rates and breastfeeding is explained by background characteristics, but most of the association is apparently due to a true contraceptive benefit of breastfeeding. For most women, then, breastfeeding seems to provide contraceptive protection that more than offsets higher rates of contraceptive nonuse.

This contraceptive effect of breastfeeding has limitations. For women with a teen first birth (and perhaps for black women as well), breastfeeding provides no net contraceptive benefit and may actually increase repeat pregnancy rates. Women who supplement breastmilk with other foods have repeat pregnancy rates about as low as women who fully breastfeed, but at six to twelve months postpartum, women who are still breastfeeding have live birth pregnancy rates equal to or higher than women who never breastfed. Women might also have a slightly higher rate of repeat pregnancies leading to a second live birth in the interval immediately after they stop breastfeeding, but that association is not statistically significant in any NSFG or NLSY model.

This study could not identify the specific reasons that teen mothers do not gain a net contraceptive benefit from breastfeeding. Teen mothers breastfeed for shorter durations than other women, but the duration of breastfeeding (and the timing of supplementation) do not explain the fact that teen mothers experience high rates of repeat pregnancies *while they are fully breastfeeding*. Part of the explanation could be that teen mothers who breastfeed, unlike other women who breastfeed, are unlikely to report an interval of postpartum sexual abstinence. Studies

indicate that partners strongly influence adolescent mothers' decisions to breastfeed (Joffe and Radius, 1987; Sciacca et al., 1995), so teen mothers' breastfeeding behavior might be deeply interrelated with their sexual behavior, contraceptive use, and other aspects of their personal relationships (see Schamess, 1993). If the sexual intercourse patterns of breastfeeding teen mothers are different from those of other mothers, that would emphasize the importance of the unique psychological and social context of breastfeeding among very young mothers. However, a significant part of the reason teen mothers experience no net contraceptive benefit from breastfeeding is likely to be biological. If that is the case, future studies of the mechanisms of lactational amenorrhoea should focus on individual variation, especially by age. In particular, it may be important to find out whether the protocols of the Lactational Amenorrhoea Method provide the same protection to women with a teen first birth as to other women.

This study has several weaknesses which perhaps cannot be redressed with data from a national sample survey. The most glaring weakness is that lack of information on the return of menses, which prevents this study from directly assessing the efficacy of the Lactational Amenorrhoea Method. This study thus lacks an important bridge to most other research on this topic. Secondly, while descriptive evidence suggests that differences in postpartum sexual intercourse might explain away part of the contraceptive benefit of breastfeeding, this study could not control for sexual intercourse in the main analyses. A third weakness is the broad time frame; in order to collect a sufficient number of events, the sample had to include women with first births as long ago as 1980. While the hazard models did control for period effects, with a limited sample size it is impossible to control for the possibility that the contraceptive effect of breastfeeding itself is changing over time. Increased public understanding of the contraceptive effects and limitations of breastfeeding could increase the contraceptive effectiveness of

breastfeeding over time, as could changes in the types of supplementary contraceptives available to breastfeeding women. Looking from the recent past to the future, increased public understanding of the lactational amenorrhoea method and its limits could further reduce pregnancy rates for breastfeeding women, but low access to and use of progestin-based contraceptives in the U.S. could be a cause for concern.

One final point of uncertainty involves trends in breastfeeding itself; the contraceptive effectiveness of breastfeeding might change as more women choose to breastfeed and as they breastfeed for longer durations. This study indicates that in the U.S., breastfeeding has a net contraceptive effect as it is now typically practiced; that is, among age groups of women who most commonly breastfeed, and at the short durations most women breastfeed. However, among women with a teen first birth and at durations beyond six months, any direct contraceptive benefit of breastfeeding is at least cancelled by other factors related to breastfeeding. In the future, if more women breastfeed and for longer durations, the gap between the contraceptive effect and efficacy of breastfeeding may widen. Health care providers who promote breastfeeding should thus anticipate increasing contraceptive needs among breastfeeding women.

BIBLIOGRAPHY

- Adams, M.M., K.M. Delaney, P.W. Stupp, B.J. McCarthy, and J.S. Rawlings. 1997. "The relationship of interpregnancy interval to infant birthweight and length of gestation among low-risk women, Georgia." *Paediatric & Perinatal Epidemiology* 11(Suppl. 1): 48-62.
- American Academy of Pediatrics. 1997. "Breastfeeding and the use of human milk." *Pediatrics* 100(6):1035-1039.
- Balassone, M.L. 1988. "Multiple pregnancies among adolescents, incidence and correlates." *Health and Social Work* 13(4): 266-274.
- Bender, D.E., E. Dusch and M.F. McCann. 1998. "From efficacy to effectiveness: Selecting indicators for a community-based lactational amenorrhoea method promotion programme." *Journal of Biosocial Science* 30(2):193-225.
- Bracher, M. 1992. "Breastfeeding, lactational infecundity, contraception, and the spacing of births: implications of the Bellagio Consensus Statement." *Health Transition Review* 2(1): 19-47.
- Campbell, O., and R.H. Gray. 1993. "Characteristics and determinants of postpartum ovarian function in women in the United States." *American Journal of Obstetrics and Gynecology* 169(1): 55-60.
- Center for Human Resource Research. 1995. *NLS User's Guide*. Columbus, Ohio: The Ohio State University.
- Diaz, S., H. Cardenas, A. Brandeis, P. Miranda, A.M. Salvatierra, and H.B. Croxatto. 1992. "Relative contributions of anovulation and luteal phase defect to the reduced pregnancy rate of breast-feeding women." *Fertility and Sterility* 58(3): 498-503.
- Erickson, P. 1994. "Lessons from a repeat pregnancy prevention program for Hispanic teenage mothers in East Los Angeles." *Family Planning Perspectives* 26(4): 174-178.
- Flanagan, P., C.S. Coll, L. Andreozzi, and S. Riggs. 1995. "Predicting maltreatment of children of teenage mothers." *Archives of Pediatrics and Adolescent Medicine* 149(4): 451-455.
- Ford, K. and Y.J. Kim. 1993. "Demographic research on lactational amenorrhoea. In *Biomedical and Demographic Determinants of Reproduction*. R. Gray, H. Leridon, and H. Spira, eds. Oxford, Clarendon Press.
- France, M.M. 1996. "A study of the lactational amenorrhoea method for family planning in New Zealand women." *New Zealand Medical Journal* 109(1022): 189-191.
- Georgetown University. Institute for Reproductive Health. 1996. "The lactational amenorrhoea method: Are you offering your clients all the options?" *Georgetown University. Institute for Reproductive Health (RH Training Materials)*.

- Glasier, A.F., J. Logan, and T.J. McGlew. 1996. "Who gives advice about postpartum contraception?" *Contraception* 53(4): 217-220.
- Gray, R.H., R. Apelo, O. Campbell, S.S. Eslami, H. Zacur, R.R. Ramos, J.C. Gehret, and M.H. Labbok. 1990. "Risk of ovulation during lactation." *Lancet* 335(8680): 25-29.
- Hatcher, R.A. et al. 1994. *Contraceptive Technology, 16th Ed.* New York, Irvington Publishers.
- Heer, D.M. 1986. "Effect of number, order, and spacing of siblings on child and adult outcomes: An overview of current research." *Social Biology* 33(1-2): 1-4.
- Hight-Laukaran, V., M.H. Labbok, A.E. Peterson, V. Fletcher, H. von Hertzen, and P.F. Van Look. 1997. "Multicenter study of the Lactational Amenorrhoea Method (LAM): II. Acceptability, utility, and policy implications." *Contraception* 55(6): 337-346.
- Hill, P., S.S. Humenick, T.M. Argubright, and J.C. Aldag. 1997. "Effects of parity and weaning practices on breastfeeding duration." *Public Health Nursing* 14(4): 227-234.
- Hollander, D. 1995. "Short pregnancy intervals may explain blacks' rate of poor birth outcomes." *Family Planning Perspectives* 27(5): 224-225.
- Holman, D.J., J.W. Wood, and K.L. Campbell. 1996. "Total human fecundability." Poster presented at the annual meeting of the Population Association of America, New Orleans, Louisiana, U.S.
- Ineichen, B., M. Pierce, and R. Lawrenson. 1997. "Teenage mothers as breastfeeders: attitudes and behavior." *Journal of Adolescence* 20(5): 505-509.
- Jekel, J., J. Harrison, D. Bancroft, D. Tyler, and L.V. Klerman. 1975. "A comparison of the health index and mortality of subsequent babies born to teenage mothers." *American Journal of Public Health* 65(4): 370-374.
- Joffe, A., and S.M. Radius. 1987. "Breast versus bottle: correlates of adolescent mothers' infant-feeding practices." *Pediatrics* 79(5): 689-695.
- Kelly, J.E., W.D. Mosher, A.P. Duffer, S.H. Kinsey. 1997. *Plan and Operation of the 1995 National Survey of Family Growth.* National Center for Health Statistics, Hyattsville MD.
- Kennedy, K.I. 1996. "Post-partum contraception." *Baillieres Clinical Obstetrics & Gynaecology* 10(1): 25-41.
- Kennedy, K.I., R. Rivera, and A.S. McNeilly. 1989. "Consensus statement on the use of breastfeeding as a family planning method." *Contraception* 39(?):477-496.
- Kennedy, K.I., and C.M. Visness. 1992. "Contraceptive efficacy of lactational amenorrhoea." *Lancet* 339(8787): 227-230.

Labbok, M.H., V. Hight-Laukaran, A.E. Peterson, V. Fletcher, H. von Hertzen, and P.F. Van Look. 1997. "Multicenter study of the Lactational Amenorrhoea Method (LAM): I. Efficacy, duration, and implications for clinical application." *Contraception* 55(6): 327-336.

Lang, J.M., E. Lieberman, K.J. Ryan, and R.R. Monson. 1990. "Intepregnancy interval and the risk of preterm labor." *American Journal of Epidemiology* 132:304-307.

Marjoribanks, K. 1994. "Sibling spacing, family resources, and children's academic performance." *Psychological Reports* 75(3): 1121-1122.

Martin, S.P., and L.L. Wu. 1998. "The subsequent fertility of adolescent mothers in the United States." University of Wisconsin Center for Demography and Ecology Working Paper #98-01.

Maynard, R., and A. Rangarajan. 1994. "Contraceptive use and repeat pregnancies among welfare-dependent teenage mothers." *Family Planning Perspectives* 26(5):198-205.

McNeilly, A.S. 1993. "Lactational amenorrhoea." *Endocrinology and Metabolism Clinics of North America* 22(1): 59-73.

Miller, J.E. 1991. "Birth intervals and perinatal health: An investigation of three hypotheses." *Famly Planning Perspectives* 23(2):62-70.

Miller, W.B., and D.J. Pasta. 1995. "How does childbearing affect fertility motivations and desires?" *Social Biology* 42(3-4):185-198.

Motil, K.J., B. Kertz, and M. Thotathuchery. 1997. "Lactational performance of adolescent mothers shows preliminary differences from that of adult women." *Journal of Adolescent Health* 20(6): 442-449.

Mott, F.L. 1986. "The pace of repeated childbearing among young American mothers." *Family Planning Perspectives* 18(1): 5-12.

Namerow, P.B., and D.S. Kalmuss. 1994. "Subsequent childbearing among teenage mothers: The determinants of a closely spaced second birth." *Family Planning Perspectives* 26(4): 149-153, 159.

National Center for Health Statistics. 1990. Public Use Data File Documentation: National Survey of Family Growth, Cycle 4 (1988): User's Guide. Hyattsville, Maryland: U.S. Department of Health and Human Services.

National Center for Health Statistics. 1997. Public Use Data File Documentation: National Survey of Family Growth, Cycle 5 (1995): User's Guide. Hyattsville, Maryland: U.S. Department of Health and Human Services.

Perez, A., M.H. Labbok, and J.T. Queenan. 1992. "Clinical study of the lactational amenorrhoea method for family-planning." *Lancet* 339(8799): 968-970.

- Polit, D.F., and J.R. Kahn. 1986. "Early subsequent pregnancy among economically disadvantaged teenage mothers." *American Journal of Public Health* 76(2): 167-171.
- Powell, B., and L.C. Steelman. 1993. "The educational benefits of being spaced out: Sibship density and educational progress." *American Sociological Review* 58(3):367-381.
- Powell, B., and L.C. Steelman. 1995. "Feeling the pinch – child spacing and constraints on parental economic investments in children." *Social Forces* 73(4):1465-1486.
- Rawlings, J.S., V.B. Rawlings, and J.A. Read. 1995a. "Prevalence of low birth weight and preterm delivery in relation to the interval between pregnancies among white and black women." *New England Journal of Medicine* 332(2): 69-74.
- Rawlings, J.S., V.B. Rawlings, and J.A. Read. 1995b. Comment in: *New England Journal of Medicine* 333(6): 387.
- Riordan, J. and K.G. Auerbach. 1993. *Breastfeeding and Human Lactation*. Boston: Jones and Bartlett.
- Rogers, I.S. 1997. "Lactational infertility." *Early Human Development* 49 (Oct.):185-190.
- Rojnik, B. K. Kosmelj, and L. Andolsek-Jeras. 1995. "Initiation of contraception postpartum." *Contraception* 51(2): 75-81.
- Ryan, A.S., D. Rush, F.W. Krieger, and G. Lewandowski. 1991. "Recent declines in breastfeeding in the United States: 1984 through 1989." *Pediatrics* 88(4): 719-727.
- Saarikoski, S. 1993. "Contraception during lactation." *Annals of Medicine* 25(2): 181-184.
- Sciacca, J.P., B.L. Phipps, D.A. Dube, and M.I. Ratliffe. 1995. "Influences on breast-feeding by lower-income women: an incentive-based, partner-supported educational program." *Journal of the American Dietetic Association* 95(3): 323-328.
- Schamess, S. 1993. "The search for love: Unmarried adolescent mothers' views of, and relationships with, men." *Adolescence* 28(110): 425-438 (summary).
- Smith, D.P. 1985. "Breastfeeding in the U.S." *Social Biology* 32(1-2): 53-60.
- Steiner, M., R. Dominick, J. Trussell, and L. Grummer-Strawn. 1996. "Measuring contraceptive effectiveness: a conceptual framework." *Obstetrics and Gynecology* 88: Supplement 1s-7s.
- Thau, H., E. Gruber, M. Anderson, and C. Archie. 1996. "Breast-feeding in adolescent mothers: The National Maternal and Infant Health Survey." *Journal of Adolescent Health* 18(2): 128.
- Visness, C.M., and K.I. Kennedy. 1997. "The frequency of coitus during breastfeeding" *Birth-Issues in Perinatal Care* 24(4): 253-257.

Visness, C.M., and R. Rivera. 1995. "Progestin-only pill use and pill switching during breastfeeding." *Contraception* 51(5): 279-281.

Williams, B. 1995. "Low birth weight in relation to the interval between pregnancies." (Letter) *New England Journal of Medicine* 333(6): 387.

Wood, J.W., D.J. Holman, A.I. Yashin, R.J. Peterson, M. Weinstein, and M. Chang. 1994. "A multistate model of fecundability and sterility." *Demography* 31(3): 403-426.

Zuravin, S.J. 1991. "Unplanned child bearing and family size: Their relationship with child neglect and abuse." *Family Planning Perspectives* 23(4): 155-161.

Table 1. Descriptive Statistics for Women with a First Birth 1980-1994, by Breastfeeding Status: NSFG 1988-1995.

<i>Age at first birth 20 or older</i>	<i>Did Respondent Breastfeed her first child?</i>	
	YES	NO
<i>Breastfeeding Rates</i>		
percent of respondents in age group who breastfed 1 st child	60 %	-----
median duration of breastfeeding	4 months	-----
<i>Repeat Pregnancy Rates</i>		
pregnancy within 6 months of 1 st birth resulting in a 2 nd live birth	4 %	5 %
unintended repeat pregnancy within 6 months of 1 st birth	4	6
<i>Background Characteristics of Respondents</i>		
percent with a mother who did not finish high school	28 %	37 %
percent whose mother had a teen birth	26	39
percent who did not live with both parents at age 14	13	12
percent with an unintended 1 st birth	21	29
percent unmarried at 1 st birth	31	46
<i>Race and Ethnicity</i>		
hispanic	13 %	12 %
nonhispanic black	12	33
nonhispanic white	70	53
other nonhispanic	4	2
<i>number of cases</i>	2819	1847
<i>Age at first birth 19 or younger</i>		
<i>Breastfeeding Rates</i>		
percent of respondents in age group who breastfed 1 st child	29 %	-----
median duration of breastfeeding	3 months	-----
<i>Repeat Pregnancy Rates</i>		
pregnancy within 6 months of 1 st birth resulting in a 2 nd live birth	8 %	8 %
unintended repeat pregnancy within 6 months of 1 st birth	10	9
<i>Background Characteristics of Respondents</i>		
percent with a mother who did not finish high school	54 %	48 %
percent whose mother had a teen birth	43	62
percent who did not live with both parents at age 14	52	59
percent with an unintended 1 st birth	62	71
percent unmarried at 1 st birth	50	75
<i>Race and Ethnicity</i>		
hispanic	30 %	14 %
nonhispanic black	21	55
nonhispanic white	45	30
other nonhispanic	4	1
<i>number of cases</i>	483	1186

Note: Scores are unweighted

Table 2. Effects of breastfeeding and other variables on the risk of a repeat pregnancy within 12 months of a first live birth. U.S. women with a first birth 1980-1994.

	MODEL 1	MODEL 2	MODEL 3	MODEL 3B
<i>Outcome</i>	live birth pregnancy	live birth pregnancy	live birth pregnancy	unintended pregnancy
<i>Breastfeeding status</i>				
currently breastfeeding	-.38 (.16)*	-.34 (.17)*	-.58 (.20) *	-.45 (.17) *
while supplementing with other food	.05 (.18)	.10 (.18)	.21 (.21)	.13 (.18)
while more than 6 months postpartum	.46 (.19)*	.42 (.19)*	.51 (.21)*	.47 (.19)*
stopped breastfeeding 1 – 3 months ago	.12 (.11)	.17 (.12)	.10 (.13)	.09 (.13)
ever breastfed		.06 (.09)	.13 (.11)	-.00 (.10)
<i>Family background and other variables</i>				
r's mother's education less than 12 years		.12 (.07)	.13 (.07)	.09 (.07)
r's mother's age at 1 st birth 19 or younger		.09 (.07)	.09 (.07)	.05 (.06)
r lived in nonintact family at age 14		-.11 (.07)	-.11 (.07)	.05 (.06)
r's 1 st birth unintended		.03 (.08)	.03 (.08)	.04 (.07)
r unmarried at 1 st birth		-.16 (.09)	-.16 (.09)	-.08 (.08)
<i>Age at first birth and interactions with breastfeeding status</i>				
age 19 or younger at 1st birth		.47 (.08) *	.49 (.10) *	.37 (.09) *
X currently breastfeeding			.97 (.35) *	.85 (.29) *
X while supplementing with other food			-.46 (.44)	-.23 (.37)
X while more than 6 months postpartum			-.38 (.45)	-.66 (.44)
X stopped breastfeeding 1 – 3 months ago			.31 (.29)	.26 (.26)
X ever breastfed			-.31 (.20)	-.09 (.18)
<i>Race of respondent</i>				
nonhispanic white	<i>omitted category</i>			
nonhispanic black	.11 (.08)	.01 (.09)	.01 (.09)	.08 (.08)
hispanic	.32 (.09)*	.14 (.10)	.14 (.10)	.21 (.09)*
other	.51 (.16)*	.43 (.16)*	.42 (.16)*	.43 (.15)*
log likelihood	-7993.6	-7956.7	-7952.9	-10084.0
N	6335	6335	6335	6111

Notes: Standard errors in parentheses. See text for definitions of samples, variables, and details on the analytical models.

Sources: NSFG 1988 and 1995 women with a first birth 1980 or later.

* p<.05

Table 3. Effects of breastfeeding and other variables on the risk of a repeat pregnancy within 9 months of a first live birth which leads to a second live birth: Identical models for different samples of women.

<i>Survey and Sample Restrictions</i>	NSFG all women	NLSY all women	NSFG white nonhispanic	NSFG black nonhispanic	NSFG hispanic
<i>Breastfeeding status</i>					
currently breastfeeding	-.48 (.17)*	-.77 (.32)*	-.43 (.23)	.16 (.46)	-.57 (.40)
while more than 6 months postpartum	.59 (.23)*	.19 (.43)	.51 (.26)*	-.75 (.80)	.50 (.51)
stopped breastfeeding 1 – 3 months ago	.10 (.14)	-.09 (.20)	.28 (.16)	-.33 (.52)	-.08 (.35)
ever breastfed	.12 (.11)	.36 (.12)*	.09 (.14)	-.20 (.29)	.13 (.28)
<i>Age at first birth and interactions with breastfeeding status</i>					
age at first birth 19 or younger	.54 (.10)*	.45 (.10)*	.42 (.20)*	.66 (.16)*	.30 (.25)
X currently breastfeeding	.80 (.31)*	1.01 (.40)*	1.00 (.50)*	-.03 (.73)	.65 (.56)
X while more than 6 months postpartum	-.57 (.40)	-.29 (.55)	-1.37 (.83)	1.59(1.10)	-.24 (.70)
X stopped breastfeeding 1 – 3 months ago	.31 (.29)	.12 (.33)	.53 (.40)	.24 (.79)	.18 (.60)
X ever breastfed	-.33 (.20)	-.50 (.21)*	-.28 (.31)	.14 (.44)	-.15 (.43)
<i>Family background and other variables</i>					
r's mother's education less than 12 years	.13 (.07)	.07 (.10)	.01 (.11)	.12 (.13)	.34 (.20)
r's mother's age at first birth 19 or younger	.09 (.07)	.06 (.06)	.08 (.10)	.10 (.14)	.19 (.17)
r lived in nonintact family at age 14	-.11 (.07)	-.02 (.10)	.00 (.11)	.19 (.13)	-.20 (.17)
unmarried at 1 st birth	-.15 (.09)	-.13 (.10)	-.34 (.15)*	-.07 (.17)	-.28 (.18)
nonhispanic white respondent	omitted category				
nonhispanic black respondent	.02 (.09)	.22 (.12)			
hispanic respondent	.17 (.10)	.37 (.12)*			
other race of respondent	.45 (.16)*	.00 (.16)			
log likelihood	-7960.9	-4424.0	-3767.2	-1840.4	-1071.7
N	6335	3358	3524	1715	902

Notes: Standard errors in parentheses. See text for definitions of samples, variables, and details on the analytical models.

Sources: NLSY 1979-1994. NSFG 1988 and 1995 women with a first birth 1980 or later.

* p<.05

**Table 4. Proportion of Respondents Reporting an Interval of Postpartum Sexual Abstinence.
By Age at First Birth and Breastfeeding Status.**

<i>R's age at first birth:</i>	<i>Did R breastfeed her first child?</i>	
	Yes	No
19 or younger	.30 (.04)	.37 (.03)
20 or older	.45 (.02)	.38 (.03)

Notes: Standard errors in parentheses. See text for definitions of samples. Postpartum abstinence is defined as no sex in the month of a birth or in one of the following two months.

Source: NSFG 1995 women with a first birth 1991-5. N = 1284.

Figure 2

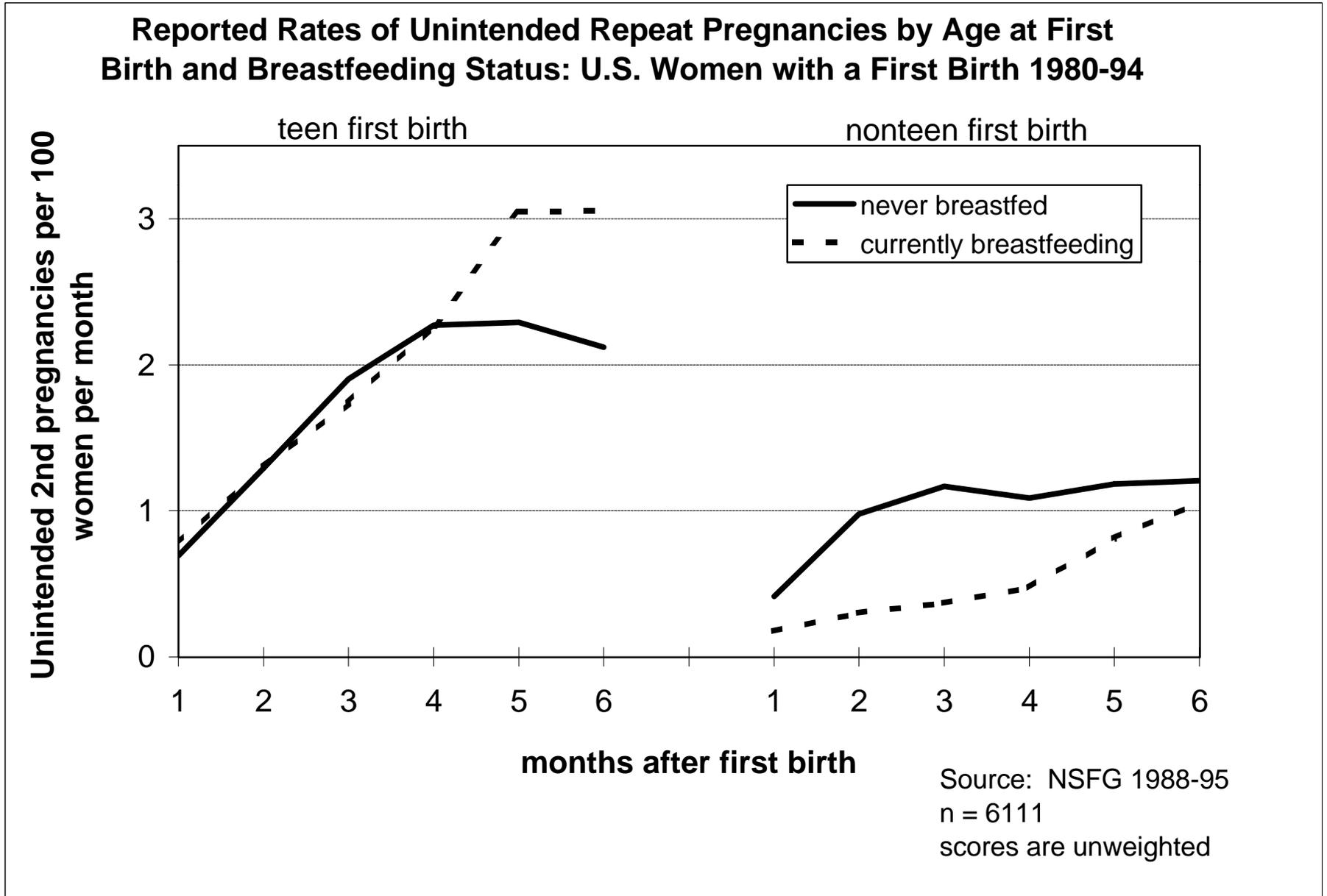


Figure 3

Parametric Estimates of Rates of Repeat Pregnancies which Lead to a Second Live Birth, by Age at First Birth and Breastfeeding Status

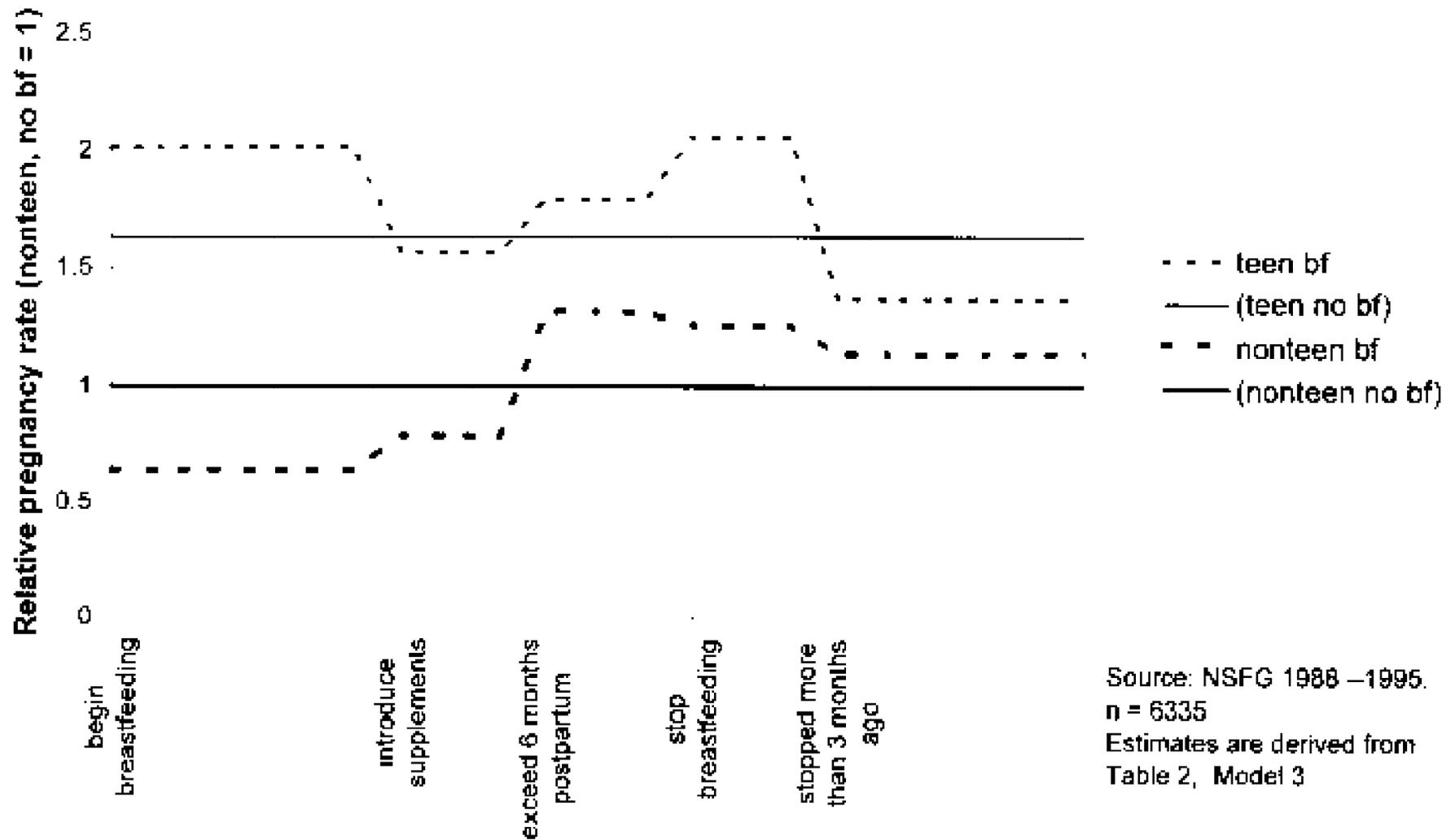
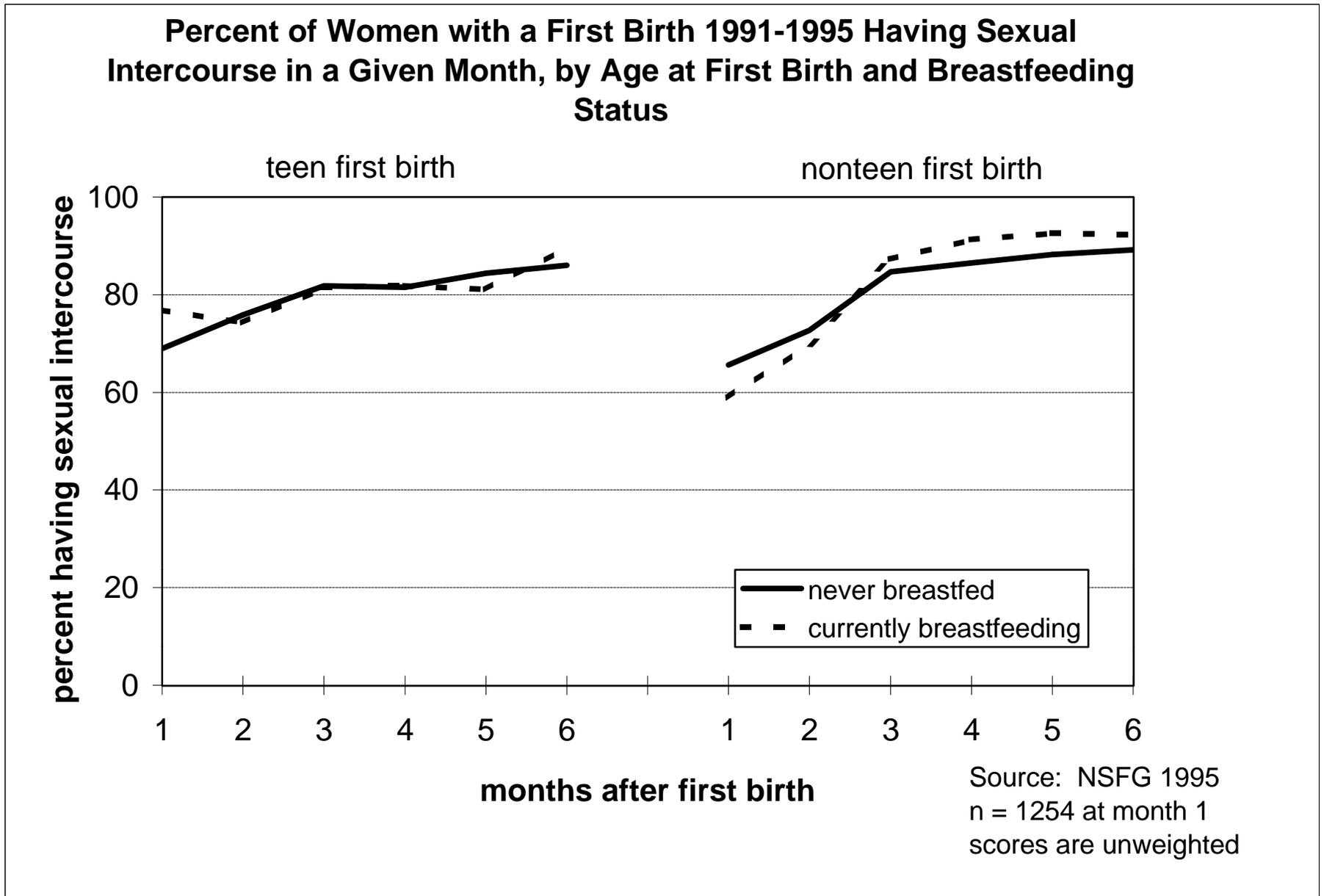


Figure 5



Center for Demography and Ecology
University of Wisconsin
1180 Observatory Drive Rm. 4412
Madison, WI 53706-1393
U.S.A.
608/262-2182
FAX 608/262-8400
comments to: smartin@ssc.wisc.edu
requests to: cdepubs@ssc.wisc.edu