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Do women with unintended births use highly effective postpartum contraception? An analysis of data from the National Survey of Family Growth, 2006-2010

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BOSTON UNIVERSITY
SCHOOL OF PUBLIC HEALTH

Thesis

**DO WOMEN WITH UNINTENDED BIRTHS
USE HIGHLY EFFECTIVE POSTPARTUM CONTRACEPTION?
AN ANALYSIS OF DATA FROM THE
NATIONAL SURVEY OF FAMILY GROWTH, 2006-2010**

by

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ABSTRACT

Objectives

Half of all U. S. pregnancies are unintended, and of these, about 6 out of 10 are carried to term. These are known as “unintended births,” and they are at elevated risk for adverse social, economic and health outcomes. The goal of this study was to examine, using the latest data from the National Survey of Family Growth (2006-2010), whether women with unintended births were more likely than their counterparts to use effective postpartum contraception.

Methods

In this retrospective cohort study of U.S. women ages 15-44, all births within three years of the study interview were classified as intended or unintended, and the method and timing of postpartum contraception were ascertained. Our primary outcome was time to initiation of a highly effective postpartum contraceptive method during the first postpartum year. Highly effective contraception was defined as a method with less than one pregnancy per 100 woman-years of typical use. Secondary outcomes included time to initiation of any contraceptive use over the first postpartum year, and postpartum

contraceptive non-use.

Results

Complete data was available for 2,691 births. Young, black, undereducated, unmarried, and poor women, as well as those who paid for their delivery with Medicaid were more likely than their counterparts to have unintended births ($p < 0.0001$). After adjustment for confounders, women with unintended births were 1.4 (95% CI: 1.2-1.6) times as likely to use highly effective postpartum contraception compared to women with intended births. During the first month postpartum, women with unintended pregnancies were 0.8 times as likely to use no contraceptive method as women with intended births (95% CI 0.7-0.9, $p = 0.0046$); there were no differences between groups for the rest of the first postpartum year. Married women, white women, women with college degrees, and women with who were giving birth for the first time were somewhat more likely than others to initiate effective contraception after an unwanted pregnancy.

Conclusion

A relatively small difference in time to initiation of highly effective postpartum contraception, along with an almost 1 in 5 prevalence of postpartum contraceptive non-use for the entire first postpartum year, indicates that women in this study sample are not well-prepared to prevent recurrence of unintended birth. These results add to the body of data supporting effective postpartum contraception as a public health priority.

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BACKGROUND

About half of all pregnancies in the United States are unintended, and of these, about six out of ten are carried to term.¹ Between 2006 and 2010, about 37% of U.S. births were unintended.² Births resulting from unintended pregnancies, or unintended births, pose an elevated risk for adverse social, economic and health outcomes for both mother and baby. For example, women with unintended births are less likely to breastfeed and to quit smoking than women with intended pregnancies, and are more likely to enter late into prenatal care.^{2,3,4} Babies born as a result of unintended pregnancies have poorer health in childhood and are more likely to experience developmental delays than children of intended pregnancies.⁵ In addition, women with unintended births were more likely than their counterparts to pay for the pregnancy using public funds. In 2008, 65% of the 1.7 million births resulting from unintended pregnancies were paid for by Medicaid or other publicly subsidized insurance, at an estimated cost to taxpayers of \$12.5 billion.⁶

Poor, young, unmarried, under-educated, and non-Hispanic black women are at increased risk for unintended pregnancy, as are multiparous women.² Among women with one unintended birth, more than one-third will have at least one other unintended birth.⁷ Because of these and other data, the U.S. government, through its Healthy People national initiative, has aimed since 1980 to reduce the percentage of pregnancies that are unintended. However, the overall rate of unintended pregnancy declined only slightly between 1981 and 2006 and the rate of unintended birth remained largely unchanged in that same time period. Over the past decade, there has been a trend in favor of carrying

unintended pregnancies to term and a reciprocal downturn in the number of abortions.²

This epidemic of unintended pregnancy has continued despite advances in the safety and availability of highly effective contraception. More than half of all unintended pregnancies (52%) happen to a minority of women (16%) who do not practice contraception for at least one month out of the year. Another 43% of unintended pregnancies occur in women who use contraceptive methods inconsistently or incorrectly, and only 5% occur because of contraceptive failures in women who are using contraception correctly.⁸ The most effective contraceptives have a failure rate less than 1% over the first year of typical use.⁹ Highly effective contraceptive modalities include permanent sterilization (female tubal ligation or occlusion and male vasectomy), and Long Acting Reversible Contraception (LARC), including intrauterine contraception and the contraceptive implant. In recent years, the safety and efficacy of LARC methods have been well-supported for most women, including most postpartum women, and the American College of Obstetricians and Gynecologists now recommends LARC as first line contraception for most women.^{10,11} The pregnancy rate with typical use of oral contraceptive pills, the most commonly used reversible contraceptive in the United States, is 11-180 times that of LARC methods.¹²

The postpartum period is an important time for women to initiate contraception because they have already accessed the health care system for pregnancy care; they may be more likely to have health insurance coverage, which is sometimes temporary; and they may have increased motivation to avoid another pregnancy.¹³ Postpartum contraception is particularly important for women with unintended births, who are at high

risk for recurrent, unintended pregnancy.⁷ Unfortunately, there currently exist significant disincentives to the initiation of LARC prior to the postpartum hospital discharge, such as non-reimbursement by health insurance, including taxpayer-subsided programs.¹⁴ The postpartum hospitalization also presents a unique opportunity for women to pursue permanent sterilization. In fact, the majority of women who are sterilized within two years of a live birth obtain the procedure during the postpartum hospitalization. Yet, various obstacles currently prevent as many as 50% of women who request postpartum sterilization during prenatal care from actually obtaining the procedure. Up to half of these women will experience a repeat, unintended pregnancy within the first postpartum year.¹⁵

Prior data looking at whether women with unintended pregnancies use effective postpartum contraception is conflicting. Two reports, including a large population-based study, found higher rates of uptake of effective postpartum contraception among women with unintended pregnancies. In a 2009 analysis of the U.S. Centers for Disease Control and Prevention (CDC) Pregnancy Risk Assessment Monitoring System (PRAMS) 2004-2006 data, it was reported that 88% of 43,887 postpartum women were using at least one contraceptive, and 62% reported using a “highly effective” method.¹⁶ Of those women with unintended births, 92.1% used at least one method and 71% used a “highly effective” method. However, “highly effective” was broadly defined to include all methods with a typical use failure rate of less than 10 percent (including all hormonal methods). This report did not distinguish between top tier efficacy methods such as LARC and sterilization, and relatively less effective methods, such as the oral

contraceptive pill.

In another report, among 800 women in North Carolina who were interviewed prior to their postpartum hospital discharge, women with unintended pregnancies were 1.6 times as likely to say that they planned to initiate LARC methods compared to women with planned pregnancies (95% CI of OR 1.2-2.1). Authors did not report what postpartum methods the women actually used.¹⁷

Other reports have not found an association between pregnancy intention and initiation of postpartum contraception. Among 4005 Florida women with live births, those with chronic medical diseases were 1.8 times as likely as healthy counterparts to have an unwanted pregnancy, but no more likely to use birth control postpartum.¹⁸ And among 797 HIV positive teenagers in Kenya, women with unintended pregnancies were no more likely to use postpartum contraception than women with intended pregnancies (OR 0.9, 95% CI 0.5-1.5).¹⁹ Authors of these two reports did not distinguish between more- and less effective postpartum contraceptive modalities.

The goal of the current study was to examine, using the latest data from the National Survey of Family Growth (NSFG; 2006-2010), patterns of contraceptive use among women with unintended births. Our hypothesis was that women with unintended births would be more likely to use highly effective contraception postpartum than their counterparts with intended pregnancies.

METHODS

Study population

This was a cross-sectional study examining the relationship between unintended birth and postpartum contraception. The study population was selected from the 2006-2010 cycle of the NSFG, a project of the United States Centers for Disease Control and Prevention, National Center for Health Statistics. The NSFG collects data on pregnancy, childbearing, men's and women's health, and parenting from a national sample of U.S. women and men 15–44 years of age.²⁰ The survey was designed and conducted by the National Center for Health Statistics (NCHS) and the Institute for Social Research (ISR), University of Michigan, of Ann Arbor, Michigan. Subjects in the 2006-2010 cycle were selected based on a nationally representative, multistate, area probability sample drawn from 110 primary sampling units (PSUs) across the country. PSUs consisted of metropolitan areas, counties, or groups of adjacent counties; they were located in most states and included the largest metropolitan areas in the United States. PSUs were further broken down into neighborhoods, and households were randomly chosen from within each neighborhood. Each chosen household was contacted, and screened. If there was more than one eligible person living in the household, one person was randomly selected. The selection of participants was random, but certain subgroups were oversampled: teenagers (15–19 years of age), Hispanic men and women, and non-Hispanic black men and women, such that each of these subgroups would comprise about 20% of the sample. Survey staff concentrated additional effort to contact a random subset of nonresponding

households, in an attempt to increase participation of these, more difficult to screen households, and to decrease non-response bias. The response rate was about 80%.²⁰

In-person interviews were conducted in the homes of 12,279 women aged 15-44 years by trained interviewers using standardized surveys in both Spanish and English. The interviews were done using computer-assisted interviewing software, on laptop computers; they lasted an average of 80 minutes. Responses to survey questions were compiled electronically into a database that was de-identified and published on a web site for public use.

Boston University Institutional Review Board exemption was granted prior to proceeding with this analysis. Two de-identified datasets were downloaded from the NSFG website: the “all female respondent” file, which contained information on timing and type of contraception in a monthly calendar for three years prior to the interview, and the “female pregnancy” file, containing information on timing of all of a woman’s previous live births, as well as whether a given pregnancy was intended. The two datasets were merged by unique subject identifier in order to link this information.

While data on pregnancy intention was available for all births regardless of time frame, contraceptive method use was available only for three years prior to the study interview. Therefore, women were included in this study if they had a live birth not more than three years prior to the interview, and if we were able to link their responses to pregnancy-related questions with those of contraceptive-related questions. Women were excluded if they responded that they did not know whether the pregnancy was intended, or if there was no information on postpartum contraceptive use. Second or higher order

births to the same woman during the study period were also excluded.

Assessment of pregnancy intention

The exposure of interest was unintended birth, that is, a live birth resulting from an unintended pregnancy. Pregnancy intention was self-reported by respondents through an in-person interview; this information was gathered retrospectively, up to three years after the index birth. It was measured via questions known as the “standard measure of unintended pregnancy.”² Respondents were asked, “How did you feel about the timing of the pregnancy?” Answer choices (and percent of responses) were “too soon” (26.5%), “at about the right time” (48.4%), “later than wanted” (8.1%), “never wanted to be pregnant at all” (16.7%), or “didn’t care” (0.5%). Questions such as this have been in use in surveys like the NSFG since the 1960s, and aim to classify pregnancies as intended, mistimed, or unwanted.² For this analysis, pregnancy intention was dichotomized as “intended” or “unintended.” Both unwanted and mistimed pregnancies were classified as “unintended.” Pregnancies that occurred at the right time, later than wanted, or in women who were indifferent, were classified as “intended.”¹

Postpartum contraceptive use

The primary outcome was time to initiation of highly effective postpartum contraception within one year of a live birth. Highly effective contraception was defined as a method with less than one failure (pregnancy) per 100 woman-years of typical use. Highly effective methods included permanent sterilization (female tubal ligation or

occlusion and male vasectomy) or long acting, reversible methods (intrauterine contraception or contraceptive implant). Contraceptive use was ascertained retrospectively, via self-report during an in-person interview. Participants were asked to complete a monthly calendar indicating which method they used each month for a period of three years prior to the interview.

The postpartum time period has been variously defined from as little as 4-6 weeks to greater than one year. There is no consensus among experts as to how long women should be considered “postpartum” for the purposes of studying contraceptive use. The first year postpartum constitutes a period of expressed desire for contraception and unmet need that results in unplanned pregnancies and unwanted childbearing worldwide.²¹ We therefore chose this time frame for our primary analysis.

Secondary outcomes included time to initiation of any postpartum contraception within one year of a live birth, as well as the relationship between pregnancy intention and contraceptive non-use over the first postpartum year.

Confounding and Effect Modification

We addressed confounding in the design stage in two different ways. First, we chose a sample in which the source population was the same for both exposed and unexposed individuals. Second, we identified potential confounders from prior literature. Characteristics which have been associated in the literature with unintended birth include young age (young), low income, less educational attainment, Black race, unmarried status, breastfeeding duration, and having a chronic medical problem.^{2,18} LARC use has

been associated with age, early onset of sexual activity, marital status, and insurance source, while use of permanent sterilization has been associated with marital status and parity.^{22,23} Information on all of these potential confounders except chronic medical problems was as part of the NSFG.

In the analysis phase, we evaluated whether exposed and unexposed women were similar according to baseline and demographic factors that had been identified as potential confounders. We also looked at the relationship between these baseline factors and the outcome, time to highly effective postpartum contraception. Then, for each potential confounder, we adjusted the relationship between pregnancy intention and time to postpartum contraception for that characteristic individually. If this adjustment changed the relationship by approximately 10% or more, the characteristic was defined as a likely confounder. A multivariate model was then composed to look at the relationship between pregnancy intention and time to highly effective postpartum contraception, adjusted for confounders.

Finally, we were interested in whether any of the baseline characteristics were effect modifiers. A stratified analysis was conducted, in which we examined the relationship between pregnancy intention and time to postpartum contraception for each level of a potential effect modifier, for example in each of four age groups. If there were clinically significant differences in the relationship between pregnancy intention and time to effective postpartum contraception between levels of a stratum, the covariate was identified as a likely effect modifier.

Missing data

Missing data for all variables used in this analysis, except for postpartum contraception, were imputed by the NCHS prior to our accessing the data. Regression imputation, which uses potentially all other variables in the data set as predictors for the missing value, was used for the majority of variables using IVEware software, available from the University of Michigan website. Logical imputation, in which a substantive expert looks at a missing value, examines related variables, and assigns a value to the missing value that is essentially an educated prediction of the true value, was used for a small minority of the data.²⁰ Using imputation flags, we determined exactly how much of the data for each variable was imputed, and what imputation method was used. For all but one variable used in this analysis, less than 1% of values were missing. For poverty level status, 6.5% of the data was imputed ([Table 1](#)). A total of 32 out of 2724 records (0.012%) were missing data on the outcome, postpartum contraception and so these records were excluded from the analysis.

Statistical analysis

Data analysis was performed using SAS 9.3 statistical software. The relationship between baseline characteristics (potential confounders or effect modifiers) and pregnancy intention was compared with a Chi-squared test. Survival curves were then constructed using Kaplan-Meier estimates for the relationship between these characteristics and time to highly effective postpartum contraception, according to levels of a given characteristic (e.g., age group) and compared visually. Using Cox

Proportional Hazards Regression, Hazard ratios (HRs) were then calculated for the relationship between each level of a baseline characteristic and time to highly effective contraception, and a Chi-squared test was used to test the hypothesis that there were no differences between these hazard ratios. Ninety-five percent confidence intervals were calculated for all HRs.

For the unadjusted primary outcome, we used a log-rank test to compare HRs for time to highly effective postpartum contraceptive use according to pregnancy intention status. A similar analysis was performed for any contraceptive use over the first postpartum year and over the first three postpartum months. Looking at the data in a slightly different way, we compared the risk of contraceptive non-use over the first postpartum year among women with unintended versus intended pregnancies using a Chi-squared test.

An adjusted analysis was then performed, in which we calculated HRs for time to highly effective postpartum contraception according to pregnancy intention, adjusted for each potential confounder. Characteristics that changed the relationship between pregnancy intention and time to postpartum contraception by 10% or more were considered confounders and were kept in the multivariate model. Multivariate Cox Proportional Hazards Regression was then performed to determine the relationship between pregnancy intention and time to effective postpartum contraception, adjusted for confounders.

To assess effect measure modification, we conducted a stratified analysis. We compared hazard ratios for time to highly effective postpartum contraceptive use

according to pregnancy intention at each level of a given characteristic, for example in each of four age groups. If there were clinically important differences between levels of a given strata, the characteristic was determined to be a likely effect modifier.

RESULTS

Study Sample

Between 2006 and 2010, in-person interviews were conducted in the homes of 12,279 women ages 15-44 years. Among female respondents, 7,538 women reported a total of 14,292 live births. 3,160 of these births occurred during the study period. After multiple births to the same woman (n=431), and women who responded that they did not know if the pregnancy was intended were excluded (n=5), 2,724 births remained. We were able to successfully link pregnancy data to contraception data in 100% of records. Of those, 2,691 women had complete data on pregnancy intention, postpartum contraception, and potential confounders ([Figure 1](#)), and contributed 22,472 person-months of follow-up during the study period.

Baseline Characteristics of Study Participants according to Pregnancy Intention

Young, undereducated, and unmarried women were more likely than their counterparts to have unintended births, as were women who had a household income that was less than 200% of the federal poverty level, and those who used publically assisted funds, such as Medicaid, to pay for delivery. Black women and women who were 14 years old or younger at first intercourse were also more likely to have unintended than intended births. Women with unintended pregnancies were less likely to have breastfed their babies. Each of these characteristics had a statistically significant association with pregnancy intention (p values <0.0001, [Table 2](#)).

Time to highly effective postpartum contraceptive use according to baseline characteristics

Older age and higher birth order were markedly associated with highly effective postpartum contraceptive use ([Table 3](#)). The youngest women were only about a third as likely to initiate highly effective postpartum contraception, compared to the oldest group (HR=0.36, 95% CI 0.26-0.50). Similarly, women having their third or more birth were more than five times as likely to initiate highly effective postpartum contraception, compared to women having their first baby (HR 5.1, 95% CI 4.0-6.4).

Distribution of Postpartum Contraceptive Use

Overall, 2215 (82.3%) of women reported using any postpartum contraceptive method, and 657 women (24.4%) used highly effective methods during the first postpartum year. Of these, 246 (9.1%) women used LARC methods (IUD or implant) and 412 (15.3%) used male or female sterilization. About one third of women (n=906, 33.7%) started a method in the first postpartum year with a greater than 1% but less than 10% typical use failure rate (including the pill, patch, ring, and injection). A total of 474 (17.6%) relied on condoms as their most effective postpartum contraceptive method, and 178 (6.6%) relied only on other, less effective methods. Overall, 477 women (17.7%) reported using no contraception during the entire first postpartum year ([Figure 2](#)).

Unadjusted Analysis

Women with unintended births were 1.1 times as likely to use highly effective postpartum contraception, compared to those with unintended pregnancy (95% CI 0.9-1.3) The difference was not statistically significant ($p=0.22$, [Figure 3](#)). Women with unintended pregnancies were 1.1 times as likely as women with intended pregnancies to initiate any postpartum contraception (95% CI 0.97-1.2, $p=0.24$, [Figure 4](#)). Women with unintended pregnancies were as likely as those with intended pregnancies to use no method for the entire first postpartum year (HR=0.97, 95% CI 0.79-1.2, $p=0.73$).

Multivariate Analysis

Only age and marital status changed the relationship between pregnancy intention and time to highly effective postpartum contraceptive use by approximately 10% or more, and so these were kept in the multivariate model ([Table 4](#)). Women with unintended births were 1.4 (95% CI: 1.2-1.6) times as likely to use highly effective postpartum contraception compared to women with intended births, after adjustment for age and marital status ($p=0.0001$). During the first month postpartum, women with unintended pregnancies were 0.8 times as likely to use no contraceptive method as women with intended births (95% CI 0.7-0.9, $p=0.0046$); there were no differences between groups for the rest of the first postpartum year ([Figure 5](#)).

Stratified Analysis

We found that women who had early age of 1st intercourse (14 years old or younger)

were less likely to initiate highly effective postpartum contraception after an unintended pregnancy than other women (HR 0.77, 95% CI 0.54-1.1, [Table 5](#)). In contrast, married women (HR=1.5, 95% CI 1.2-1.9) white women (HR= 1.4, 95% CI 1.1-1.7), and women for whom the unintended pregnancy was their first birth (HR= 1.6, 95% CI 1.0-2.3) were more likely than others to initiate highly effective postpartum contraception after an unintended pregnancy, but these differences were not statistically significant. With increasing level of educational attainment there was a trend toward greater likelihood of initiating highly effective postpartum contraception after an unwanted pregnancy, that was not statistically significant (HR= 0.89, 1.1, and 1.2 for no high school degree, high school graduate, and college graduate, respectively). Age, income, and insurance status were not found to be effect modifiers.

DISCUSSION

This is one of the first epidemiologic studies to examine the connection between pregnancy intention and postpartum contraception, and the first to focus specifically on initiation of highly effective postpartum contraception according to pregnancy intention. We had hypothesized that women with unintended births would be more likely to use effective postpartum contraception than women with intended pregnancies, based on prior literature and because we suspected that they would be highly motivated to prevent another unintended pregnancy in the setting of caring for an unplanned-for infant. In addition, we felt that clinicians would be more likely to guide these women toward highly effective, user-independent contraceptive methods with high continuation rates. Our finding that women with unintended births were 40% more likely (adjusted HR 1.4) than women with intended births to initiate highly effective contraception in the first postpartum year confirmed this hypothesis. In addition, women with unintended births were slightly more likely than their counterparts to initiate any contraception in the first postpartum month.

Our results are in line with prior data from the CDC, which found a similar difference between groups (RR 1.3), despite overall higher contraceptive uptake rates, and a much broader definition of “highly effective contraception.”¹⁶ Our findings are also similar to those of Tang et al.¹⁷ In their analysis, women with unintended births were 60% more likely to plan to initiate postpartum LARC (OR 1.6, 95% CI 1.2-2.1), although plans for sterilization and actual contraceptive method used were not reported.

In women with unintended pregnancies who seek abortion, clinicians have long been attuned to the importance of post-abortion contraception. Users of highly effective post-abortion contraception are less than half as likely as non- users to return for a repeat abortion within two years.^{24,25} In addition, in adolescents, for whom 80% of pregnancies are unintended, users of postpartum LARC methods are up to 35 times less likely to have a repeat pregnancy within the next two years.²⁶ It stands to reason that adult women with unintended births might similarly benefit from the initiation of highly effective postpartum contraception. We are therefore concerned that a relatively low overall uptake of highly effective contraception, along with an almost 1 in 5 prevalence of postpartum contraceptive non-use for the entire first postpartum year, indicates that women in this study sample are not well-prepared to prevent recurrence of unintended births.

We have identified certain groups of women who were somewhat more likely than others to initiate effective contraception after an unwanted pregnancy; these included married women, white women, women with college degrees, and women with who were giving birth for the first time. Conversely, women who became sexually active at a young age were less likely to initiate highly effective contraception after an unwanted birth. Clinicians may use this information to guide counseling and identify women who may be at higher risk for recurrent unintended birth.

These results should be considered within the context of this study's strengths and limitations. Strengths include a large sample size gained from a diverse, population-based study sample, the NSFG. Because the NSFG collected monthly data on contraceptive

method used, we were able to perform a time-to-event analysis and compare hazard ratios, an analysis which recognized that time taken to initiate effective contraception is a clinically important determinant of its effectiveness in pregnancy prevention. There was a high response rate and a low rate of exclusion for missing data, which minimized selection bias.

There was likely to have been some non-differential misclassification of exposure in this study. Pregnancy intention was ascertained retrospectively by patient self-report during an in-person interview up to three years after a birth. Subjects may have had difficulty recalling the initial intention of the pregnancy. Women may also have intentionally reported unintended pregnancies as intended out of shame, embarrassment, or a change of heart. Prior reports have demonstrated that abortions are underreported in the NSFG by almost 50%; it is possible that the same is true of unintended births.¹ These forces likely led to a net underreporting of unintended births and reciprocal overreporting of intended births. This misclassification was likely to have been non-differential with respect to postpartum contraceptive use, and would have biased results toward a null finding.²⁷ In other words, we might have found more prominent differences between groups if intention of births had been ascertained prospectively.

Our outcome, effective postpartum contraceptive use, was also self-reported up to three years after initiation, but we believe that it was less vulnerable to misclassification. Use of long-term contraceptive methods such as sterilization or IUDs tend to be easier for respondents to remember and report correctly than methods used infrequently up to three years ago, and there is no stigma associated with their use. Further, as long as any

misclassification of contraceptive use was non-differential with respect to pregnancy intention, it would not have biased relative measures of association.²⁷

Both pregnancy intention and postpartum contraceptive use were self-reported, and so if some participants were under-reporters of both exposure and outcome and some were over-reporters of both exposure and outcome, this could have created a dependent bias away from the null.²⁷ We do not believe that this was a significant source of bias in this study because the outcome, contraceptive use, is objectively verifiable.

Given that this was an observational study based on existing data, there was the potential for confounding. Data was gathered on many potential confounders and used in the adjusted analysis. We were able to adjust for all major known confounders identified by prior literature. However, we were not able to gather information on sexual activity. A woman might have used no contraception during a month where she was not at risk for pregnancy. A higher rate of sexual activity might be related to both having an unwanted pregnancy and to using highly effective contraception and might explain the small difference seen between groups. Additionally, the unintended and intended birth groups differed significantly on every baseline characteristic measured and therefore unidentified or unmeasured confounders may also have been unbalanced between groups, biasing results in either direction.

Another issue was that lactational amenorrhea (LAM) was not a choice in the contraceptive method calendar. If women using LAM indicated that they were using no method, or natural family planning, this would not have biased our primary outcome, as LAM would not have been considered a highly effective method, having a perfect use

failure rate of 2%. Furthermore, any overestimate of the number of women using no method would have been small, given that only a small fraction of American women exclusively breastfed for the infant's first six months.²⁸

We believe that these results are generalizable to American women between 15 and 44 years of age. The NSFG is a diverse, nationally representative sample. Oversampling of minority women and teens led to more stable estimates of associations in those populations. A large, prospective study is warranted to confirm our results. Ideally, women should be asked whether they intend to become pregnant prior to conception, to minimize risk of exposure misclassification. It would be also be helpful if the NSFG were to collect postpartum contraceptive data specifically as a part of its pregnancy dataset. Further analysis linking the time to initiation of postpartum contraception to the incidence of recurrent, unintended pregnancies would be informative.

Obstacles to initiation of effective postpartum contraception in women with unintended births may be contributing to the ongoing epidemic of unintended pregnancy in the United States. At the clinical level, unplanned but desired pregnancies are treated similarly to planned and desired pregnancies. It may be more helpful if clinicians were to document, consider, and discuss with patients the intention of the pregnancy when planning for postpartum contraception.

Given the success of highly effective contraception at preventing recurrent unintended pregnancy in closely related contexts, clinicians should encourage women with unplanned pregnancies to plan initiation of highly effective postpartum

contraception and help them follow through with implementing these plans.

At the regulatory level, cumbersome postpartum sterilization consent requirements for women enrolled in Medicaid should be removed. Additionally, health insurance billing structures that disallow reimbursement for LARC placement prior to postpartum hospital discharge should be revised. The results of this investigation add to the body of data supporting effective postpartum contraception, particularly in women with unintended births, as a public health priority.

Table 1: Imputation of missing data

Variable name	Definition	Survey data (n)	Imputed		Imputation method	
			n	%	Regression	Logical
WANTRESP	Intention of pregnancy	2690	2	0.07%	2	0
AGEPREG	Age at pregnancy outcome	2692	0	0%	0	0
HISPRACE2	Race	2692	0	0%	0	0
RMARCON6	Marital status	2683	9	0.34%	8	1
POVERTY	Poverty level status	2518	174	6.5%	174	0
PAYDELIV	Payment type for delivery	2690	2	0.07%	2	0
VR1STAG	Age at sexual debut	2685	7	0.26%	4	3
PARITY	Number of live births	2691	1	0.04%	1	0
BIRTHORD	Birth order	2692	0	0%	0	0
HIEDUC	Highest completed educational level	2691	1	0.04%	1	0
BFEEDWKS	Duration of breastfeeding in weeks	2672	20	0.74%	20	0

Table 2: Distribution of selected characteristics according to pregnancy intention

Characteristic	Unintended (n=1159)		Intended (n=1533)	
	n	%	n	%
Age at pregnancy outcome				
Under 20	250	21.6	76	5.0
20-24	392	33.8	311	20.3
25-29	281	24.2	504	32.9
30-44	236	20.4	642	41.9
Income, as % of federal poverty level				
<=200%	890	76.8	827	53.9
>200%	269	23.2	706	46.1
Education level				
No high school degree	394	34.0	316	20.6
High school graduate	602	51.9	677	44.2
College degree	163	14.1	540	35.2
Race				
Black/African American	346	29.9	273	17.8
Hispanic	332	28.6	410	26.7
White	404	34.9	731	47.7
Other	77	6.6	119	7.8
Marital status				
Married	292	25.2	881	57.5
Cohabiting	383	33.0	397	25.9
Not married, not cohabiting	484	41.8	255	16.6
Age at first intercourse				
14 years old or younger	255	22.0	230	15.0
Older than 14 years old	903	78.0	1303	85.0
Publicly subsidized insurance used to pay for delivery				
Yes	787	67.9	667	57.8
No	372	32.1	865	56.4
Number of live births				
1	416	35.9	513	33.5
2	312	26.9	568	37.1
3 or more	431	37.2	452	29.5
Birth order				
1 st live birth	418	36.1	534	34.8
2 nd live birth	328	28.3	571	37.2
3 rd or higher order	413	35.6	428	27.9
Breastfeeding duration				
Never breastfed	461	41.5	401	27.1
Less than one month	149	13.4	195	13.2
One month to less than six months	282	25.4	372	25.2
Six months or longer	220	19.8	510	34.5

Table 3: Time to highly effective postpartum contraceptive use according to selected baseline characteristics

Characteristic	n	HR*	95% CI	p **
Age at pregnancy outcome				
Under 20	326	0.3	0.3-0.5	
20-24	703	0.6	0.5-0.8	
25-29	785	0.7	0.6-0.9	
30-44	878	REF		<0.0001
Income, as % of federal poverty level				
<=200%	1717	1.2	1.0-1.4	
>200%	975	REF		0.015
Educational level				
No high school degree	710	1.2	0.9-1.4	
High school graduate	1279	1.3	1.1-1.6	
College degree	703	REF		0.026
Race				
Black/African American	619	0.8	0.6-0.95	
Hispanic	742	1.0	0.8-1.2	
White	1135	REF		
Other	196	0.922	0.7-1.3	0.090
Marital Status				
Married	1173	1.3	1.1-1.6	
Cohabiting	780	1.1	0.9-1.3	
Not married, not cohabiting	739	REF		0.012
Age at 1st intercourse				
14 years old or younger	485	1.0	0.9-1.3	
Older than 14 years old	2206	REF		0.71
Publicly subsidized insurance used to pay for delivery				
Yes	1454	1.1	0.98-1.3	
No	1237	REF		0.090
Number of live births				
1	929	REF		
2	880	2.9	2.3-3.8	
3 or more	883	5.1	4.1-6.5	<0.0001
Birth order				
1 st live birth	952	REF		
2 nd live birth	899	3.0	2.3-3.8	
3 rd or higher order	841	5.1	4.0-6.4	<0.0001
Breastfeeding duration				
Never breastfed	862	REF		
Less than one month	344	1.1	0.8-1.4	
One month to less than six months	654	1.1	0.9-1.3	
Six months or longer	730	1.0	0.8-1.2	0.816

*HR = Hazard Ratio

**Chi squared test

Table 4. Time to highly effective postpartum contraceptive use according to pregnancy intention, individually adjusted for each characteristic

Characteristic	HR*	Unadjusted/ Adjusted
Unadjusted	1.1	REF
Age at pregnancy outcome	1.4	0.8
Poverty level income	1.1	1.0
Educational level	1.1	1.0
Race	1.1	0.97
Marital status	1.2	0.90
Age at 1 st intercourse	1.1	1.0
Public insurance	1.1	1.0
Number of live births	1.1	1.0
Birth order	1.1	1.0
Breastfeeding duration	1.1	1.0

*HR = Hazard Ratio

Table 5: Effect of baseline characteristic levels on relationship between pregnancy intention and time to initiation of highly effective postpartum contraception

Characteristic	Stratum-specific HR*	95% CI
Age at pregnancy outcome		
Under 20	1.4	0.6-3.2
20-24	1.1	0.8-1.6
25-29	1.4	1.1-1.9
30-44	1.4	1.1-1.8
Income, as % of federal poverty level		
<=200%	1.0	0.9-1.3
>200%	1.1	0.8-1.5
Educational level		
No high school degree	0.9	0.7-1.2
High school graduate	1.1	0.9-1.4
College degree	1.2	0.9-1.8
Race		
Black/African American	0.9	0.6-1.3
Hispanic	1.0	0.8-1.3
White	1.4	1.1-1.7
Other	1.0	0.6-1.9
Marital Status		
Married	1.5	1.2-1.9
Cohabiting	1.0	0.8-1.4
Not married, not cohabiting	1.0	0.8-1.5
Age at 1st intercourse		
14 years old or younger	0.8	0.5-1.1
Older than 14 years old	1.2	1.0-1.4
Publicly subsidized insurance used to pay for delivery		
Yes	1.0	0.9-1.3
No	1.1	0.9-1.4
Number of live births		
1	1.6	1.1-2.5
2	0.9	0.7-1.2
3 or more	1.0	0.8-1.3
Birth order		
1 st live birth	1.5	1.0-2.3
2 nd live birth	0.9	0.7-1.2
3 rd or higher order	1.0	0.8-1.3
Breastfeeding duration		
Never breastfed	0.9	0.7-1.2
Less than one month	1.4	0.9-2.1
One month to less than six months	1.0	0.8-1.4
Six months or longer	1.3	1.0-1.8

*HR = Hazard Ratio

Figure 1: Study Sample Selection

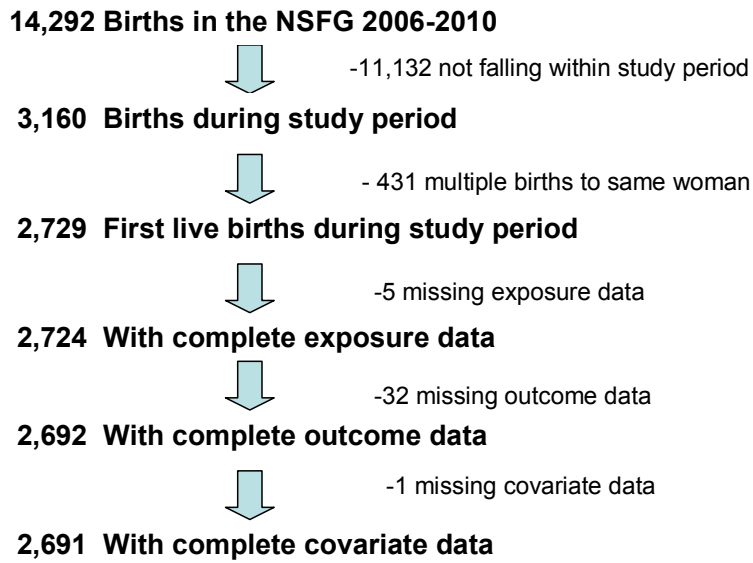


Figure 2: Most effective method used in the first postpartum year, by tier of effectiveness

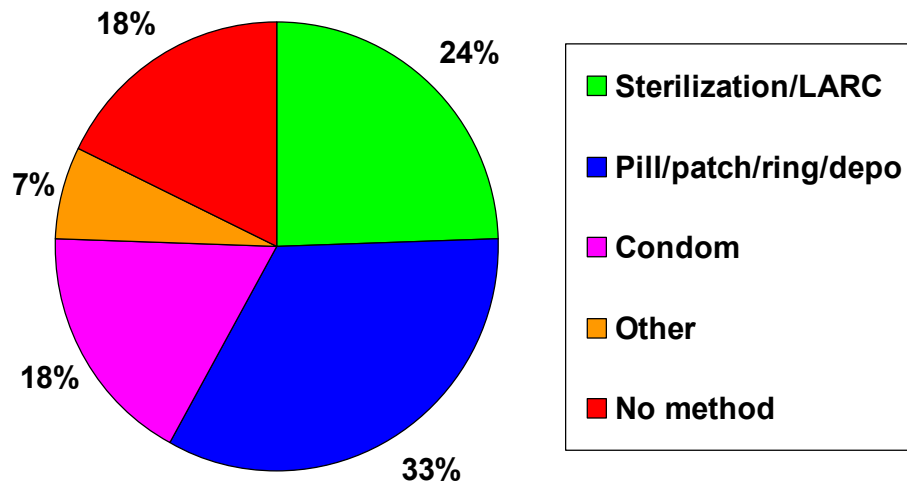
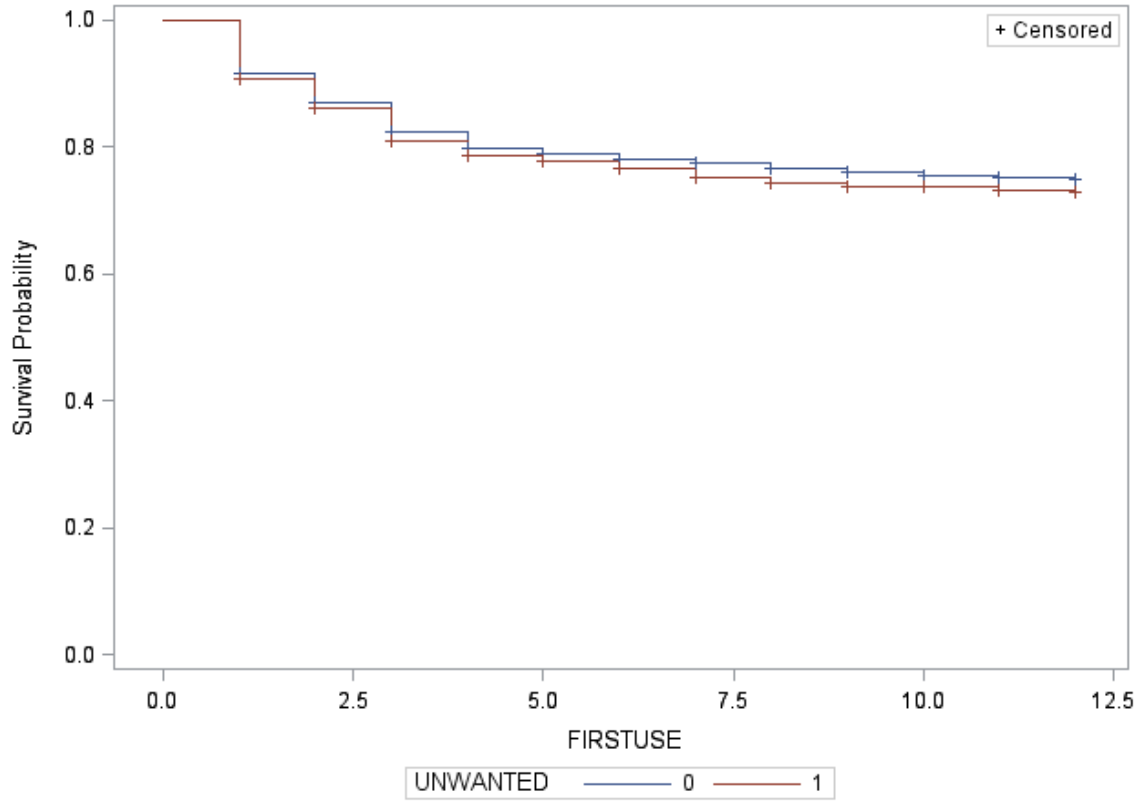


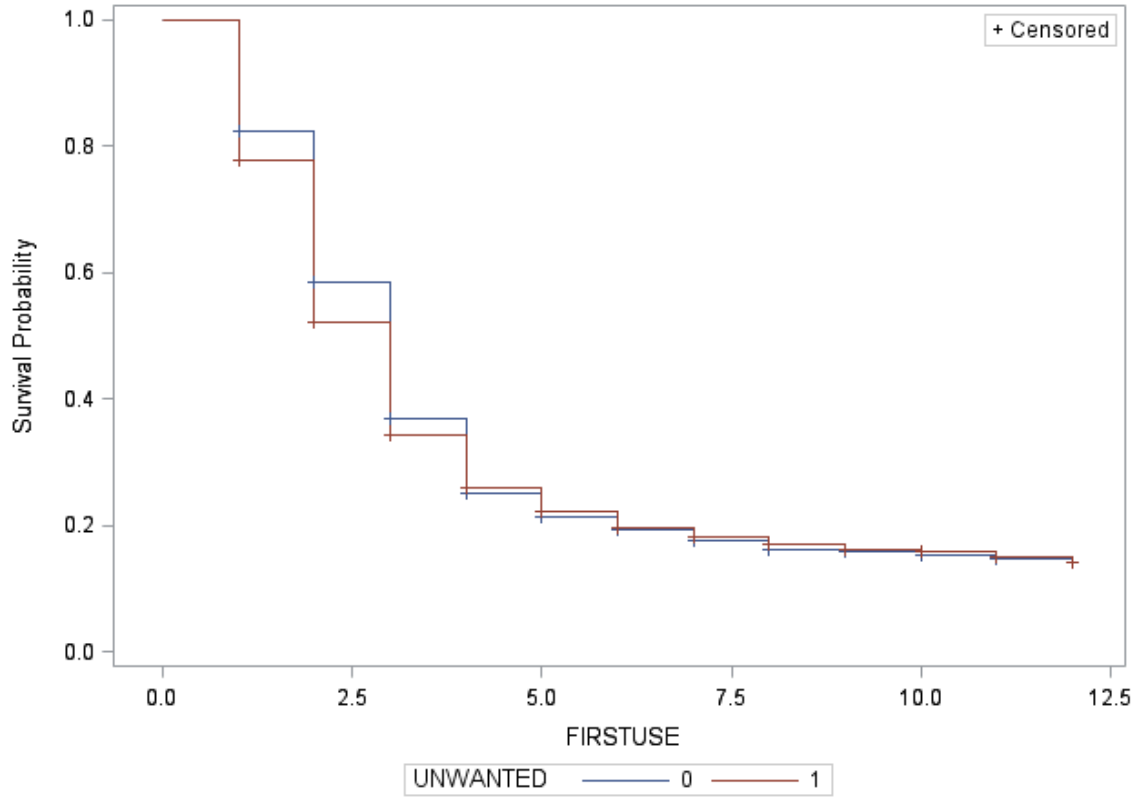
Figure 3: Time to effective postpartum contraceptive use by pregnancy intention status, unadjusted analysis



Blue (0): Unintended births

Red (1): Intended births

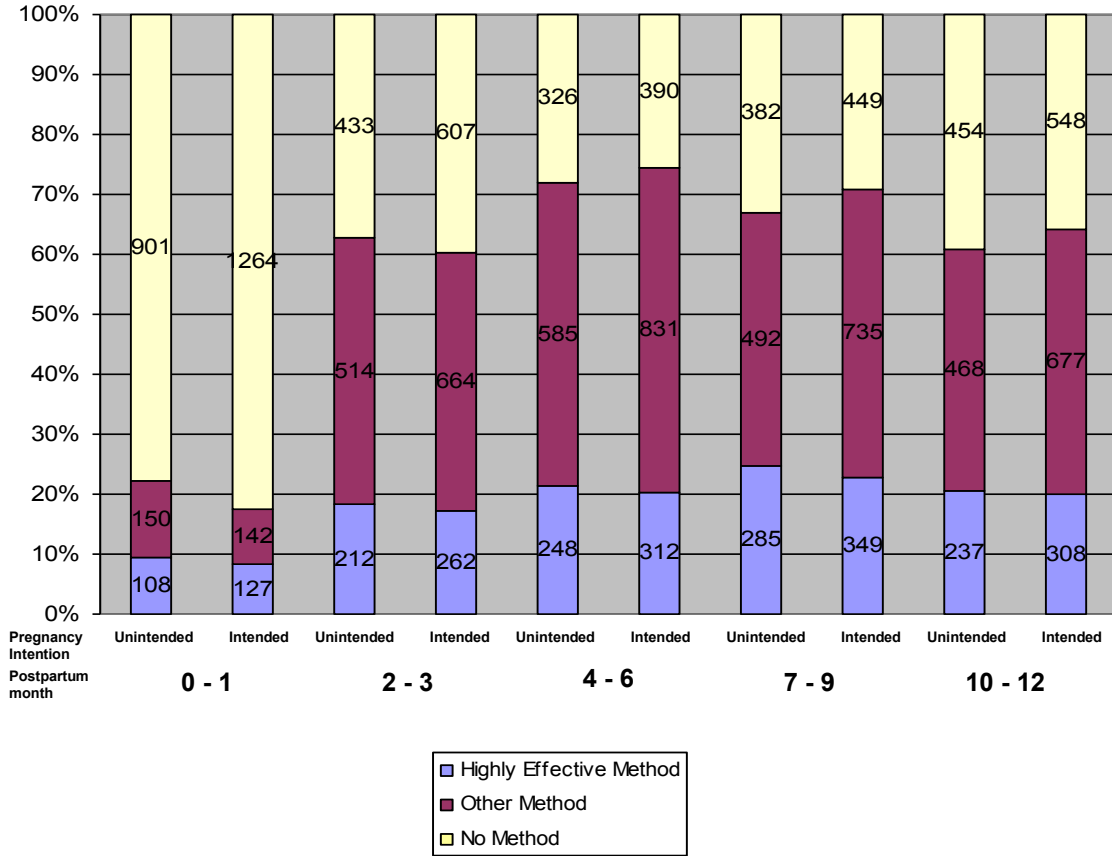
Figure 4: Time to any postpartum contraceptive use by pregnancy intention status, unadjusted analysis



Blue (0): Unintended births

Red (1): Intended births

Figure 5: Postpartum method use according to effectiveness and time period



REFERENCES

List of Abbreviated Journal Titles	
Am J Obstet Gynecol	American Journal of Obstetrics and Gynecology
BMC Womens Health	BMC Women's Health
Fam Plann Perspect	Family Planning Perspectives
Fertil Steril	Fertility and Sterility
J Adolesc Health	The Journal of Adolescent Health
J Fam Pract	The Journal of Family Practice
J Obstet Gynecol Neonatal Nurs	Journal of Obstetric, Gynecologic, and Neonatal Nursing
MMWR	Morbidity and Mortality Weekly Report
MMWR Recomm Rep	Morbidity and Mortality Weekly Report: Recommendations and Reports
Natl Health Stat Report	National Health Statistics Reports
Obstet Gynecol	Obstetrics and Gynecology
Perspect Sex Reprod Health	Perspectives on Sexual and Reproductive Health
Vital Health Stat	Vital & Health Statistics

¹ Finer LB, Zolna MR. Unintended pregnancy in the United States: incidence and disparities, 2006. *Contraception*. 2011; 84:478-485.

² Mosher WD, Jones J, Abma JC. Intended and unintended births in the United States: 1982-2010. *Natl Health Stat Report*. 2012 Jul 24;(55):1-28.

³ Taylor JS, Cabral HJ. Are women with unintended pregnancy less likely to breastfeed? *J Fam Pract*. 2002 May; 51(5):431-6.

⁴ Hulsey TM, Association between early prenatal care and mother's intention of and desire for pregnancy. *J Obstet Gynecol Neonatal Nurs*. 2001 May-Jun;30(3):275-82.

⁵ Baydar N. Consequences for children of their birth planning status. *Fam Plann Perspect* 1995;27:228-34, 245.

⁶ Sonfield A, Kost K, Gold RB, Finer LB. The Public Costs of Births Resulting from Unintended Pregnancies: National and State-Level Estimates. *Perspect Sex Reprod Health*. Volume 43, Number 2, June 2011, 94-102.

⁷ Wildsmith E, Guzzo KB, Hayford SR. Repeat unintended, unwanted and seriously mistimed childbearing in the United States. *Perspect Sex Reprod Health*. 2010

Mar;42(1):14-22.

⁸ Sonfield A, Hasstedt K, Gold RB. Moving Forward, Family Planning in the Era of Health Reform, New York: Guttmacher Institute, 2014.

⁹ United States Centers for Disease Control and Prevention. Reproductive Health, Unintended Pregnancy, Contraception. Atlanta: April, 2013. [Cited May 6, 2013]. Available from:
<http://www.cdc.gov/reproductivehealth/unintendedpregnancy/contraception.htm>..

¹⁰ United States Centers for Disease Control and Prevention. U S. Medical Eligibility Criteria for Contraceptive Use, 2010. MMWR Recomm Rep. Jun 2010;59(RR-4):1-86.

¹¹ American College of Obstetricians and Gynecologists. ACOG Committee Opinion no. 450: Increasing use of contraceptive implants and intrauterine devices to reduce unintended pregnancy. Obstet Gynecol. Dec 2009;114(6):1434-1438.

¹² United States Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report: U.S. Selected Practice Recommendations for Contraceptive Use, 2013: Adapted from the World Health Organization Selected Practice Recommendations for Contraceptive Use, 2nd Edition MMWR Recomm Rep. June 2013; 62(RR05);1-46.

¹³ United States Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report: Update to CDC's U.S. Medical Eligibility Criteria for Contraceptive Use, 2010: Revised Recommendations for the Use of Contraceptive Methods During the Postpartum Period. July 8, 2011 / 60(26);878-883.

¹⁴ American College of Obstetricians and Gynecologists. Coding and Reimbursement for LARC. Washington, D.C.: 2014. [Cited June 14, 2013]. Available from:
http://www.acog.org/About_ACOG/ACOG_Departments/Long_Acting_Reversible_Contraception/Coding_and_Reimbursement_for_LARC.

¹⁵ Thurman AR, Janecek T. One-Year Follow-up of Women With Unfulfilled Postpartum Sterilization Requests. Obstet Gynecol. Nov 2010; 116(5):1071-1077.

¹⁶ United States Centers for Disease Control and Prevention. Contraceptive Use Among Postpartum Women—12 States and New York City, 2004-2006. MMWR. August 7, 2009; 58 (30); 821-826.

¹⁷ Tang JH, Dominik R, Rea S, Brody S, Stuart GS, Characteristics associated with interest in long-acting reversible contraception in a postpartum population.

Contraception. 2013 Jul;88(1):52-7.

¹⁸ Chor J, Rankin K, Harwood B, Handler A. Unintended pregnancy and postpartum contraceptive use in women with and without chronic medical disease who experienced a live birth. *Contraception*. Jul 2011;84(1):57-63.

¹⁹ Obare F, van der Kwaak A, Birungi H, Factors associated with unintended pregnancy, poor birth outcomes and post-partum contraceptive use among HIV-positive female adolescents in Kenya. *BMC Womens Health*. 2012 Oct 6;12:34.

²⁰ Lepkowski JM, Mosher WD, Davis KE, Groves RM, Van Hoewyk J. The 2006–2010 National Survey of Family Growth: Sample design and analysis of a continuous survey. National Center for Health Statistics. *Vital Health Stat* 2(150). 2010.

²¹ Ross JA, Winfrey WL. Contraceptive Use, Intention to Use and Unmet Need During the Extended Postpartum Period. *International Family Planning Perspectives*. 2001 March; Volume 27, Number 1.

²² Dempsey AR, Billingsley CC, Savage AH, Korte JE. Predictors of long-acting reversible contraception use among unmarried young adults. *Am J Obstet Gynecol*. 2012 Jun;206(6):526.e1-5.

²³ Finer LB, Jerman J, Kavanaugh ML. Changes in use of long-acting contraceptive methods in the United States, 2007-2009. *Fertil Steril*. 2012 Oct;98(4):893-7.

²⁴ Cohen S. Repeat Abortion, Repeat Unintended Pregnancy, Repeated and Misguided Government Policies. *Guttmacher Policy Review*, Spring 2007, Voume 10, Number 2, p8-12.

²⁵ Rose SB, Lawton BA, Impact of long-acting reversible contraception on return for repeat abortion. *Am J Obstet Gynecol*. 2012 Jan;206(1):37.e1-6. Epub 2011 Jul 13.

²⁶ Baldwin MK, Edelman AB. The effect of long-acting reversible contraception on rapid repeat pregnancy in adolescents: a review. *J Adolesc Health*. 2013 Apr;52(4 Suppl):S47-53.

²⁷ Aschengrau A, Seage GR. *Essentials of Epidemiology in Public Health*. 2nd ed. Sudbury, MA: Jones and Bartlett Publishers, 2008. 278-282.

²⁸ United States Centers for Disease Control and Prevention. CDC breastfeeding report card 2013. Atlanta; 2013. [Cited June 25, 2014]. Available from:

<http://www.cdc.gov/breastfeeding/pdf/2013breastfeedingreportcard.pdf>

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