Short interpregnancy intervals in the United States:

Results from the 2006-2010 National Survey of Family Growth

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DRAFT: PLEASE DO NOT CITE OR QUOTE

Abstract

Objective: To investigate the prevalence and correlates of short interpregnancy intervals (IPIs) in the United States.

Methods: We analyzed pregnancy data from a nationally representative sample of 12,279 women from the 2006-2010 National Survey of Family Growth. We limited our sample to second and higher order births within five years of the interview. Interpregnancy intervals were calculated as the interval between the delivery date of the preceding live birth and the conception date of the index birth, with short IPIs defined as intervals less than 18 months. We used simple and multivariate logistic regression analyses to examine associations between short IPIs and maternal demographic and childbearing characteristics, including pregnancy intention.

Results: Among the 2,253 pregnancies in our sample, one third (35%) were conceived within 18 months of a prior birth. After adjusting for socio-demographic and childbearing characteristics, women were significantly more likely to have a short IPI if they were aged 15-19 or married at the time of conception of the index pregnancy, initiated childbearing after age 30, or reported the pregnancy as unintended. Short IPIs were more likely to be intended among more advantaged women (married, non-Hispanic white, college educated, or non-Medicaid delivery). We estimate that preventing unintended pregnancies would reduce the proportion of short IPIs from 35% to 23%.

Conclusion: Providing counseling about the potential negative consequences of short IPIs and improving women's contraceptive use to reduce rates of unintended pregnancy would likely reduce the proportion of short IPI pregnancies in the United States.

Introduction

Short inter-pregnancy intervals (IPIs) are associated with a number of adverse outcomes for both mother and child, including increased risk of preterm birth, low birth weight, and preeclampsia (1-5), making prevention of short IPIs a public health priority in the U.S. Specifically, the 2020 Healthy People Objectives call for a 10% reduction of pregnancies that occur within 18 months of a previous birth (6).

There has been little systematic national surveillance of pregnancy interval length in the U.S. Instead, most relevant studies focus on single states and key subpopulations (7,8). National-level baseline estimates in Healthy People 2020 relying on unpublished bivariate analyses from the National Survey of Family Growth suggest that about a third of IPIs in the United States fall below the 18-month threshold (6). However, to our knowledge, there has been no national-level investigation of the correlates of short IPIs in a multivariate framework.

The potential association between pregnancy intentions and IPIs is of particular interest. Strategies to reduce unintended pregnancy may indirectly impact the prevalence of short IPIs; in particular, reducing mistimed pregnancies (those reported as occurring sooner than a woman desires) would increase IPI length. Moreover, a 2001 study in Denmark found that unplanned pregnancy was associated with an increased risk of IPI of 9 months or less (9). Given high rates of unintended pregnancy in the U.S. (10), similar investigation of the relationship between pregnancy intention and short IPIs using national-level data is needed.

Our research objective is to identify the characteristics of women associated with short IPIs in order to inform programs and policies aimed at reducing the occurrence of short IPIs. We use nationally representative data to analyze the prevalence and correlates of short IPIs, paying particular attention to the role of pregnancy intention.

Materials and Methods

The institutional review board of the second author's organization (Department of Health and Human Services identifier institutional review board 00002197) determined that the project is exempt from Institutional Review Board approval. The data from this study are drawn from the 2006-2010 National Survey of Family Growth (NSFG), a periodic national probability survey of the noninstitutionalized population aged 15–44 in the U.S, conducted by the National Center for Health Statistics (NCHS). The survey used a multi-stage, stratified, clustered sampling frame to collect interviews continuously from June 2006 to June 2010. Methods of data collection and dissemination of the public use dataset are reviewed by the Institutional Review Board at NCHS for protections of human subjects. Further methodological details are available elsewhere (11,12). Face-to-face interviews were conducted with 12,279 women who answered detailed retrospective questions about their pregnancy experiences; the response rate was 78%. Data for each reported pregnancy were contained in a separate data file and linked to the primary respondent file.

The interpregnancy interval was calculated as the time elapsed between the conception date of any second or higher order birth (hereafter labeled index pregnancy) and the date of a prior birth. Following the convention of prior studies and the Healthy People 2020 objective, pregnancies conceived within 18 months after a previous birth were classified as having a short IPI.

This analysis excluded all pregnancies not ending in live birth (i.e. miscarriage, abortion, stillbirth) due to both likely underreporting of these other pregnancy outcomes and the relevance of birth spacing for perinatal health. We also excluded all multiple births from both the preceding

and index pregnancies. To reduce issues of retrospective reporting bias and focus on experiences during a period of current policy interest, we limited our sample to second or higher order singleton births born in the five years preceding the interview (n=2,265); the preceding singleton live births used to calculate the interval could have occurred outside of this five year window. We also excluded pregnancies with implausible interpregnancy interval lengths due to erroneous reporting (n=5) and pregnancies with missing covariates (n=7). Thus, the final sample size for analysis included 2,253 second and higher order singleton births that occurred within 5 years of the interview date, were preceded by a singleton birth, and have complete data.

Independent variables selected for this analysis include the following measures of mothers' sociodemographic characteristics: race/ethnicity, union status at conception of index pregnancy, Medicaid funded delivery of index pregnancy, and completed education at the time of the interview. Measures related to childbearing include number of births prior to the index pregnancy, age at conception of the index pregnancy, and age at initiation of childbearing, as well as pregnancy intention of the index pregnancy. Pregnancy intention was determined from a series of questions women were asked to assess their feelings right before they got pregnant. Based on their responses, each pregnancy was classified as intended (wanted and on time, later than wanted, didn't care/indifferent), mistimed (wanted but occurring sooner than desired), or unwanted, following conventional measurement approaches for this concept (13).

The present study used three analytical approaches. First, we employed simple and multivariate logistic regression to estimate unadjusted and adjusted odds ratios for the relationship between short IPIs and maternal demographic and childbearing characteristics. Multivariate models included all of the measures with a significant bivariate relationship to short IPIs (α=0.05); union status, parity, and education were retained in the models for theoretical

reasons. Because age at first birth and age at most recent conception are essentially a linear combination of the interpregnancy interval length for most pregnancies in the sample, we estimated models controlling for each of these factors separately; Model 1 controls for age at conception of the index birth and Model 2 controls for age at first birth.

The second analytical approach focused on pregnancies occurring from the short IPI and used simple logistic regression to examine variation in pregnancy intention by maternal demographics among these pregnancies.

Lastly, we estimated a hypothetical estimate of the share of short IPIs if unintended pregnancies (mistimed and unwanted pregnancies) were averted. For this calculation, all pregnancies to women who reported they had not wanted to have any (more) children were removed from both the numerator and the denominator. For pregnancies that were reported by the mother as mistimed (occurring too soon), we recalculated the interpregnancy interval length by adding the number of months by which the pregnancy was reported to be mistimed to the actual interval. For example, if the actual interpregnancy interval was 12 months, but the mother reported that the pregnancy occurred 9 months before desired, then the new interpregnancy interval would be 21 months and would be shifted to a longer IPI. Interpregnancy interval lengths for pregnancies reported as intended were unchanged. All analyses were weighted and used the *svy* command prefix in Stata 12.1 (StataCorp, College Station, TX) to adjust for the complex survey design of the NSFG.

Results

Among the 2,253 pregnancies in our sample (all of which were second or higher-order births), the average IPI was 34.0 months. One third (35%) were conceived within 18 months of a

prior birth, meeting our criteria of a short inter-pregnancy interval (Table 1). The majority of pregnancies had an interpregnancy interval of 18 months or more, with 50% at 18-59 months, and 16% having a length of 60 months or more.

There is some evidence of associations between measures of pregnancy intention, childbearing history, and short IPIs (Table 2). Pregnancies reported as mistimed or unwanted were significantly more likely to have short IPIs compared to pregnancies reported as intended (unadjusted ORs 4.3 and 1.8 respectively). Short IPIs were significantly inversely associated with age at conception of the pregnancy. In contrast, births to women initiating childbearing before age 30 were significantly less likely to have shorter IPIs than births to women aged 30 and older at first birth.

There was limited variation in the share of short IPIs by other core demographic measures (Table 2). Births to non-Hispanic Black women were significantly more likely than births to Hispanic women to have short IPIs, as were births whose delivery was paid by Medicaid. However, maternal union status at conception and maternal education were not associated with short IPIs at the bivariate level.

Results from multivariate analyses predicting the likelihood of having a short IPI are shown in Table 3. Although both models include different measures of age, the results are generally similar to those found in the bivariate results. Both models also indicate that marital status, which was not significant at the bivariate level, is a significant predictor of IPI length; the adjusted odds of having a short IPI were higher among births to married as compared to single women. Additionally, Model 1 provides evidence that births were more likely to be short IPI if born to high parity women or women with a college degree, while Model 2 suggests that IPIs are more likely among Medicaid delivery births or births to non-Hispanic Black women.

Table 4 further explores the associations between pregnancy intentions and short IPI by examining the proportion of all short IPI pregnancies (n=791) that were intended. We find that 45% of these pregnancies were reported as intended by the mother and this varied significantly across all of the childbearing and demographic measures examined. Short IPI pregnancies to more advantaged mothers were more likely to be intended; 59-70% were intended among births to those age 30 or older at first birth, college graduates, and those not using Medicaid to pay for delivery. Similarly, about half of the short IPI pregnancies were intended among births to White women, those married at conception, and those age 30-44 at the most recent birth.

We calculated the extent to which preventing unintended pregnancies would reduce the share of all pregnancies that were short IPIs by assuming that all unwanted pregnancies in our sample were averted and that mistimed pregnancies were appropriately timed by the mother. Based on these counterfactual assumptions, we estimate that the prevention of unintended pregnancies would reduce the proportion of short IPIs overall from 35% to 23% (data not shown).

Discussion

Using recent nationally representative data, we estimate that more than one in three of second or higher parity singleton births occur following a short IPI. Indeed, nearly 7% are conceived within six months of a prior birth.

Age plays an important role in short IPIs for two distinct groups of women. First, we identify short IPIs as a correlated and troublesome outcome of second births to teenage mothers; two-thirds of births to this age group had a short IPI. Although teen mothers make up only a small share (6%) of all second or higher parity births, additional interventions are needed to

address sub-optimal birth spacing in this population. Second, women with a first birth at age 30 or older are more likely to experience short IPIs than those initiated childbearing earlier, suggesting that closer birth spacing is a response to later initiation of childbearing. This premise is supported by the finding that among pregnancies that had short IPIs to women initiating childbearing after age 30, nearly three out of four were intended pregnancies. For this group, short IPIs appear to be a choice and not an unintended outcome.

To our knowledge, this is the first study to explore relationships between interpregnancy intervals and pregnancy intention using national-level data in the U.S. With 55% of short IPI pregnancies unintended, helping women achieve their desired pregnancy intentions is the low-hanging fruit for public health interventions to reduce the share of short IPI pregnancies. Improvements in women's contraceptive use can further reduce rates of unintended pregnancy, and by extension short IPIs. Long-acting reversible contraceptives (LARCs), such as intrauterine devices (IUDs) and implants, seem particularly well-suited to lengthening the interpregnancy interval (17,18). However, this approach will only go so far since we estimated that alleviating all unintended pregnancies among these second and higher order births—an exceptionally lofty goal—would still leave 23% with short IPIs.

Further supporting the idea that closely spaced births may be part of a strategy for family building was the finding that more than half of short IPI births to more advantaged women were reported as intended. Increasing IPI length among intended births is more challenging and likely requires health care providers to educate and counsel patients about the potential negative health consequences of short IPIs. Further research is needed to reevaluate the evidence base for negative health consequences of short IPIs among the substantial share of intended births to more advantaged women. Indeed, any suggestion of promoting longer pregnancy intervals for these

women must weigh benefits against the potential health risks and decreased fecundity associated with increasing maternal age at birth (19, 20).

The choice of an 18-month cut-off to define a short IPI in this analysis was based on the indicator used in Healthy People 2020. While much literature suggests that IPIs less than 18 months are associated with increased risk, it is important to note that even within this 18-month window, the level of risk has been found to decrease as interval length increases (1). Additionally, while the Healthy People 2020 Objectives is limited to reduction of short IPIs, there is evidence that IPIs over 60 months are also detrimental to maternal and child health (1). Considering that 16% of pregnancies in our sample had IPIs over 60 months, these data suggest that about half (51%) of IPIs in the US fall outside of generally recommended standards.

The National Center of Health Statistics (NCHS), as part of Healthy People 2020 objectives, tracks short IPIs using the same NSFG data we analyze here. However, NCHS reports as their baseline measure the *share of women* having a short IPI during the five years preceding the interview, as opposed to the *share of pregnancies*. Since each woman can only provide a single pregnancy to the numerator, their measurement approach is biased away from measuring short IPIs; women with shorter intervals may have more than one pregnancy during the period and thus have relevant pregnancy experiences excluded. Our pregnancy-based measure conceptually parallels the stated objective to reduce the share of short IPI pregnancies and is methodologically sound in incorporating all reported pregnancies ending in live birth. Future monitoring should use a pregnancy-based measure, as we do here.

Although linked vital records are often used to assess the causes and consequences of interpregnancy length, they are unable to provide pregnancy intention status, which, as demonstrated here, is a key determinant of interpregnancy length. Another source of data, the

Pregnancy Risk Assessment Monitoring System (PRAMS), provides data on interpregnancy length and pregnancy intention, but not all states participate in data collection efforts. Therefore, this study drew strength from its ability to link interpregnancy intervals and maternal characteristics—including pregnancy intentions—from a recent nationally representative large sample of pregnancies.

While the NSFG data is widely utilized and considered highly reliable and valid, there are always limitations to self-reported data. Relevant to this study, women may potentially misreport birth dates or gestational age of a child, resulting in a miscalculation of the length of the IPI. External validation with medical records of this self-reported data was not possible; however, any misreporting is likely random and should not bias the observed relationships. The overall response rate for the NSFG was 78%, which may have resulted in underrepresentation of certain high risk groups. Likewise, our exclusion of multiple births may have also impacted our estimate of short IPI pregnancies. Lastly, there has been concern about bias in the retrospective reporting of pregnancy intentions, if women adjust their reporting of births towards more intended farther from the actual time of conception (21). Limiting the analyses to a five-year retrospective period minimizes this concern, and follows methodological approaches established in prior analyses of this measure from the National Survey of Family Growth (10,13).

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Table 1. Demographic and childbearing characteristics associated with pregnancies* conceived after a previous birth, 2006-2010.

Characteristic	n=2,253
Mean IPI length	34.0 months
IPI length	
<18 months	35.1
< 6 months	6.7
6-11 months	12.4
12-17 months	16.0
18-59 months	49.5
60+ months	15.5
Pregnancy intention	
Intended	61.7
Mistimed	20.8
Unwanted	17.5
Age at conception of most recent pregnancy	
15-19	5.9
20-29	56.3
30-44	37.9
Age at first birth	
15-19	35.3
20-29	53.9
30-44	10.9
Prior births	
1	53.1
2	28.5
3 or more	18.4
Race/Ethnicity	
Non-Hispanic white	53.4
Hispanic	25.1
Non-Hispanic African American	14.7
Non-Hispanic other	6.7

IPI, interpregnancy interval; GED, general equivalency diploma.
Data are in % except for mean IPI length.
Figures may not add up due to rounding.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.

Table 1. Demographic and childbearing characteristics associated with pregnancies* conceived after a previous birth, 2006-2010. (cont.)

Characteristic	n=2,253
Union status at time of conception	
Not married or cohabiting	13.9
Married	65.7
Cohabiting	20.4
Education	
< High School	24.5
High School graduate or GED	27.2
Some College	23.4
College graduate or above	24.9
Medicaid funded delivery	
Yes	48.3
No	51.8

IPI, interpregnancy interval; GED, general equivalency diploma.
Data are in % except for mean IPI length.
Figures may not add up due to rounding.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.

Table 2. Percent of pregnancies* conceived within 18 months of a previous birth and unadjusted odds ratios and 95% confidence intervals for short interpregnancy intervals by selected characteristics, 2006-2010.

Characteristic	Pregnancies* conceived within 18 months of a previous birth (%)	Unadjusted OR (95% CI)
All	35.0	
Pregnancy intention		
Intended	25.6	—
Mistimed	59.7	4.30† (3.00, 6.18)
Unwanted	38.6	1.82‡ (1.24, 2.70)
Age at conception of most recent pregnancy		
15-19	67.1	—
20-29	37.2	0.29† (0.17, 0.48)
30-44	26.8	0.18† (0.10, 0.31)
Age at first birth		
15-19	36.8	0.61§ (0.39, 0.92)
20-29	31.1	0.47† (0.31, 0.71)
30-44	49.0	—
Prior births		
1	34.5	—
2	33.5	0.96 (0.72, 1.28)
3 or more	38.9	1.21 (0.86, 1.71)
Race/Ethnicity		
Non-Hispanic white	36.5	1.31 (0.97, 1.77)
Hispanic	30.5	—
Non-Hispanic African American	39.6	1.49§ (1.02, 2.18)
Non-Hispanic other	29.7	0.96 (0.59, 1.56)

OR, odds ratio; CI, confidence interval; GED, general equivalency diploma
— indicates reference category.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.
† Significant difference at P<.001.
‡ Significant difference at P<.01.
§ Significant difference at P<.05.

Table 2. Percent of pregnancies* conceived within 18 months of a previous birth and unadjusted odds ratios and 95% confidence intervals for short interpregnancy intervals by selected characteristics, 2006-2010. (cont.)

Characteristic	Pregnancies* conceived within 18 months of a previous birth (%)	Unadjusted OR (95% CI)
Union status at time of conception		
Not married or cohabiting	32.3	—
Married	36.0	1.18 (0.84, 1.65)
Cohabiting	33.5	1.06 (0.71, 1.58)
Education		
< High School	38.9	1.03 (0.69, 1.53)
High School graduate or GED	32.9	0.79 (0.55, 1.14)
Some College	29.8	0.69 (0.44, 1.06)
College graduate or above	38.3	—
Medicaid funded delivery		
Yes	38.0	1.29§ (1.01, 1.65)
No	32.3	—

OR, odds ratio; CI, confidence interval; GED, general equivalency diploma
— indicates reference category.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.
† Significant difference at P<.001.
‡ Significant difference at P<.01.
§ Significant difference at P<.05.

Table 3. Adjusted odds ratios and 95% confidence intervals from logistic regression analysis investigating the association between pregnancies* conceived within 18 months of a previous birth and selected characteristics, 2006-2010.

Characteristic	Model 1 Adjusted OR (95% CI)	Model 2 Adjusted OR (95% CI)
Pregnancy intention		
Intended	—	—
Mistimed	4.43† (3.07, 6.39)	4.78† (3.36, 6.86)
Unwanted	2.11‡ (1.37, 3.27)	2.21† (1.43, 3.41)
Age at conception of most recent pregnancy		
15-19	—	—
20-29	0.27† (0.15, 0.48)	—
30-44	0.12† (0.06, 0.23)	—
Age at first birth		
15-19	—	0.51§ (0.28, 0.92)
20-29	—	0.41‡ (0.25, 0.68)
30-44	—	—
Prior births		
1	—	—
2	1.11 (0.79, 1.57)	0.99 (0.72, 1.36)
3 or more	1.93‡ (1.31, 2.86)	1.34 (0.89, 2.01)
Race/Ethnicity		
Non-Hispanic white	1.35 (0.94, 1.94)	1.36 (0.95, 1.94)
Hispanic	—	—
Non-Hispanic African American	1.40 (0.93, 2.11)	1.59§ (1.06, 2.39)
Non-Hispanic other	1.00 (0.56, 1.79)	0.92 (0.53, 1.59)
Union status at time of conception		
Not married or cohabiting	—	—
Married	2.13† (1.42, 3.19)	1.85‡ (1.23, 2.78)
Cohabiting	1.46 (0.93, 2.30)	1.38 (0.90, 2.13)
College graduate or above	2.31† (1.54, 3.48)	1.42 (0.94, 2.14)
Medicaid funded delivery	1.14 (0.84, 1.56)	1.41§ (1.04, 1.91)

OR, odds ratio; CI, confidence interval.
— indicates reference category.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.
† Significant difference at P<.001.
‡ Significant difference at P<.01.
§ Significant difference at P<.05.

Table 4. Among pregnancies* conceived within 18 months of a previous birth, percent intended and unadjusted odds ratios and 95% confidence intervals for intended pregnancies by selected characteristics, 2006-2010.

Characteristic	Among pregnancies[a] conceived within 18 months of a previous birth, intended pregnancies (%)	Unadjusted OR (95% CI)
All	45.2	
Age at Conception of most recent pregnancy		
15-19	15.4	—
20-29	44.1	4.33† (2.08, 9.03)
30-44	59.0	7.91† (3.356, 17.6)
Age at first birth		
15-19	30.7	0.19† (0.09, 0.39)
20-29	48.4	0.39§ (0.18, 0.87)
30-44	70.4	—
Prior births		
1	52.2	—
2	35.7	0.51‡ (0.32, 0.82)
3 or more	39.7	0.60 (0.35, 1.03)
Race/Ethnicity		
Non-Hispanic white	52.1	1.85§ (1.13, 3.05)
Hispanic	37.0	—
Non-Hispanic African American	31.5	0.78 (0.45, 1.37)
Non-Hispanic other	47.7	1.55 (0.66, 3.68)
Union status at time of conception		
Not married or cohabiting	23.5	—
Married	54.3	3.88‡ (1.83, 8.24)
Cohabiting	27.6	1.25 (0.55, 2.85)

OR, odds ratio; CI, confidence interval; GED, general equivalency diploma
— indicates reference category.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.
† Significant difference at P<.001.
‡ Significant difference at P<.01.
§ Significant difference at P<.05.

Table 4. Among pregnancies* conceived within 18 months of a previous birth, percent intended and unadjusted odds ratios and 95% confidence intervals for intended pregnancies by selected characteristics, 2006-2010. (cont.)

Characteristic	Among pregnancies[a] conceived within 18 months of a previous birth, intended pregnancies (%)	Unadjusted OR (95% CI)
Education		
< High School	32.3	0.21† (0.11, 0.43)
High School graduate or GED	33.7	0.23† (0.11, 0.46)
Some College	45.0	0.37§ (0.15, 0.88)
College graduate or above	69.0	—
Medicaid funded delivery		
Yes	32.6	0.34† (0.20, 0.56)
No	59.0	—

OR, odds ratio; CI, confidence interval; GED, general equivalency diploma
— indicates reference category.
*Among pregnancies conceived within 5 years of the interview date and ending in a live birth.
† Significant difference at P<.001.
‡ Significant difference at P<.01.
§ Significant difference at P<.05.