The Long and the Short:
Birth Interval Spacing among Women in the United States

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Birth spacing among women is affected by several factors and as a result for some women a birth interval is too short; for some women the interval is too long; and for other women it is just right. In this paper we look at both sides of the coin: what factors contribute to a short birth interval, and what are the factors leading to a long birth interval?

The United States government has addressed the concern over short birth intervals in *Healthy People 2010* with recommendation 9-2: "Reduce the proportion of births occurring within 24 months of a previous birth" (U.S. Department of Health and Human Services 2000). The report calls for women of all ages to space pregnancies adequately to lower the risk of adverse perinatal outcomes. The target for 2010 is to reduce the percentage of second births that occur to women within 24 months of the first birth from 11 percent (as of 1995) to 6 percent in 2010.

The report notes that adolescent women are slightly less likely to have a second birth within 24 months of the first birth than women of other ages. Bearing a second child while still an adolescent, however, increases the probability of mental and physical problems for themselves and their children. Thus it is a public health concern to decrease the percentage of short birth intervals, particularly among younger women.

At the other end of the spectrum is the concern about birth intervals for older women. Older women who have delayed the start of their childbearing might be expected to have a short birth interval between first and second births simply because their reproductive ages have been telescoped into fewer years. There are also public health concerns regarding older mothers: for themselves with

the increased risk of fertility problems and pregnancy loss associated with maternal age (Wood 1994) and for their children with the increased risk of Down's syndrome (Hook and Lindsjo 1978).

Women of all ages may choose short birth spacing as an economic strategy. This rational choice strategy would maximize the use of baby equipment and clothing of the first child and/or minimize opportunity costs of being out of the labor force if the mother had been in the labor force prior to the birth of the first child and left the labor force after the birth of the first child.

At the other end of the continuum are long birth intervals. Two primary factors that could potentially lead to long birth intervals are marital/cohabitation disruption and fertility problems, including pregnancy loss. The number of people cohabiting grew from 3.2 million in 1990 to 5.5 million in 2000 (Simmons and O'Connell 2003). Just under half of married couple households had a child under the age of 18 living in the household, and children were present in 39-43% of unmarried partner households (Simmons and O'Connell 2003).

There may be differentials associated with cohabiting that would affect the length of birth intervals. Manning (2001) has shown that Hispanic women were 77% more likely than white women to conceive a child while cohabiting and black women were 69% more likely than white women to do so, and were 2-3 times less likely to marry their partner by the time of the child's birth than were white women.

Cohabitation itself would not lead to a lengthening of birth intervals per se as fertility rates for cohabiters are just slightly lower than those of married women, but cohabiting relationships tend to be very fragile. Disruption could lead to a longer birth interval if the disruption occurs after the first birth.

Data from the 1980s showed that 40 percent of cohabiters either married or stopped living together within a year and just one-third were still cohabiting after two years (Bumpass and Sweet 1989; Thornton 1988). Using data from the 1995 National Survey of Family Growth, Bramlett and

Mosher (2002) found that the likelihood of disruption after 3 years of cohabiting was 39 percent, with Hispanic women the least likely to experience a disruption (32 percent) and non-Hispanic black women the most likely to experience a disruption (56 percent).

Married women are not immune to disruption that could affect birth intervals. As of 1995 women aged 15-44 in their first marriage faced a 20% probability that marriage will end in divorce within 5 years (Bramlett and Mosher 2002). Taken together, marriages and partnerships are at a fairly high risk of being dissolved, which could lead to a lengthening of the birth interval if the break-up occurs after the first child is born.

In addition, apparent fecundability rates are known to decrease with maternal age (Wood 1994). Because by definition women who are attempting to have a second child are at an older maternal age than they were at the birth of the first child, they may experience secondary infertility when they attempt to have a second child. Secondary infertility may lengthen the birth interval between the first and second live birth deliveries. If a woman seeks fertility treatment that may also affect the length of the birth interval until a procedure is successful.

In this paper we examine relationships between maternal characteristics and the interval between first and second births. We are most interested in determining the factors associated with short birth intervals (those less than 2 years) as they are of primary concern for public health.

DATA AND METHODS

This analysis utilizes data from Cycles 5 and 6 of the National Survey of Family Growth (NSFG), conducted in 1995 and 2002 respectively, to examine the pattern of birth spacing among women aged 15-44. (The proposal we submit here shows preliminary results based only on the 2002 data, but our full paper will incorporate the 1995 data as well.) The NSFG is based on multistage

probability samples of the household population of women in the United States aged 15-44. Black women and Hispanic women were oversampled in 1995 and 2002. Men were included in the 2002 survey, but we limit this analysis to women because the potential health and social consequences of shorter birth intervals are primarily relevant for women. Also, focusing on women allows us to study a longer time trend in birth spacing.

This paper will examine the length of time from first birth to second birth among women who had at least one live birth delivery at the time of survey. Selected analyses will further focus on women with at least a second delivery at time of survey. We limit the analysis to the interval between first and second live birth delieveries because the cell sizes would be too small to analyze for higher order birth intervals. Given our interest in the possible impact of delayed childbearing on birth intervals, it is all the more pertinent to focus on first to second birth spacing because relatively few delayers of childbearing will have more than two children.

We first present descriptive analyses of birth intervals by several independent variables. The dependent variable, months between first and second birth, is categorized for the descriptive analyses as follows: no second birth, less than or equal to 24 months, 25-36 months, 37-48 months, and 49 or more months. This categorization allows for cell sizes to be large enough for analysis, while still allowing for variation among groups. The interval refers to months between live birth deliveries, regardless of any intervening pregnancy loss; in the case of multiple births, they are counted as one delivery.

Independent variables included in this analysis are: age at time of first birth, year of first live birth, marital or cohabiting status at time of first birth, and race/ethnicity. A variable for marital disruption between first and second births is included if the respondent was married at the time of her

first birth. Educational level is shown for women who were aged 22-44 at time of interview, and poverty level income is shown for ages 20-44.

Given the distribution of the birth intervals as well as the Healthy People 2010 objectives, the dependent variable for our logistic regression analysis has been dichomotized as less than or equal to 24 months between first and second live birth deliveries versus greater than 24 months. For the regression analysis, we limit the sample to only women 22-44 who had a second birth. The limitation to ages 22-44 allows us to have reliable income and education data for all cases, and the limitation to those who have had a second birth reduces truncation of birth spacing based on the year and age of first birth. We first show the logistic regression for all women 22-44, then select for women aged 22-44 who were married at the time of the first birth to determine if marital disruption between first and second live birth deliveries is a factor in birth spacing.

For our full paper, we will create comparable measures based on the Cycle 5 (1995) NSFG data and pool with the Cycle 6 (2002) data; we do not present those analyses in our preliminary results. We will also examine variables not yet addressed in our preliminary results such as employment status, maternity leave, and intervening pregnancy loss.

While it may be ideal to study birth spacing with an event history approach, it is not possible to do so using both cycles of NSFG data. The 1995 survey included a richer array of event history data, including greater detail on work and relationship history, but the 2002 survey had to be scaled back considerably and cannot support this level of analysis.

PRELIMINARY RESULTS

In Table 1 we present the percentage distribution of length between first and second live birth deliveries by maternal characteristics. The overall pattern of birth spacing is U-shaped with an equal

percentage (20.6%) of the total sample having children less than 25 months apart and having children 49 or more months apart. As would be expected with increasing maternal age and more recent first deliveries, a smaller percentage of women have had a second child. Among older women who have a second live delivery, over three times as many women (10.6 percent) have had a short interval (less than or equal to 24 months) as compared with 2.3 percent of women with a long interval (49 months or longer).

In Table 2 we present the percentage distribution of birth intervals for women by their current fertility status and age at time of first birth. The U-shaped pattern of birth spacing noted among the total sample in Table 1 is evident here only among women who were less than 25 years old at the time of their first birth and do not have a current fertility problem. The percentages of women who have not had a second child increase with maternal age and are much higher for women with a fertility problem than for women who do not have a current fertility problem. Less than 12 percent of women aged 35-44 with a current fertility problem have had a second delivery. Even among women who do not have a current fertility problem there is a strong age effect with less than 30 percent of women aged 35-44 at time of first birth having had a second live delivery.

In Table 3 we present the mean number of months between first and second live birth deliveries for women aged 15-44 who have had at least two live birth deliveries. As expected, women who were older at their first births and those whose first births occurred more recently had shorter birth intervals. For example, women who had their first children in 1996 or prior had a mean birth interval of 41-49 months, whereas women whose deliveries occurred between 1997 and 2002 have a mean interval of 28 months, which reflects that truncation of birth intervals in this category. Two factors we hypothesized to have a relationship with birth intervals are included here as well. Marital disruption between the two births had the expected association in that those with a marital disruption had a longer mean birth

interval. Fertility problems, however, showed no bivariate association with mean birth interval, perhaps because the receipt of infertility services for these fertility problems is a confounding factor.

Given the public health interest in reducing the proportion of births that occur within two years of the prior birth, Table 4 shows the percentage of women who have had at least two live birth deliveries who had a "short interval" between those births, that is, less than 25 months. The data are shown by race and ethnicity. Twenty-two percent of non-Hispanic women who had their first birth before 1985 had a short birth interval, as compared with about a third of the women in the other race/ethnic groups. For the 1985-89 and 1997-2002 time periods for first birth, however, the non-Hispanic white women were the most likely to have had a short birth interval. In 1985-89 a third of non-Hispanic white women had a short birth interval, compared with 20-25 percent for the other groups; in the most recent period over half of white non-Hispanic white women had a short birth interval, with the other groups in the 33-41 percent range. Non-Hispanic white women are the most likely to delay childbearing and their mean age at first birth is higher than for the other groups of women, thus the pattern is in the expected direction for 1985-89 and 1997-2002. Additional analyses in the final paper will address the lack of a consistent pattern for non-Hispanic white women over time.

To help us disentangle some of these confounding factors, we turn to logistic regression to estimate the adjusted odds of having a second birth more than 2 years after a first birth (Table 5). As stated earlier, we limit the logistic regression to women 22-44 at interview in order to have reliable education and income information for all cases. In the left-hand column of Table 5, we show the model for all women who 22-44 who have had had least two live birth deliveries. In the right-hand column we further subset those women who were married at the time of their first birth to consider the effect of marital disruption between their first and second births. We find that the odds of having a shorter birth interval (that is, spacing of 24 months or less between first and second births) were higher

among women who had their first births most recently, for both models. This is intuitive since women who had first births between 1997 and 2002 had less chance of a chance to have longer intervals. Looking at the right-hand model based on women who were married at the time of the first birth, women who had a marital disruption between their first and second live birth deliveries did indeed have higher odds of having short birth intervals, controlling for the other factors in the model.

Additional analyses will examine data from 1995 and will look more closely at most recent births with detailed data on maternity leave, employment history, and marital/cohabitation histories.

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Table 1. Percent distribution by number of months from first birth to second birth for women aged 15-44 with at least one birth, according to selected characteristics, United States: 2002

Characteristic	Number in thousands	Total	Interval between first and second birth 1/				
			No second birth	24 months or less	25-36 months	37-48 months	49 or more months
			Percent distribution				
Total	35938	100.0	31.7	20.6	16.4	10.8	20.6
Age at first birth							
Under 25 years	23342	100.0	25.9	21.8	16.8	11.2	24.3
25-29 years	8040	100.0	35.3	19.1	18.1	10.1	17.5
30-34 years	3741	100.0	49.7	18.4	12.2	11.3	8.5
35-44 years	817	100.0	77.0	10.6	7.2	3.0	2.3
Date of first live birth							
Before 1985	7733	100.0	14.0	23.3	20.6	11.4	30.6
Between 1985 and 1989	6587	100.0	14.7	25.6	17.9	11.3	30.5
Between 1990 and 1996	11960	100.0	23.5	20.5	18.3	14.1	23.7
Between 1997 and 2002	9657	100.0	67.5	15.1	9.5	5.9	2.1
Marital or cohabiting status at 1st birth							
Married	21692	100.0	30.7	21.2	18.5	11.1	18.6
Cohabiting	4450	100.0	35.0	20.7	11.8	10.7	21.8
Formerly married	690	100.0	36.5	24.7	20.2	5.1	13.5
Never married	9107	100.0	32.0	18.7	13.3	10.6	25.4
Marital disruption relative to 1st birth 2/							
Yes, between 1st and 2nd births	11697	100.0	0.0	28.8	26.2	17.1	27.9
Yes, but no 2nd birth yet	1495	100.0	100.0	0.0	0.0	0.0	0.0
No marital disruption	8470	100.0	60.9	14.6	11.1	4.3	9.1
Current fertility problems							
Yes	4703	100	47.8	15.4	10.0	7.9	18.9
No	31236	100	29.2	21.4	17.3	11.2	20.9
Education 3/							
No high school diploma or GED	5126	100.0	17.6	31.9	16.7	10.7	23.1
High school diploma or GED	11646	100.0	27.7	19.6	16.3	11.2	25.2
Some college, no bachelor's degree	10201	100.0	31.0	20.5	17.0	11.0	20.5
Bachelor's degree or higher	7251	100.0	37.2	17.1	17.6	11.6	16.5
Percent of poverty level 4/							
0-149 percent	11534	100.0	24.8	27.9	15.1	11.0	21.2
150-299 percent	10425	100.0	28.6	17.7	18.4	10.7	24.7
300 percent or higher	13208	100.0	36.7	17.5	16.4	11.3	18.2
Hispanic origin and race							
Hispanic or Latina	6159	100.0	27.9	21.9	13.9	12.5	23.8
non-Hispanic white	22568	100.0	31.8	20.8	17.2	10.9	19.4

non-Hispanic black	5428	100.0	33.4	19.9	15.5	9.1	22.1
non-Hispanic other	1784	100.0	37.7	14.9	16.9	9.0	21.4

1/ Refers to intervals between deliveries, not intervals between 1st and 2nd babies born as a multiple birth. Pregnancies resulting in multiple births (e.g., twins) are considered one delivery.

2/Limited to women married at the time of their first birth.

3/ Limited to women 22-44 years of age at time of interview. GED is General Educational Development diploma.

4/ Limited to women 20-44 years of age at time of interview.

Note: Percents may not add to 100 due to rounding.

Table 2. Percentage distribution of birth intervals among women who have current fertility problems and those who do not have current fertility problems, by age at time of first birth, United States: 2002

Age at time of first birth	Total	No second birth	Interval between first and second birth 1/ 24 months or less	25-36 months	37-48 months	49 or more months
Women who have a current fertility problem						
<25	100.0	36.0	17.2	10.9	10.4	25.5
25-29	100.0	52.4	14.4	10.7	6.6	15.9
30-34	100.0	74.9	14.4	6.3	1.5	2.9
35-44	100.0	88.5	4.3	6.0	1.2	0.0
Women who do not have a current fertility problem						
<25	100.0	24.6	22.4	17.5	11.3	24.2
25-29	100.0	32.6	19.8	19.2	10.7	17.7
30-34	100.0	44.8	19.1	13.4	13.2	9.5
35-44	100.0	71.5	13.5	7.8	3.8	3.4

1/ Refers to intervals between deliveries, not intervals between 1st and 2nd babies born as a multiple birth. Pregnancies resulting in multiple births (e.g., twins) are considered one delivery.

Table 3. Average number of months between first and second live birth deliveries among women aged 15-44 with at least two live birth deliveries, by characteristics of woman, United States: 2002

Characteristic	Mean number of months1/
Age at first birth	
Under 25 years	45.2
25-29 years	38.6
30-34 years	34.1
35-44 years	28.0
Date of first live birth	
Before 1985	48.6
Between 1985 and 1989	46.7
Between 1990 and 1996	41.2
Between 1997 and 2002	28.3
Marital or cohabiting status at 1st birth	
Married	40.7
Cohabiting	44.8
Formerly married	34.5
Never married	47.7
Marital disruption relative to 1st birth 2/	
Yes, between 1st and 2nd births	42.4
No disruption between 1st and 2nd births	34.7
Fertility problems	
Yes	45.3
No	42.5
Education 3/	
No high school diploma or GED	39.7
High school diploma or GED	45.8
Some college, no bachelor's degree	42.2
Bachelor's degree or higher	42.4
Percent of poverty level 4/	
0-149 percent	41.0
150-299 percent	44.8
300 percent or higher	43.2
Hispanic origin and race	
Hispanic or Latina	43.7
non-Hispanic white	41.5
non-Hispanic Black	46.0
non-Hispanic other	47.0

1/ Refers to intervals between deliveries, not intervals between 1st and 2nd babies born as a multiple birth. Pregnancies resulting in multiple births (e.g., twins) are considered one delivery.

2/Limited to women married at the time of their first birth.

3/ Limited to women 22-44 years of age at time of interview. GED is General Educational Development diploma.

4/ Limited to women 20-44 years of age at time of interview.

Note: Percents may not add to 100 due to rounding.

Table 4. Percentage of women who have had at least two live birth deliveries within two years of the first birth, by race and ethnicity and date of first live birth, United States: 2002

Race/ethnicity	Date of first live birth			
	Before 1985	1985-89	1990-96	1997-2002
Hispanic or Latina	35.9	24.3	26.0	40.7
non-Hispanic white	22.2	33.9	27.0	50.6
non-Hispanic black	32.5	20.3	31.0	38.6
non-Hispanic other	35.1	19.2	17.4	33.4

Table 5. Adjusted odds of having a second birth 24 months or less after a first birth, among women 22-44 years of age who have had at least two live birth deliveries and for women who were married at time of first birth, United States: 2002

Characteristic	All women with 2+ live birth deliveries	Women who were married at time of 1st birth
Age at first birth		
25-29 years	1.05 (0.7-1.5)	0.92 (0.6-1.5)
30-34 years	1.38 (0.9-2.1)	1.16 (0.7-1.9)
35-44 years	1.95 (0.7-5.4)	1.57 (0.5-4.9)
Date of first live birth		
Between 1985 and 1989	1.15 (0.8-1.7)	1.37 (0.7-2.5)
Between 1990 and 1996	0.95 (0.7-1.3)	1.13 (0.7-1.9)
Between 1997 and 2002	2.22** (1.5-3.3)	3.25** (1.8-5.8)
Married at time of 1st birth	1.09 (0.8-1.5)	n/a
Marital disruption between 1st and 2nd births	n/a	0.61* (0.4-1.0)
Current fertility problems	0.94 (0.7-1.3)	0.83 (0.5-1.3)
Is a college graduate	0.77 (0.6-1.1)	0.90 (0.6-1.4)
300 percent or higher of poverty level income	0.81 (0.6-1.1)	0.81 (0.6-1.2)
Hispanic origin and race		
Hispanic or Latina	0.95 (0.8-1.2)	0.83 (0.6-1.2)
non-Hispanic black	1.02 (0.7-1.5)	1.05 (0.6-1.8)
non-Hispanic other	0.76 (0.4-1.6)	0.62 (0.3-1.3)

Note: Reference groups are: 22-24 years of age at time of first birth, first birth before 1985, no fertility problems, not a college graduate, less than 300% of poverty level income, and non-Hispanic white.
For the first model: not married at time of first birth is also the reference category.
For the second model: no disruption between 1st and 2nd births is also a reference group.