Trends in First Interpregnancy Interval Among U.S Women

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Introduction

The fertility patterns of women have changed significantly over time. Recent years have seen a decrease in both birth and pregnancy rates, including a dramatic drop in adolescent childbearing and an increase in first births to older women (1-3). These declines reflect a number of behavioral changes, including the increase of cohabitation and nonmarital childbearing, as well as the adoption and increased use of long-acting reversible contraceptives (4-5). Pregnancy spacing has typically been studied in terms of the relationship between short birth-to-pregnancy intervals and the risk of pregnancy-related complications (6). Previous research has emphasized racial disparities in levels of adverse maternal and child health outcomes due to short interpregnancy intervals, particularly among Black women (7). However, trends in pregnancy and birth spacing among women in the U.S have not been recently examined because of a dearth of nationally representative data. The collection of information on the "Date of last live birth" item on the birth certificate was discontinued after 1995, and has since been reinstated to the 2003 revised birth certificate which all states will have adopted by 2015 (8).

Given the absence of a national reporting area for data pertaining to pregnancy and birth spacing, there is a need to better understand current changes in birth spacing over the second half of the 20th century. This paper explores trends in the interval between first live birth and a second pregnancy (leading to a live birth), often termed the interpregnancy interval (IPI), among Hispanic, Black and White women. To this end, the detailed pregnancy and birth histories in the 1995, 2002 and 2006-2010 National Survey of Family Growth (NSFG) are used to describe changes in the timing of second births in the United States and whether differences in the first birth to second pregnancy interval are evident by race/ethnicity over a long historical period.

Methods

Data Measures and Sample

Data come from the 1995, 2002 and 2006-2010 National Survey of Family Growth pregnancy files which contain information on each reported pregnancy, including when it began and how it ended. Detailed information on the date of the end of the pregnancy and the date of conception (computed from the date of the end of the pregnancy and the reported pregnancy length (weeks converted to months)) were both used to provide information on pregnancy and birth spacing. The analytic sample included women aged 15-44 who had one or more live births at the time of interview. Data from 6,885 women from Cycle 5, 4,399 women from Cycle 6 and 6,648 women from the 2006-2010 NSFG were pooled, resulting in 17,932 women. The interpregnancy interval (IPI) was calculated as the number of months elapsed between the conception date of a second live birth and the date of the first live birth.

This paper focuses on the interval of time between the first birth and the second pregnancy that resulted in a live birth. For shorthand purposes, the term "second pregnancy" is referring only to those pregnancies that ended in a live birth. This analysis excluded IPIs resulting from all second pregnancies not ending in live birth (i.e, miscarriage, abortion, and stillbirth) due to underreporting of these other pregnancy outcomes. These analyses also excluded all multiple births and births with implausible interpregnancy intervals (e.g, IPI <0). Event-history estimation procedures require both a duration (time-to-event) variable and a variable that denotes the censored cases. About one-third of the analytic sample did not have a second live birth during the study period (N=5,857). These women received a duration variable that equaled the time from first birth to the date of the interview and were coded as censored.

Trends in IPIs are measured according to timing of the first birth: 1964-1979, 1980-1989, 1990-1999, 2000-2010. Women whose first births occurred during the earliest time period (1964-1979) were weighted toward the experience of women in the 1995 survey who had a first birth before age 25 (see

Table 1); thus, interpretation of results for this group are limited by age at time of interview and by year of first birth. Data from first births that occurred most recently in 2005-2010 are not shown in figures because the majority of these women were censored. Other explanatory variables include those measured at the time of at the time of first birth (age, marriage/cohabiting status) and those measured at the time of interview (race/ethnicity, education). Last, intervening pregnancy loss that occurred between the first live birth and the second pregnancy is included as a covariate.

Analytic Approach

For the descriptive analyses (**Figures 1-3**), life table methods were used to calculate pregnancy hazard rates within a specific set of intervals measured in months. Continuous-time Cox regression models were also estimated. Cox models assume the effects of covariates on the hazard are constant over time. Preliminary Cox models showed the interaction between the year of first birth (ie, 1964-1979, etc) and duration since first birth was significant, which means the hazard predicting IPI were not proportional over time. Other tests (e.g, Schoenfeld residuals) indicated the hazards for covariates such as the effect of age at first birth and race/ethnicity on IPI were also not proportional. As a result, Cox regression models predicting IPI for Hispanic, White and Black women were modeled separately.

Results

Table 1 shows the weighted descriptive statistics for women aged 15-44 with one or more live births. These data from the 1995, 2002 and 2006-2010 NSFG are presented by the year in which women first gave birth: 1964-1979, 1980-1989, 1990-1999 and 2000-2010. The median time to second pregnancy was generated from Kaplan-Meier life table estimates. A pattern of lengthening IPI is evident: the time from first birth to second pregnancy increased from 29 months, or about 2.5 years, to 40 months, or over 3 years. There are two changes in maternal characteristics that reveal important shifts in the context of first births over time. First, the distribution of first births shifted to older ages,

increasing to 24% of women aged 30-44 in 2000-2010, compared to just 5% two decades earlier. Second, a higher percentage of first births occurred within cohabiting unions, from 10% in 1980-1989 to 24% in 2000-2010. In 2000-2010, a higher percentage of women were cohabiting at the time of birth (24%) than those who were neither married nor cohabiting at the time of first birth (20%), a reversal in the trend from earlier decades.

Hazard rates of time to second pregnancy are presented separately by year of first birth and Hispanic race and origin (**Figures 1 and 2**). Women who had a first birth in early years showed a sharp peak in hazards of second pregnancy within 20 months of a first birth, that is, a strong pattern of second pregnancy soon after a first birth. This peak flattened out for women whose first births occurred in more recent years. Unlike women who had first births longer ago, women who had a first birth in more recent years exhibited more variation in the timing of a second pregnancy relative to a first birth. By race/ethnicity, there was more fluctuation in pregnancy hazards for Hispanic women than for White or Black women, possibly due to smaller sample sizes for women whose first birth occurred in the more distant past (**see Figure 2**). For Hispanic women, pregnancy hazards peaked soon after a first birth and again at 40 months, or about 3 years after a first birth. The increase in the hazard of a second pregnancy was larger and more rapid for White women than for Hispanic or Black women. Black women showed the lowest hazard of a second pregnancy and less variation compared to the other race groups.

Results from continuous time models predicting the odds of a second pregnancy are shown in **Table 2**. These models assess whether the descriptive patterns shown in Figures 1 and 2 persist once controlling for maternal characteristics and test the statistical significance of these patterns. As stated, models are shown separately by race to relax the assumption of proportionality of these hazards over time. For all race groups, women who were adolescents at the time of first birth had 2 -3 times the odds of a second pregnancy compared to women aged 30 and older. Compared to women who were married at the time of first birth, the odds of a second pregnancy were lowest for women who were not married

or cohabiting and about 75-88% as high for women who were cohabiting at the time of birth. The results by year of first birth are largely consistent with the previous figures: the odds of a second pregnancy are lowest for the most recent first births among Hispanic and White women, indicating a delay in second pregnancy following a first birth. For Black women, higher odds of a second pregnancy were present for women with more recent births, a pattern that suggests higher peaks at earlier months in the hazard rates of second pregnancy throughout the 1980s-1990s compared to more recent first births (**see Figure 3**). For White women, an intervening pregnancy loss increased the odds of a second pregnancy by 26%.

Discussion and Next Steps

Behavioral factors such as improved contraceptive use, delay in the ages of first marriage and first birth, and increasing childbearing outside of marriage have created multiple pathways to completed fertility. Data from the 1995, 2002 and 2006-2010 NSFG presented here indicate an increase in inter-pregnancy length between first birth and second pregnancy from the late 1960s through 2010. These nationally representative data lend support for declining birth and pregnancy rates in the United States. One of the drawbacks of the Cox regression model is that the shape of the hazard function cannot be estimated. For the final paper, further tests will be conducted to determine how the baseline hazard functions of second pregnancy differ by race/ethnicity and the rate at which these hazard functions vary over time. Research focusing on shifts in the spacing of pregnancies and births provide a valuable lens for studying the changing meaning of family formation throughout the 21st century.

References

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Table 1: Weighted Descriptive Statistics for Women Aged 15-44 with 1 or More Live Births, by Year of First Birth, 1995-2010 National Survey of Family Growth

	Year of First Birth			
Characteristic[1]	1964-1979	1980-1989	1990-1999	2000-2010
Median time to second birth (in months)	29	33	37	40
Total	100.0	100.0	100.0	100.0
Age at first birth				
15-19	57.6 (1.2)	32.9 (1.1)	25.7 (0.8)	22.6 (1.2)
20-24	35.0 (1.2)	41.3 (1.1)	32.5 (0.8)	30.1 (1.3)
25-29	7.3 (0.6)	20.4 (1.0)	26.1 (0.8)	23.2 (1.0)
30-44	0.1 (0.0)	5.4 (0.4)	15.7 (0.7)	24.1 (1.2)
Marital Status at time of first birth				
Married	68.0 (1.2)	63.9 (1.1)	59.6 (0.9)	54.9 (1.5)
Cohabiting	6.1 (0.6)	10.4 (0.6)	15.5 (0.6)	24.0 (1.1)
Not married, not cohabiting	24.1 (1.2)	23.9 (1.0)	23.2 (0.8)	19.7 (1.0)
Hispanic origin and race				
Hispanic	12.8 (1.0)	14.8 (0.8)	18.4 (1.1)	18.0 (1.6)
Non-Hispanic White	64.0 (1.3)	64.3 (1.2)	61.5 (1.3)	59.3 (1.8)
Non-Hispanic Black	19.2 (1.2)	15.4 (0.8)	13.0 (0.7)	14.5 (1.2)
Maternal education				
Less than a high school diploma	22.3 (1.1)	16.9 (0.8)	16.8 (0.8)	18.1 (1.0)
High school graduate	46.2 (1.2)	39.6 (1.0)	32.8 (0.8)	26.4 (0.9)
Some college	22.8 (1.1)	27.0 (0.9)	28.4 (0.8)	25.2 (1.0)
Bachelor's degree or higher	8.8 (0.7)	16.4 (0.7)	22.0 (0.9)	30.3 (1.3)
Intervening pregnancy loss				
Yes	8.7 (0.7)	8.8 (0.5)	7.8 (0.4)	3.6 (0.4)
No	91.3 (0.7)	91.2 (0.5)	92.2 (0.4)	96.4 (0.4)

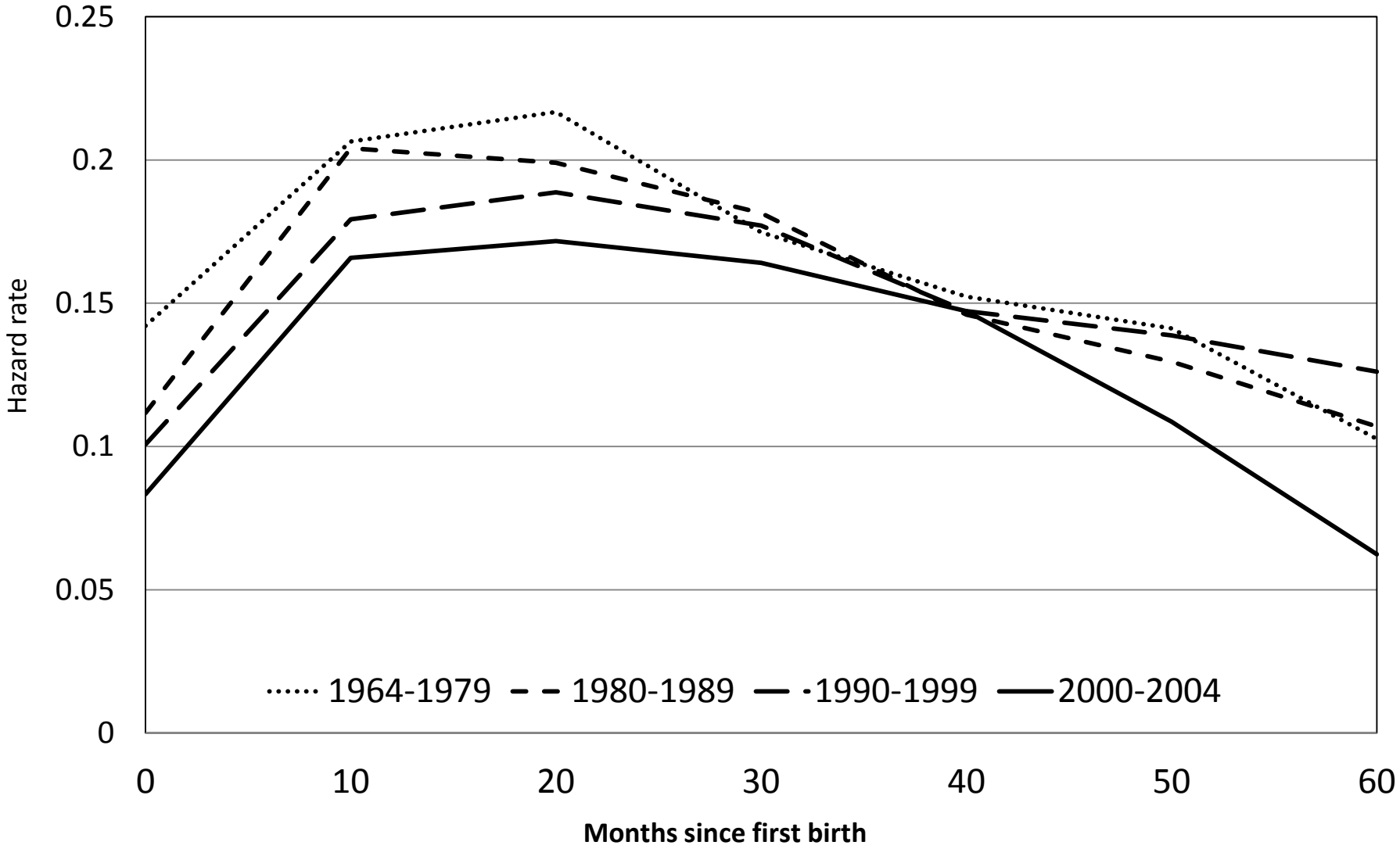
1 Includes women of other or unknown race and origin groups, not shown separately.

Table 2. Continuous Time Hazard Models Predicting the Second Pregnancy Among Women 15-44 Years, by Hispanic Origin and Race, 1995-2010 National Survey of Family Growth

Characteristic	Hispanic	Non-Hispanic White	Non-Hispanic Black
	Hazard ratios		
Age at first birth			
30-44	Ref	Ref	Ref
25-29	1.42***	1.41***	1.43***
20-24	1.58***	1.50***	2.10***
15-19	1.99***	1.71***	2.75***
Marital Status at time of first birth			
Married	Ref	Ref	Ref
Cohabiting	0.88**	0.75***	0.80***
Not married, not cohabiting	0.66***	0.61***	0.72***
Maternal education			
Less than a high school diploma	Ref	Ref	Ref
High school graduate	0.82***	0.80***	0.64***
Some college	0.72***	0.80***	0.66***
Bachelor's degree or higher	0.82**	0.94	0.64***
Year of first birth			
1964-1979	Ref	Ref	Ref
1980-1989	0.99	0.94	1.13**
1990-1999	0.99	0.94	1.21***
2000-2010	0.76***	0.80***	1.06
Intervening pregnancy loss			
No	Ref	Ref	Ref
Yes	0.97	1.26***	1.10

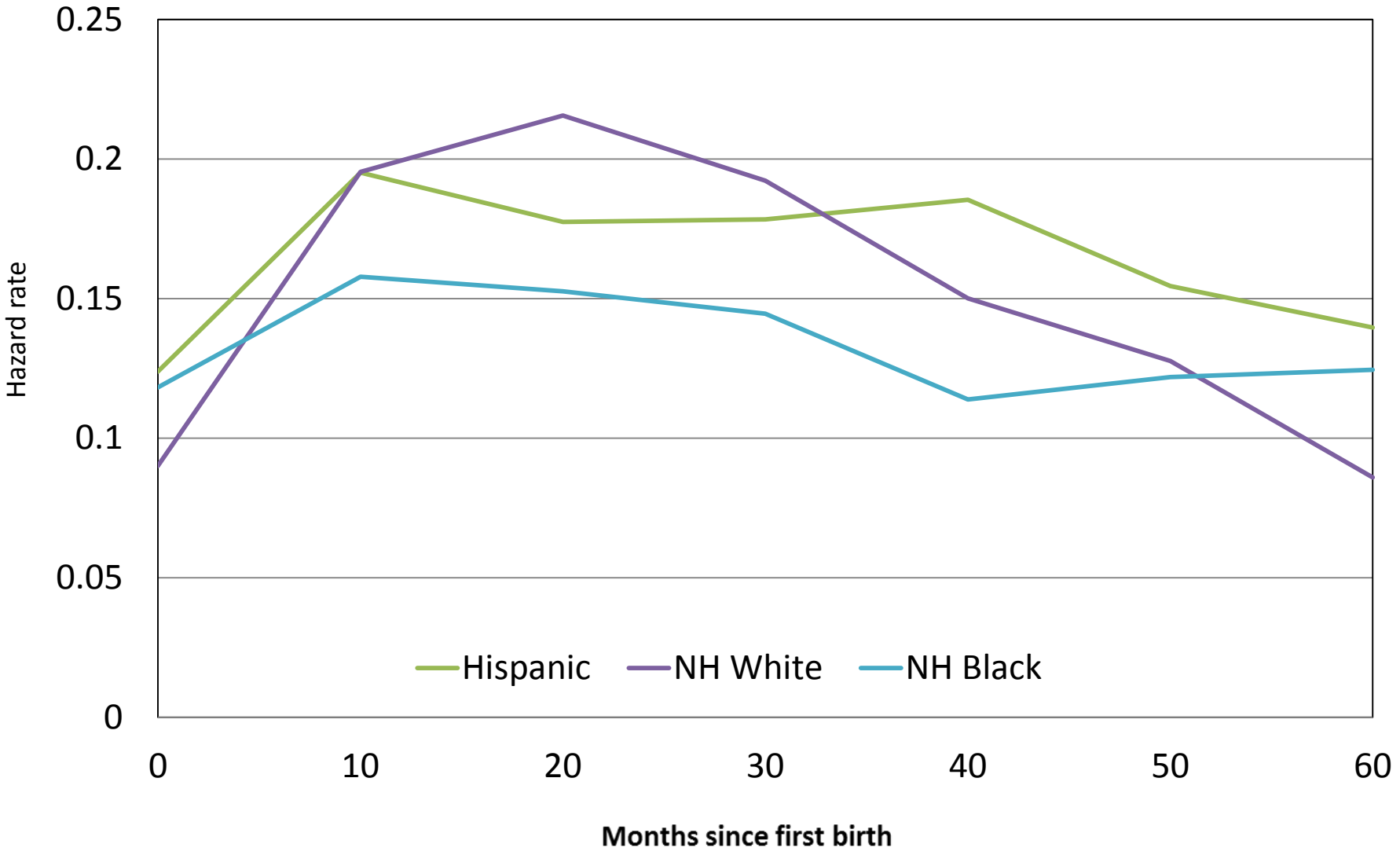
***p< .001; ** p<.05, * p<.01

Figure 1: Hazard Rates of Time to Second Pregnancy Among Women Aged 15-44 Years, by Year of First Birth



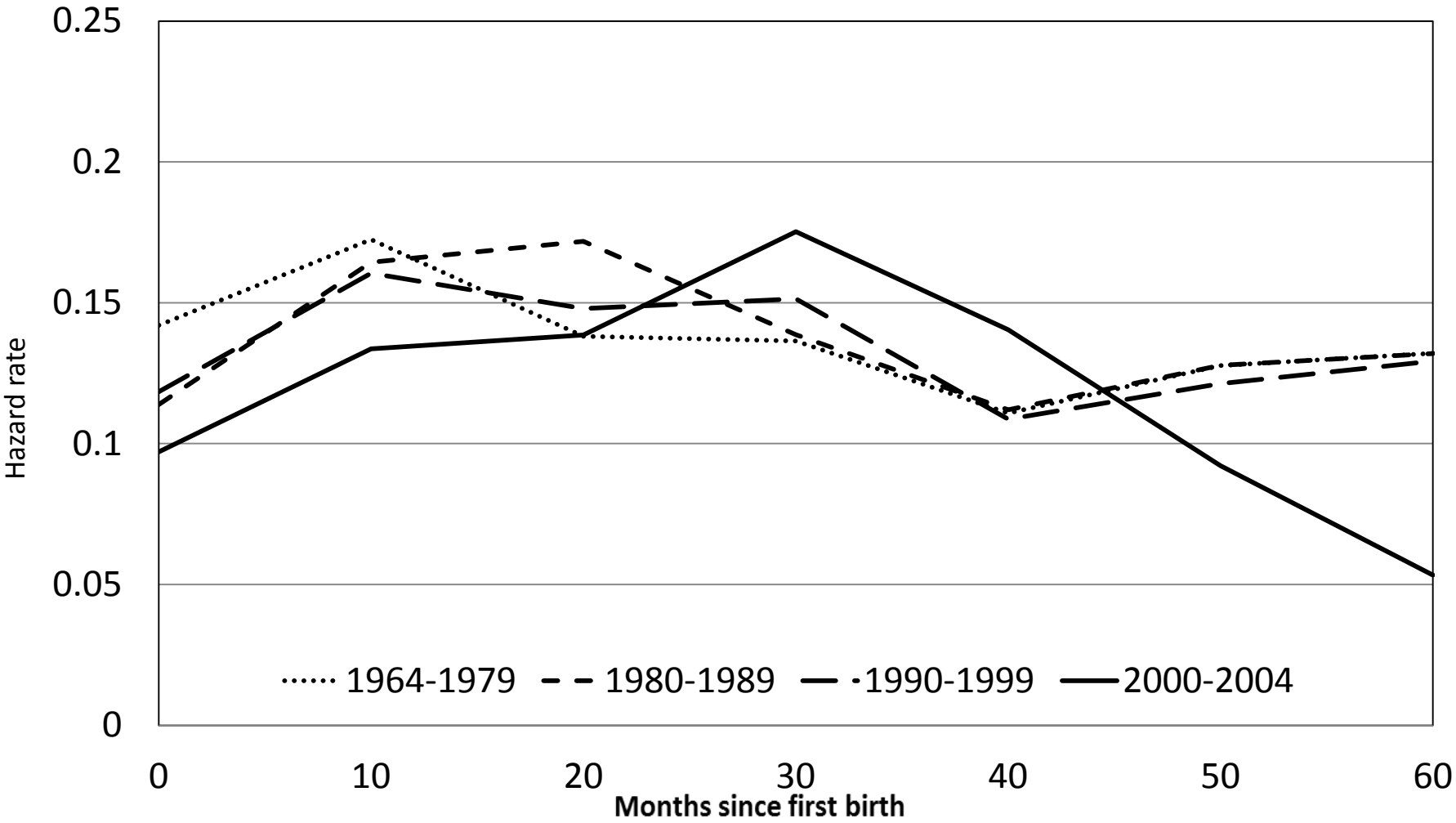
Data from the 1995, 2002 and 2006-2010 National Survey of Family Growth. Data for women whose first birth occurred in 2005-2010 omitted because of a higher percentage of censored cases.

Figure 2: Hazard Rates of Time to Second Pregnancy Among Women 15-44 Years, by Hispanic Origin and Race



Data from the 1995, 2002 and 2006-2010 National Survey of Family Growth

Figure 3: Hazard Rates of Time to Second Pregnancy Among Non-Hispanic Black Women Aged 15-44, by Year of First Birth



Data from the 1995, 2002 and 2006-2010 National Survey of Family Growth. Data for women whose first birth occurred in 2005-2010 omitted due to a high percentage of censored cases.