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Rising Preterm Birth Rates, 1989-2004: Changing Demographics or Changing Obstetric Practice?

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Abstract

Preterm birth rates are higher in the United States than in most industrialized countries, and have been rising steadily. Some attribute these trends to changing demographics, with more older mothers, more infertility, and more multiple births. Others suggest that changes in obstetrics are behind the trends. We sought to determine what the preterm birth rate in 2004 would have been if demographic factors had not changed since 1989. We examined complete US birth certificate files from 1989 and 2004 and used logistic regression models to estimate what the 2004 preterm birth rates (overall, spontaneous, and medically induced) would have been if maternal age, race, nativity, gravidity, marital status, and education among childbearing women had not changed since 1989. While the overall preterm births increased from 11.2% to 12.8% from 1989-2004, medically induced rates increased 94%, from 3.4% to 6.6%, and spontaneous rates declined by 21%, from 7.8% to 6.2%. Had demographic factors in 2004 been what they were in 1989, the 2004 rates would have been almost identical. Changes in multiple births accounted for only 16% of the increase in medically induced rates. Our analysis suggests that the increase in preterm births is more likely to be due primarily to changes in obstetric practice, rather than to changes in the demographics of childbearing. Further research should examine the degree to which these changes in obstetric practice affect infant morbidity and mortality.

Keywords

C-section; Demographic Trends; Induction; Prenatal care; Preterm birth; USA

Introduction

Preterm birth is considered the most important preventable cause of infant mortality in the United States (Berkowitz & Papiernik, 1993). Lowering preterm birth rates has been a centerpiece of perinatal health policy for decades (Institute of Medicine, 1985; Goldenberg & Jobe, 2001; Buekens & Klebanoff, 2001; Healthy People, 2010). Thirty years ago, the key

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to lowering preterm birth rates was thought to lie in improving access to prenatal care. Programs were put in place to improve such access.

In 2006, the Institute of Medicine issued a comprehensive report in which they acknowledged that, in spite of increased access to and utilization of prenatal care, preterm birth (<37 weeks gestational age) had increased rather than declined over the prior thirty years (Behrman & Butler, 2006). This was partly because prenatal care seemed to be less effective in the unselected high-risk populations that gained new access to prenatal care than it had seemed in the self-selected groups who had previously made up the prenatal care population (Alexander & Korenbrot, 1995; Lu et al., 2003). Measuring the effectiveness of prenatal care in those years was further complicated by the fact that the demographics of childbearing had changed dramatically, with fewer teen pregnancies, more women delaying childbearing, more children born to immigrants, and more unmarried mothers (Hamilton et al., 2007). More births now follow treatment for infertility, with rising rates of multiple pregnancies (Lu et al., 2008). These shifts in demographic factors all likely lead to higher preterm birth rates.

However, obstetrics have also changed, with increased use of fetal monitoring and rising rates of medically-induced preterm birth (Davidoff et al., 2006). The widespread availability of neonatal intensive care led to better survival rates for preterm babies, changing the calculus of decisions to induce preterm birth (Alexander et al., 2003). These changes all influence preterm birth rates in different ways.

Some recent studies, aimed at identifying the underlying causes of the rising rates of preterm birth, have drawn a distinction between spontaneous and medically induced preterm birth and have called attention to the rising rate of medically induced preterm birth, defined as c-section or induction prior to 37 weeks (Ananth & Vintzileos, 2006a; Moutquin, 2003; Pickett, et al., 2000; Savitz et al., 2005). The increase in medically-induced preterm birth complicates the interpretation of the preterm birth rate. In the past, when most preterm births were spontaneous, and near-term birth was associated with much higher infant mortality rates, the preterm birth rate was a good surrogate measure of infant health. Today, while the overall preterm birth rate has risen, due to medically-induced preterm deliveries, there has been a concomitant fall in rates of fetal and neonatal death, and of infant morbidity.

Discussions of preterm birth have presupposed that demographic changes are related to the increase in preterm birth (Kuehn, 2010). A study of preterm birth trends in Canada from 1981 through 1994 that did not distinguish between spontaneous and medically induced preterm birth, suggested that a substantial portion of the rise in preterm birth was due to an increase in multiple births which was assumed to be related to delayed childbearing and a resultant rise in infertility (Joseph et al., 1998). This phenomenon was also found in France, England and the United States (Blondel et al., 2002).

In this analysis, we examine the degree to which rises in preterm birth rates in the United States can be explained by changes in the demographics of childbearing women and the increase in multiple births, for all preterm births and also separately for spontaneous and medically-induced preterm births. We carry out the analysis by using statistical models to answer the counterfactual question, “What changes would we have seen in the rates of preterm birth in the United States if the demographics of childbearing had not changed since 1989?” In other words, how much of the observed rise in preterm birth can be explained by changes in factors such as maternal age, race, education, marital status, nativity, or multiple pregnancy?

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Methods

We used natality files from the National Center for Health Statistics for 1989 (N=4,045,881) and 2004 (N=4,118,907). These publicly available de-identified files are derived from all birth certificates in the 50 states and District of Columbia. Information for c-section and induction was first available in these files in 1989. Although natality files for 2005 and 2006 have been released, the public files do not contain complete geographic information due to restrictions from states. Our analyses thus track 15-year trends from 1989 to 2004. The birth certificate forms changed over this period but our analyses use demographic variables available from all versions, including gestational age; multiple birth; maternal age, race, Hispanic origin, education, marital status, birth history, and place of birth along with geographic divisions of the country.

Preterm birth was categorized according to the gestational age variable in the NCHS data derived from the last menstrual period. The NCHS data have gestational age estimates both derived from last menstrual period and from clinical/obstetric information; however different clinical/obstetric procedures were used in the 1989 and 2004 estimates (Wier et al., 2007), rendering the clinical/obstetric estimate unsuitable for the analysis of trends.

Medically induced preterm birth is defined, as in prior literature (Ananth & Vintzileos, 2006a; Moutquin, 2003; Pickett, et al., 2000; Savitz et al., 2005), as c-section or induction prior to 37 weeks gestation. We note that not all “medically induced” preterm births are “medically indicated.” It is difficult to identify, from the NCHS data (or any other data source), those preterm births that are genuinely medically indicated. Our analysis and discussion thus considers results for all medically induced preterm births. To define medically induced preterm birth, we include labor induction but not labor augmentation. It is not possible to distinguish preterm c-section with or without prior spontaneous labor. Data on premature or prolonged rupture of membranes, which might be used to distinguish some of these cases, is not available on the 2003/2004 revised form. Consequently we include all c-sections prior to 37 weeks as medically induced preterm birth.

We combined race and ethnicity to form these categories: White non-Hispanic, Black non-Hispanic, Hispanic, Asian/Pacific Islander, and Native American. Maternal age was categorized as less than 15, six consecutive age categories of five years each, and a final category of 45 years or more; years of maternal education was categorized as 0-8, 9-11, 12, 13-15 and 16 or more; plurality as single, twin, and triplet or higher; maternal place of birth as U.S., Mexico, Canada and the rest of the world and gravidity as 1, 2 and 3 or more.

We calculated overall preterm birth rates for 1989 and 2004 in the entire population and for different demographic groups defined by race/ethnicity, maternal age and multiple births. We then calculated preterm birth rates in 1989 and 2004 for spontaneous and medically induced preterm birth considered separately for the entire population and for different demographic groups.

Conceptually, in order to examine what the preterm birth rates would have been in 2004 had demographic factors been the same as they were in 1989, with the associations between demographics and preterm birth as they were in 2004, we first estimated the actual rates of preterm birth for different demographic groups in 2004. We then used those rates to analyze what the preterm birth rates would have been in 2004 if, contrary to fact, the demographics of childbearing had stayed the same over this time period. For example, since we knew the age distribution of mothers in 1989 and 2004 and we could estimate the rates of preterm birth for women at each age in 2004, we can estimate what the rate of preterm birth would have been in 2004, given obstetric practices in 2004, if the age distribution of childbearing had been what it was in 1989. In this way we analyze the degree to which changes in preterm birth were accounted for by changes in the demographics of childbearing.

Analytically, we first fit a logistic regression model of preterm birth on maternal characteristics (age, race/ethnicity, education, marital status, birth history, maternal place of birth and geographic division of the country) for 2004. For each pregnancy in the 1989 sample, we used the 1989 demographic covariate information and the 2004 logistic regression model coefficients to predict the probability of preterm birth in 2004. We then averaged over all of these predicted probabilities. This gave an estimate of what preterm birth rates would have been in 2004 with the 1989 distribution of demographic characteristics. We conducted similar analyses for spontaneous and medically induced preterm birth considered separately. Finally, we repeated these analyses adding multiple births as a covariate in order to examine whether trends in preterm birth rates (overall, spontaneous or medically induced) were additionally explained by changes in multiple births.

We conducted two sensitivity analyses. First, we examined whether the results would be similar when using adjacent years to ensure the findings were not idiosyncratic to 1989 and 2004 and also to examine the impact of the revised birth certificate form whose use increased substantially between 2003 and 2004. Second, we ran weighted analyses to examine the sensitivity of our results to missing data on education; weights for observations were obtained by regressing an indicator for missing education on maternal age, race/ethnicity, marital status, birth history, place of birth and geographic division, which were available for almost all individuals and then predicting for each individual the probability of their having missing data conditional on maternal age, race/ethnicity, marital status, birth history, place of birth and geographic division. All statistical analyses were carried out in SAS 9.2.

Results

The distribution of demographic factors in 1989 and 2004 are presented in Table 1. Notable changes include increased maternal age, higher educational attainment, more foreign-born women and a larger proportion of unmarried mothers.

From 1989-2004, overall preterm births increased by 14%, from 11.2% of births in 1989 to 12.8% of births in 2004. During this same period, medically induced preterm birth increased by 94%, from 3.4% to 6.6% of births, while spontaneous preterm births declined by 21%, from 7.8% to 6.2%. As shown in Table 2, similar trends in declining spontaneous preterm birth rates and rising medically induced preterm birth were present for all race/ethnicity categories, all maternal age categories and all multiple birth categories (singleton, twins and multiples of three or more). Similar trends were also present for all categories of maternal place of birth, education, birth history, marital status, and all U.S. geographic divisions (data not shown).

Adjusted odds ratios for the logistic regression models using 2004 data with demographic factors and plurality are reported in Table 3. The associations between maternal age and spontaneous and medically induced preterm births are in opposite directions: the odds of spontaneous preterm decline with age, while the odds of medically induced increase. Odds for both categories of preterm birth are as high or higher for all other race/ethnicity categories compared with White Non-Hispanic. Odds for both categories of preterm birth are lower for foreign-born women. Odds for both categories of preterm birth tend to decrease with higher levels of education.

The actual rate of overall preterm births in 2004 was 12.8%. Using the logistic regression model, we estimate that had demographic factors in 2004 been what they were in 1989, the overall rate would also have been 12.8%.

The actual rate of spontaneous preterm birth in 2004 was 6.2%; had demographic factors in 2004 been what they were in 1989, the rate would have been 6.2%; had plurality also remained constant, the rate would still have been 6.2%. Of the decline in spontaneous preterm birth rates from 7.8% to 6.2%, overall shifts in demographic factors and plurality explain none of the change.

The actual rate of medically induced preterm birth in 2004 was 6.6%; had demographic factors in 2004 been what they were in 1989, the rate would have been 6.6%; had plurality also remained constant, the rate would have been 6.1%. That is, 16% of the increase in the rate of medically induced preterm birth is explained by increased multiple births (an actual rise from 3.4% to 6.6% vs. a counterfactual rise to 6.1%).

If the distinction between spontaneous and medically induced preterm birth is ignored then multiple births explains about a third of the increase in preterm birth (an actual rise from 11.2% to 12.8% vs. a counterfactual rise to 12.3%) because the changes in medically induced and spontaneous rates are in opposite directions and cancel each other out.

Similar results were obtained when using 1990 rather than 1989 and 2003 rather than 2004. Adjustment for missing data led to changes in rates of at most 0.2 percentage points and thus would not substantively alter our results.

Discussion

The demographic characteristics of the women who are bearing children in the United States have clearly changed over the last few decades. Many of these demographic changes would likely have led to increased rates of preterm birth. For example, we know that the average age at childbearing is increasing and that older maternal age is associated with higher rates of both preterm birth and infertility. We know that infertility treatments/assisted reproductive technologies lead to more multiple gestations and that these are frequently associated with preterm births. Thus, we speculated that one of the explanations for the rising rate of preterm birth was the changing demographics of childbearing.

In this paper we examined the effect of these changing demographics on the rate of preterm birth. Surprisingly, our analysis shows that, overall, these changes have had almost no effect on preterm birth rates. That is, given what we know about the associations between various demographic characteristics and preterm birth, the preterm birth rate would have risen just as fast as it did if the demographics had not changed at all between 1989 and 2004. Given the trends described above, this may seem implausible. We tend to forget, however, that not all the demographic changes would lead to higher rates of preterm birth. Some have the opposite effect. There are fewer teen pregnancies now than there were twenty years ago. Levels of education among childbearing women are higher now. More births today are to women who were not born in the United States. Each of these shifts is associated with lower rates of preterm birth.

Our analysis shows that the demographic shifts in childbearing in the United States make almost no *net* contribution to preterm birth rates. Taken together, factors that increase preterm birth rates have been almost exactly offset by factors that decrease preterm birth rates.

Changing demographics do not seem to explain the increase in preterm birth rates. This, along with the increase in medically induced (as opposed to spontaneous) preterm births, leads to the conclusion that the rise in preterm birth rates over these years has been driven primarily by changes in obstetric practices demographically comparable groups (cf. MacDorman et al., 2010). Preterm inductions and c-sections have increased steadily. Put simply, obstetricians are more likely to opt for early delivery today than they were 20 years ago in every demographic group. Knowing this, we analyzed trends in medically-induced and spontaneous preterm birth separately. Demographic factors did not explain any of the increase in medically-induced preterm births or any of the decrease in spontaneous preterm births. The rise in multiple pregnancies (twins, triplets, etc.) accounted for none of the decrease in spontaneous preterm birth and only 16% of the increase in induced preterm birth.

Prior literature on trends in preterm birth rates has suggested that multiples make a more substantial contribution to the increase in preterm birth rates than indicated by the results here (Joseph et al., 1998). That research did not distinguish between spontaneous preterm births and medically induced preterm births. Because the trends for induced and spontaneous preterm birth are in opposite directions, ignoring the distinction makes it appear as though changes in multiple birth rates account for a larger portion of the overall change in preterm birth, even though multiple births explain little of each trend separately.

Taken together, our results suggest that it is not changing demographics, or even increased multiple births that are responsible for the increases in preterm birth rates. Rather, what appears to driving the overall increase in preterm birth rates is changing obstetric practice: there are more medically-induced preterm births in all demographic groups. The empirical results of the present study strongly support this conclusion. Our analysis is, however, subject to a number of important limitations. First, we have used demographic information from 1989 to get predicted probabilities for preterm birth from a model using data in 2004. It is, however, not clear that the meaning of these demographic variables has stayed constant over time. For example, 16+ years of education may have indicated something different in 1989 than it did in 2004; the analysis effectively assumes that the demographic categories are equivalent across years. Although this is a limitation of the approach, we believe the analyses still give a reasonably good picture of the role of demographics because the span of time in the comparison is relatively short. Second, the data we used did not allow us to directly examine changes in obstetric practice and decision-making, so our argument was essentially based on ruling out demographic factors. A third limitation of the analysis is that we were only able to consider demographic factors for which data were available in the NCHS birth certificate files. We cannot rule out the possibility that changes in economic, physical or psychological characteristics, that we were unable to adjust for, might explain some of the rise in preterm birth rates. Nonetheless, the method we have used will partially control for unmeasured characteristics, to the extent that they are correlated with the demographics that we could include.

Arguably the chief limitation of this study, however, is the data source. The natality files from the National Center for Health Statistics, derived from birth certificates, may not be highly accurate. There have been many studies of the accuracy of different pieces of information on birth certificates (Northam & Knapp, 2006). Delivery characteristics, such as induction, are likely under-reported (Lydon-Rochelle et al., 2005). We also could not tell how many preterm c-sections followed the spontaneous onset of labor. However, since the focus of this study is on trends, inaccuracies would not be particularly problematic unless the reporting bias has changed over time. We are unaware of any studies that find a trend in the accuracy of delivery characteristics, such as women's report of last menstrual period. The NCHS dataset does, however, have the advantage that it constitutes complete birth certificate files for the United States. Previous studies have similarly distinguished spontaneous and medically induced preterm birth using birth certificate data (Ananth & Vintzileos, 2006a).

The key question raised by this analysis is whether the changes in obstetrics that have led to the rise in preterm birth also lead to better birth outcomes. In other words, are medically induced preterm births generally medically indicated and medically appropriate? Or are they often unnecessary? If we reduced the number of medically induced preterm births, would we pay a price in increased fetal or neonatal mortality?

There are two schools of thought on this. One view is that many c-sections and inductions are not medically necessary. They are thus doing more harm than good (Kuehn, 2010; American College of Obstetricians and Gynecologists, 2007; March of Dimes, 2009). According to this view, lowering the number of medically induced preterm births would lead to better birth outcomes. The March of Dimes is a proponent of this view. It has launched a national campaign to reduce the rate of elective early inductions and c-sections. This campaign, called "Healthy Babies are Worth the Wait," includes education for both pregnant women and for doctors (http://www.marchofdimes.com/professionals/medicalresources_hbww.html). Such approaches might be working. In 2007 and 2008, preterm birth rates dropped. This was the first time in thirty years that preterm birth rates dropped two consecutive years. Surprisingly, however, the preterm birth rate drop did not occur in the way that might have been expected. That is, it was not as a result of a drop in medically induced preterm births in low risk women. Instead, rates of both medically induced and spontaneous preterm birth dropped and those rates dropped in numerous demographic groups. Rates fell for poor women as well as for non-poor women, for Blacks and for Whites, and for singleton pregnancies as well as multiple pregnancies. Policy analysts are not sure whether the fall is the beginning of a new trend (Martin et al., 2010).

The alternative view of the high rates of medically induced preterm birth is that most medically induced preterm births are truly medically indicated. Circumstantial evidence for this hypothesis comes from the concurrence of these changes in obstetrics with decreased infant and fetal mortality rates (Ananth et al., 2005; Ananth & Vintzileos, 2006b). This is the result that one would expect if medically induced preterm birth prevented fetal demise or led to the delivery of a healthier baby than would have occurred if the pregnancy had been allowed to proceed. This could be the case when doctors induce preterm delivery for a woman with pre-eclampsia, for example, or other conditions that cause fetal distress (Leeman & Fontaine, 2008). Advances in fetal monitoring clearly allow obstetricians to see the signs and symptoms of fetal distress earlier and more precisely than they could decades ago. Still, fetal monitoring remains imprecise. Given the availability of neonatal intensive care, and a litigious environment, medical induction of preterm delivery in the face of non-reassuring fetal monitoring results is a tempting choice.

The challenge for perinatologists is to determine the optimal balance between watchful waiting and obstetric intervention when there are signs of fetal distress. Ignoring those signs may lead to lower rates of preterm birth but higher rates of fetal and neonatal mortality (Kramer et al., 2000). Responding to them, however, may lead to higher rates of medically-induced preterm birth, with the consequent morbidity that is associated with prematurity. It is clear, however, that preterm birth is not always the worst outcome. Sometimes, medically induced preterm birth prevents more serious problems.

The steady rise in preterm birth rates over the last twenty years as well as the appropriate response to this trend is not as straightforward as they once seemed. The decline in spontaneous preterm births may indicate successful preterm birth prevention efforts in some patient subpopulations. The rise in medically induced preterm birth may indicate successful efforts at identifying pregnancy complications for which the appropriate standard of care has become preterm c-section or induction. Further research will be needed to distinguish whether the decline in spontaneous preterm birth rates is in fact indicative of real progress in preventing preterm birth or whether medically induced births prior to 37 weeks gestation are simply being substituted for spontaneous preterm births. Such research should examine whether medically induced preterm births were the result of the early detection of pregnancy complications for which intervention is appropriate, or whether inductions are being done for less compelling indications. Pending the results of such research, efforts to lower preterm birth rates should be undertaken with caution and with careful attention to the effect they have on fetal and infant mortality rates. The continued practice of using the rate of preterm birth as the metric to evaluate policies aimed at increasing prenatal care or perinatal health may also need to be reexamined. It may be preferable to use measures of perinatal mortality – which includes both late fetal mortality as well as neonatal mortality – to assess the efficacy of modern obstetrics and perinatology.

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Highlights

- Overall preterm births in the US increased from 11.2% to 12.8% from 1989-2004.
- Medically induced rates increased 94%, from 3.4% to 6.6%; spontaneous rates declined by 21%, from 7.8% to 6.2%.
- Had maternal demographic factors in 2004 been what they were in 1989, the 2004 rates would have been almost identical.
- Changes in demographics do not explain rising preterm birth rates; trends in different factors have offset one another.
- The increase in preterm birth rates appears to be due principally to changes in obstetric practices.

Table 1

Maternal and pregnancy characteristics for all live births in 1989 and 2004, from the National Center for Health Statistics Natality Files.

	1989	2004
Maternal Race/Ethnicity (%)		
White N-H	66.4	56.7
Black N-H	16.3	14.2
Hispanic	13.1	22.7
Asian & Pacific Islander	3.3	5.4
Native American	0.9	1.0
Maternal Age in Years (%)		
< 15	0.3	0.2
15-19	12.3	10.0
20-24	26.3	24.9
25-29	31.4	26.9
30-34	21.2	23.7
35-39	7.5	11.7
40-45	1.1	2.5
45-49	0.04	0.15
Maternal Years of School (%)		
0-8	5.8	6.0
9-11	16.9	15.3
12	39.0	29.3
13-15	20.5	22.3
16+	17.8	27.1
Maternal Marital Status (%)		
Married	73.4	64.6
Unmarried	26.6	35.4
Pregnancy Plurality (%)		
Singleton	97.6	96.5
Twin	2.32	3.3
Triplet+	0.07	0.18
Maternal Birth Place (%)		
U.S.	85.4	75.8
Mexico	5.0	10.5
Canada	0.3	0.3
Rest of the World	9.3	13.4
Maternal Gravidity (%)		
Gravid 1	41.0	39.8
Gravid 2	32.5	32.3
Gravid 3+	26.5	27.9

Table 2

Spontaneous and Medically Induced Preterm Birth Rates (%) in 1989 and 2004 for various demographic groups from the National Center for Health Statistics Natality Files

	Spontaneous 1989	Spontaneous 2004	Induced 1989	Induced 2004
All Births	7.8	6.2	3.4	6.6
Maternal Race/Ethnicity				
White N-H	5.9	5.3	3.1	6.6
Black N-H	15.2	9.4	4.9	8.9
Hispanic	8.6	6.7	3.1	5.7
Asian & Pacific Islander	7.7	5.7	2.7	5.1
Native American	9.8	7.7	3.0	6.7
Maternal Age in Years				
< 15	21.4	16.2	4.4	7.8
15-19	12.4	9.3	3.3	5.6
20-24	8.7	7.0	3.1	5.8
25-29	6.6	5.7	3.1	6.1
30-34	6.2	5.2	3.6	7.1
35-39	6.7	5.2	4.4	8.6
40-45	7.4	5.5	5.6	10.9
45-49	8.6	5.6	7.0	20.7
Pregnancy Plurality				
Singleton	7.5	5.9	2.8	5.2
Twin	23.0	14.7	24.7	45.4
Triplet+	17.3	4.9	69.3	88.5

Table 3

Adjusted odds ratios and 95% confidence intervals for categories of preterm birth, from the National Center for Health Statistics Natality Files 2004*

	Spontaneous	Induced	Overall
Maternal Race/Ethnicity (Reference White N-H)			
Black N-H	1.50 (1.48,1.52)	1.40 (1.38,1.41)	1.50 (1.49,1.51)
Hispanic	1.15 (1.13,1.17)	1.14 (1.12,1.15)	1.15 (1.14,1.16)
Asian & Pacific Islander	1.37 (1.34,1.41)	1.00 (0.97,1.03)	1.19 (1.18,1.20)
Native American	1.16 (1.12,1.21)	1.10 (1.06,1.15)	1.15 (1.14,1.16)
Maternal Age in Years (Reference 25-29)			
< 15	2.01 (1.87,2.16)	1.01 (0.92,1.12)	1.60 (1.59,1.61)
15-19	1.30 (1.27,1.32)	0.75 (0.73,0.76)	1.02 (1.01,1.03)
20-24	1.08 (1.07,1.10)	0.85 (0.84,0.86)	0.96 (0.95,0.97)
30-34	0.96 (0.95,0.97)	1.22 (1.21,1.24)	1.09 (1.08,1.10)
35-39	0.96 (0.95,0.98)	1.50 (1.48,1.53)	1.24 (1.23,1.25)
40-45	0.99 (0.96,1.02)	1.97 (1.92,2.01)	1.49 (1.48,1.50)
45-49	0.85 (0.76,0.96)	2.42 (2.24,2.63)	1.67 (1.66,1.68)
Pregnancy Plurality (Reference Singleton)			
Twin	2.94 (2.89,2.99)	15.5 (15.4,15.7)	13.1 (12.9,13.2)
Triplet+	0.99 (0.88,1.09)	158 (146,171)	142 (129,157)
Maternal Birth Place (Reference United States)			
Canada	0.99 (0.90,1.09)	0.87 (0.79,0.95)	0.92 (0.91,0.93)
Mexico	0.89 (0.87,0.91)	0.70 (0.69,0.72)	0.78 (0.77,0.79)
Remainder of the World	0.91 (0.89,0.92)	0.83 (0.81,0.84)	0.85 (0.84,0.86)
Maternal Education (Reference 13-15 years)			
0-8 years	1.34 (1.31,1.37)	1.02 (0.99,1.04)	1.20 (1.19,1.21)
9-11 years	1.26 (1.25,1.28)	1.14 (1.13,1.16)	1.23 (1.22,1.24)
12 years	1.11 (1.09,1.12)	1.06 (1.04,1.07)	1.08 (1.07,1.09)
16+ years	0.89 (0.88,0.91)	0.78 (0.77,0.79)	0.83 (0.82,0.84)

*Adjusted also for marital status, gravidity and geographic division