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Primary Cesarean Delivery Among Parous Women in the United States, 1990 – 2003

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Abstract

Objective—To explore trends in primary cesarean delivery rates among parous women with singleton pregnancies in the United States between 1990 and 2003.

Methods—The analysis used data from national birth files based on U.S. birth certificates between 1990 and 2003. The primary cesarean delivery rate was defined as the number of primary cesarean deliveries per 100 deliveries among parous women with singleton pregnancies who have not had a previous cesarean delivery. A stratified analysis was employed to investigate whether trends varied by maternal age, gestational age, race/ethnicity and region.

Results—In the United States, the primary cesarean delivery rate among parous women decreased modestly from 7.1% in 1990 to 6.6% in 1996 but increased progressively to 9.3% in 2003. The increase in cesarean rates from 1996 to 2003 varied substantially by race/ethnicity: Hispanic and non-Hispanic white women exhibited lower and similar rates, while rates for non-Hispanic black women were consistently higher and rose by a far greater extent across the years. There were substantial differences in cesarean delivery trends across geographic divisions, with greatest increases observed in the Mid-Atlantic, South Central and South Atlantic areas of the United States. Primary cesarean rates also declined considerably with increasing gestational age.

Conclusion—Similar to the overall cesarean delivery rate, primary cesarean rates among parous women with singleton pregnancies increased substantially in the United States since 1996.

Introduction

The overall cesarean delivery rate in the United States has increased since the 1960s, reaching a high of 31.1% by 2006 (1). The only exception to this trend occurred between 1989 and 1996, when the rates declined slightly before resuming their long-term upward trend (2–4). Likewise, by 2005, the primary cesarean rate for all pregnancies had risen to 24.3% and accounted for more than half of the observed increase in the overall rates (5). Previous research seeking to explain these trends has focused on changes in obstetrical practices with regards to primary cesarean deliveries in nulliparous women and repeat cesarean deliveries in parous women (6).

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Few studies, however, have examined trends in primary cesarean rates among parous women, even though there is evidence to suggest they may be subject to the same demographic, obstetric, and social influences that affect the national cesarean rates (3,7,8). The majority of the research on cesarean trends among parous women dates back to the late-1960s, when the national cesarean rate was much lower, ranging from 2.4% to 11.3% annually (9–12). The limited research may be due to the prevailing assumption that the cesarean rate among parous women is considerably lower and not much of an issue, in so far as a previous vaginal birth is protective against future cesarean deliveries. Yet this assumption was contradicted by a recent study, which demonstrated that the primary cesarean rate in 2002 was 13.3% among parous women as compared to 18% among nulliparous women – a much smaller difference than the conventional wisdom would suggest (2).

To explore this issue further, we examined trends in primary cesarean rates among parous women with singleton pregnancies between 1990 and 2003. Specifically, we assessed whether the trends in rates varied by maternal age, gestational age, race/ethnicity, and geographic divisions.

Materials and Methods

The data used in our analysis were compiled by the National Center for Health Statistics, US Centers for Disease Control and Prevention, from the certificates of live births in the U.S. between 1990 and 2003. The “method of delivery” item on birth certificates was used to determine the primary cesarean delivery rate, defined as the percentage of primary cesarean deliveries among parous women with singleton pregnancies who have not had a previous cesarean delivery. Women with repeat cesarean and vaginal births after cesarean (VBAC) deliveries were excluded since these women were not at risk for a primary cesarean delivery. In addition, we restricted the analysis to gestational ages between 25 and 43 weeks, due to underreporting of births prior to 25 weeks and the relative inaccuracy of estimates of gestational age beyond 43 weeks.

All statistical analyses were conducted using SAS version 9.1 (SAS Institute, Cary, NC). We stratified our analysis in order to explore whether or not trends varied by maternal age, gestational age, race/ethnicity (Hispanic, non-Hispanic white, and non-Hispanic black) and geographic division (New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific).

From 1990 to 2003, the distributions of maternal age and race/ethnicity among mothers giving birth changed substantially. To account for the impact of these changes on the observed cesarean rates, we used an indirect standardization model. Specifically, we calculated the 1990 maternal age- and ethnic-specific cesarean rates and applied them to populations from 1991 to 2003 to obtain an age-ethnicity standardized expected cesarean delivery rate from 1991 to 2003. Given our large sample size, even a smallest difference can be statistically highly significant; therefore, no *p* values are reported. Furthermore, since our data encompass all the births in the entire U.S. population, rather than a sample of the population, no confidence limits are needed. Because the data are released by the Centers for Disease Control and Prevention and publicly available, our study qualified for IRB exemption.

Results

After visual inspection of the data, we selected three time points (1990, 1996, and 2003) to describe the trends in cesarean rates among parous women. In the United States, there were a total of 4,162,917, 3,894,874 and 4,096,092 births in 1990, 1996 and 2003, respectively. Our analysis, however, excluded primiparous women (1990: 1,717,715; 1996: 1,613,986; 2003:

1,648,617), multiple pregnancies (1990: 76,596; 1996: 83,097; 2003: 105,262), repeat cesarean deliveries (1990: 325,466; 1996: 280,005; 2003: 415,414), VBAC deliveries (1990: 82,387; 1996: 113,584; 2003: 50,679), and women with gestational ages less than 25 weeks or greater than 43 weeks (1990: 85,356; 1996: 64,609; 2003: 57,517). Taking into account these exclusions, we were left with 1,875,397, 1,739,593 and 1,818,603 parous women from 1990, 1996, and 2003, respectively.

In the U.S., the primary cesarean rate among parous women with singleton pregnancies decreased modestly from 7.1% in 1990 to 6.6% in 1996 but increased progressively to 9.3% in 2003 (Table 1). During this same time period, there was a substantial change in the racial/ethnic distribution of parous women: the proportion of Hispanic women increased from about 16% to 24%, whereas the proportions of non-Hispanic white and black women declined. The average age of parous women increased by 1 year but the geographic distribution of births remained steady.

Between 1990 and 2003, the trend in expected primary cesarean rates among parous women with singleton pregnancies, which accounts for the change in maternal age and race/ethnicity distribution over time, remained relatively flat (Figure 1, left y-axis). This pattern is in sharp contrast to the observed rate, which increased from 7.1% in 1990 to 9.3% in 2003. The increase in the observed cesarean rates among parous women varied by race/ethnicity (Figure 1, right y-axis): After remaining fairly stable through the mid-1990's, the rates for all women began to increase steadily over time, although the rates for non-Hispanic black women were consistently higher and rose by a greater extent than the rates for Hispanic and non-Hispanic white women. Furthermore, the impact of maternal age varied by ethnicity: nearly 23% of non-Hispanic black mothers over the age of 35 had a cesarean delivery in 2003, as compared to 12% and 16% of non-Hispanic white and Hispanic mothers, respectively (data not shown).

For all racial/ethnic groups under study, the upward trend in the primary cesarean rates between 1990 and 2003 was reflected in increases in both pre-term and at-term cesarean deliveries (Figure 2). With the exception of Hispanic women, cesarean rates were modestly lower with increasing parity. Among Hispanic women, by contrast, both pre-term and at-term cesarean rates in a fifth or later pregnancy were higher than those in a third or fourth pregnancy.

Across all nine geographical divisions, primary cesarean rates among parous women with singleton pregnancies decline modestly or remained essentially unchanged between 1990 and 1996, but increased substantially between 1996 and 2003 (Figure 3). In 1990 and 1996, the primary cesarean rates were lowest in the Mountain and New England divisions and highest in the East South Central, South Atlantic and West South Central divisions. By 2003, the rates had risen across all divisions, with the most dramatic increases in the Mid-Atlantic, South Central, and South Atlantic divisions.

In both 1990 and 2003, the primary cesarean delivery rates among parous women with singleton pregnancies increased with maternal age; the rates were consistently higher in 2003 across all ages (Figure 4). This positive relationship between primary cesarean delivery rates and maternal age persisted after the analysis was stratified by racial/ethnic groups (data not shown). With respect to gestational age, the pattern is similar for both time periods with higher rates among earlier gestational ages but the rates in 2003 are higher for every gestational week (Figure 5). The difference at the earlier ages is most striking with peak difference around 27 weeks (44.6% in 2003 compared with 32.2% in 1990).

Discussion

In one of the few studies to explore trends in primary cesarean delivery rates among parous women with singleton pregnancies in the U.S., we observed that cesarean rates followed a

similar pattern as the general cesarean rate, increasing substantially since 1996 (3,4,6). The results also indicated that this increasing trend was not explained by changes in maternal age or race/ethnicity. Of note, the magnitude of the observed increase in cesarean rates varied substantially by race/ethnicity: the rates for Hispanic and non-Hispanic white mothers were consistently lower and rose by a lesser degree over time among non-Hispanic black mothers. Similarly, there were considerable differences in the trends across geographic divisions, with the greatest increases observed in the Mid-Atlantic, South Central and South Atlantic areas of the U.S. Lastly, while cesarean rates showed a substantial decline with increasing gestational age, rates for all gestational ages increased over time.

The higher rate of cesarean deliveries among older mothers in our study could be attributed to clinicians presuming that these women were at a higher risk for labor complications and thus providing more conservative types of treatment (13–15). While higher maternal age does not directly increase the risk of cesarean delivery, older mothers can experience more complications during pregnancy and labor (e.g., prolonged second stages of labor), which indirectly raises cesarean rates (8,16).

In our study, non-Hispanic black women exhibited consistently higher primary cesarean rates as compared to both non-Hispanic white and Hispanic women. As suggested by previous studies, one possible explanation for this finding is the potential association between obesity and higher cesarean rates (7,17,18). Obesity may be directly related to higher cesarean rates, as well as increasing the risk of several pregnancy complications (e.g., pregnancy-induced hypertension, gestational diabetes, macrosomia, dystocia) that could, in turn, result in more frequent cesarean deliveries (17,19). Considering there are large disparities in obesity prevalence by race-ethnic groups—approximately 49% of black women, 38% of Hispanic women, and 26% of non-Hispanic White women between the ages of 20 and 39 years in the U.S. were classified as overweight or obese in 2005–2006—obesity may play a significant role in the higher cesarean rates observed in the non-Hispanic black and the Hispanic segment of the population (20). Unfortunately, we were unable to confirm this potential association between weight and cesarean risk since the birth certificate files do not include reliable information on mothers' weight. Several studies have concluded, however, that while national obesity rates increased steadily during our study period, obesity trends did not match or explain concurrent trends in the overall cesarean rates (2,21,22).

Previous research has documented regional disparities in cesarean rates, suggesting that geographic location could be associated with maternal characteristics and/or obstetric practices (23–25). At the same time, cesarean rates have been found to differ across rural and urban settings, as well as to vary by insurance type and hospital type, size, ownership and teaching status (14,26,27). Since all divisions encompass a mixture of individuals, communities and hospitals, it is highly likely that several factors contribute to the observed variation in primary cesarean rates across the nine geographic divisions in our study.

Our finding that cesarean rates were higher in both pre-term and at-term deliveries during 2003, relative to the corresponding categories in 1990, may reflect changes in obstetric practices over time. Other studies have shown a heightened use of both preventative and intervention cesareans before and during labor (4,28). These trends have been attributed to the adoption of lower thresholds to carry out cesareans, as well as an increased reluctance to attempt difficult labors because of concerns about potential complications and the associated risk of malpractice lawsuits (29,30).

The use of data derived from birth certificates, as in this study, has periodically been criticized due to inaccurate recording of certain information, e.g., maternal weight gain and the use of forceps and induction (31,32). With these concerns in mind, we do not include these measures

in our analysis and instead rely strictly on items that studies have shown are reliably recorded on birth certificates, e.g., maternal age, parity, and primary cesarean delivery. At the same time, there is data to suggest that with some regularity birth records misclassify vaginal birth after cesarean (VBAC) cases by reporting them as vaginal deliveries (33). As a result, these cases would be mistakenly included in our analysis when they should have been excluded. If this error is consistent (i.e., VBACs are underreported) across all years, then the actual primary cesarean rates would be higher than those found in our analysis. In 2003, two states (Pennsylvania and Washington) adopted a new version of birth certificate, which is able to identify more repeated cesarean delivery and VBACs. We repeated the analyses excluding Pennsylvania and Washington and the results remained unchanged.

An evident limitation of our analysis is that it encompassed only three race/ethnic groups – non-Hispanic white, non-Hispanic black, and Hispanics. A more thorough examination of other groups would certainly have strengthened our findings. Similarly, inaccuracies in the recording of maternal weight gain on birth certificates (31) prevented us from confirming the potential association between weight and primary cesarean risk among parous women. Lastly, the analysis would have benefited from reliable data on prenatal risk factors and pregnancy complications; however, several studies have shown that this information is substantially underreported and lacking in reliability on birth certificates (32,34,35).

Despite these considerations, our study has several features that make it a significant contribution to the existing literature. We focused on primary cesarean deliveries in parous women with singleton pregnancies in the U.S., which has rarely been the subject of recent studies. Our research, therefore, should improve awareness among clinicians of the increase in primary cesarean rates in this distinct population. Moreover, our analysis was further enhanced by the use of a large population-based cohort to explore trends over a 13-year period. Our finding of increasing rates of primary cesarean deliveries among parous women with singleton pregnancies over time also has important clinical implications. Between 1996 and 2004, the VBAC rate in the U.S. declined sharply from 28.3% to 9.2% (36). This steep drop in the VBAC rate coincided with a corresponding increase in the rate of repeat cesarean sections to nearly 91% in 2004, since most women who undergo a primary cesarean delivery will undergo a cesarean section in subsequent pregnancies (37). Therefore, the present levels of primary cesarean rates in parous women may lead to even higher repeat cesarean rates in the future.

While the clinical benefits of a medically-indicated cesarean section are reduced morbidity and mortality for both the mother and the neonate, the benefits associated with cesarean delivery on maternal request remain a matter of debate. For example, there is only weak and inconsistent evidence to support one of the primary reasons that women consider an elective cesarean delivery, namely the prevention of pelvic floor disorders, such as urinary and fecal incontinence and uterine prolapse (38). Other reported benefits of a planned cesarean section include the avoidance of pain to the mother, as well as higher convenience and lower negligence claims for the doctor (39). The parous women in our study, however, have had successful previous vaginal deliveries. It is even more uncertain whether the perceived benefits of cesarean delivery on maternal request would outweigh the risks associated with this surgical procedure.

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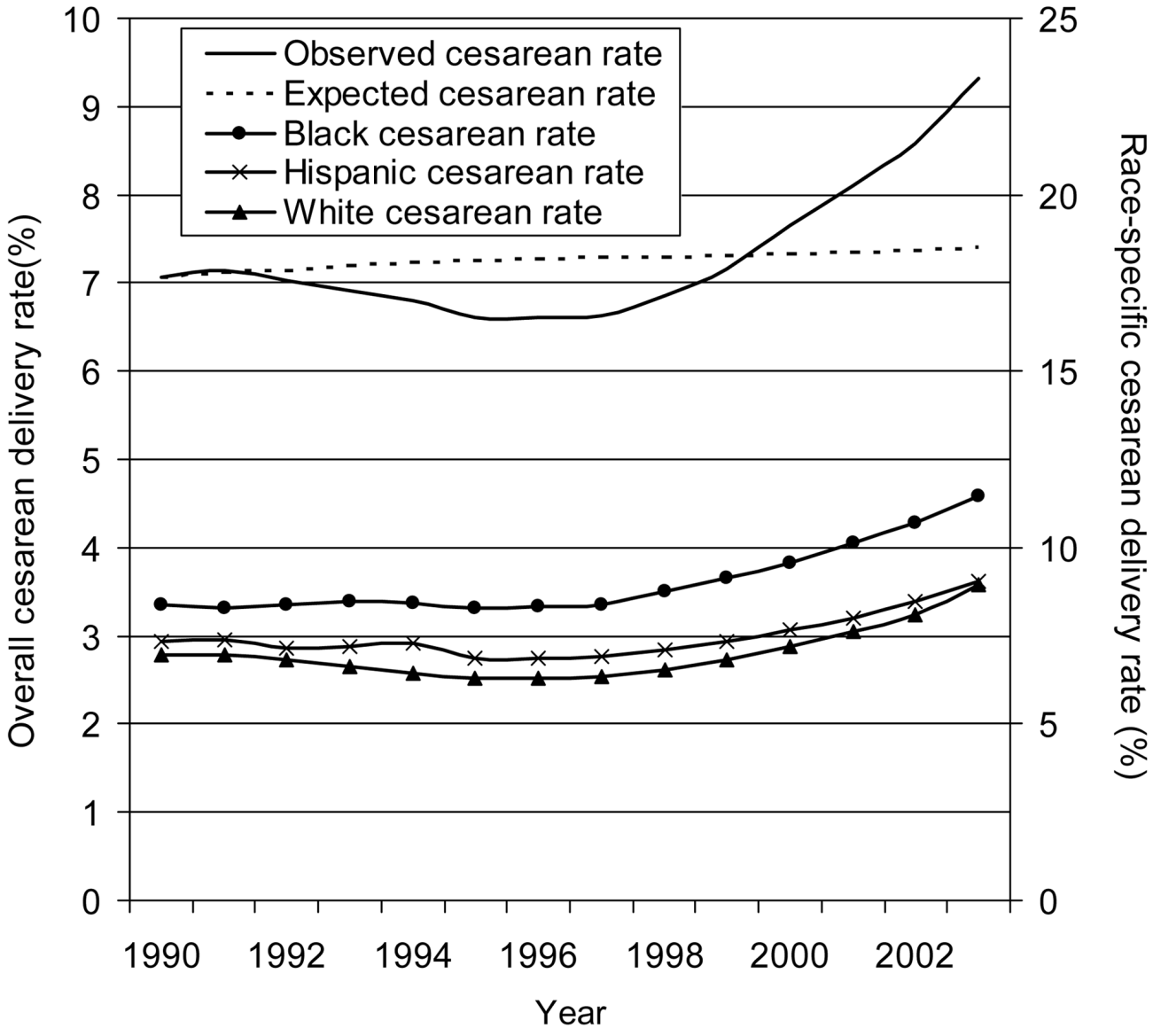

Figure 1.
Overall and race-specific primary cesarean delivery rates among parous women with singleton pregnancies in U.S.: 1990 – 2003. The overall rate is on the left y-axis; race-specific rate is on the right y-axis.

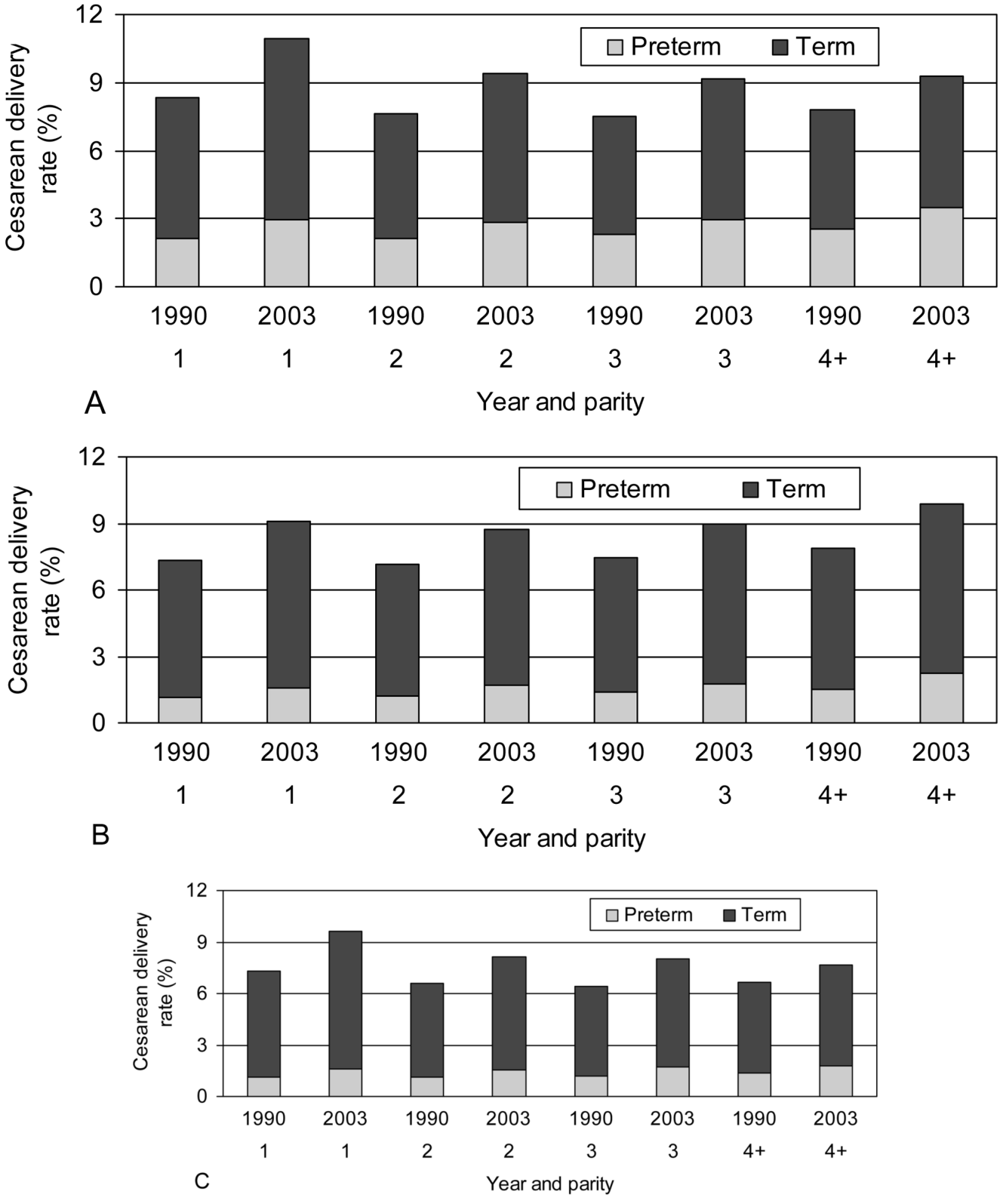

Figure 2.

Primary cesarean delivery rates among non-Hispanic white, black, and Hispanic parous women with singleton pregnancies by parity and term/preterm delivery: 1990 and 2003.

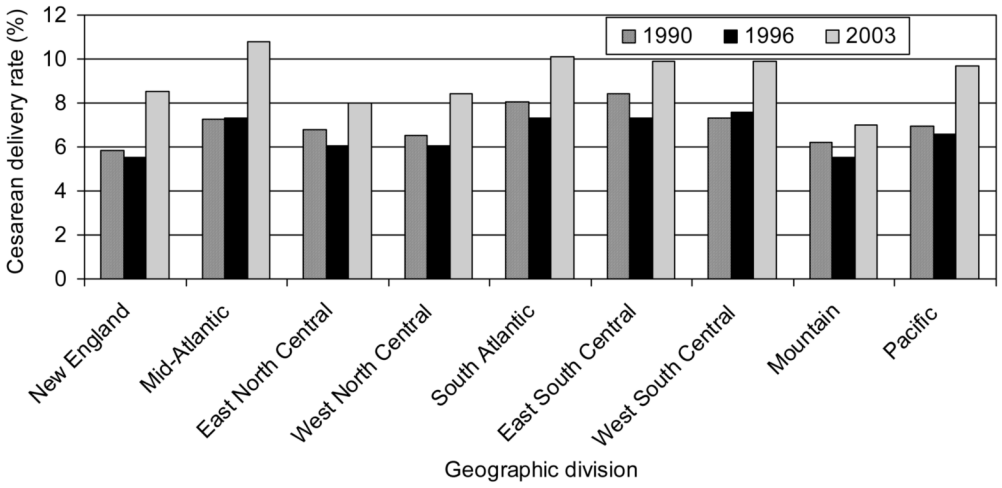

Figure 3.
Primary cesarean delivery rates among parous women with singleton pregnancies by U.S geographic divisions: 1990, 1996 and 2003.

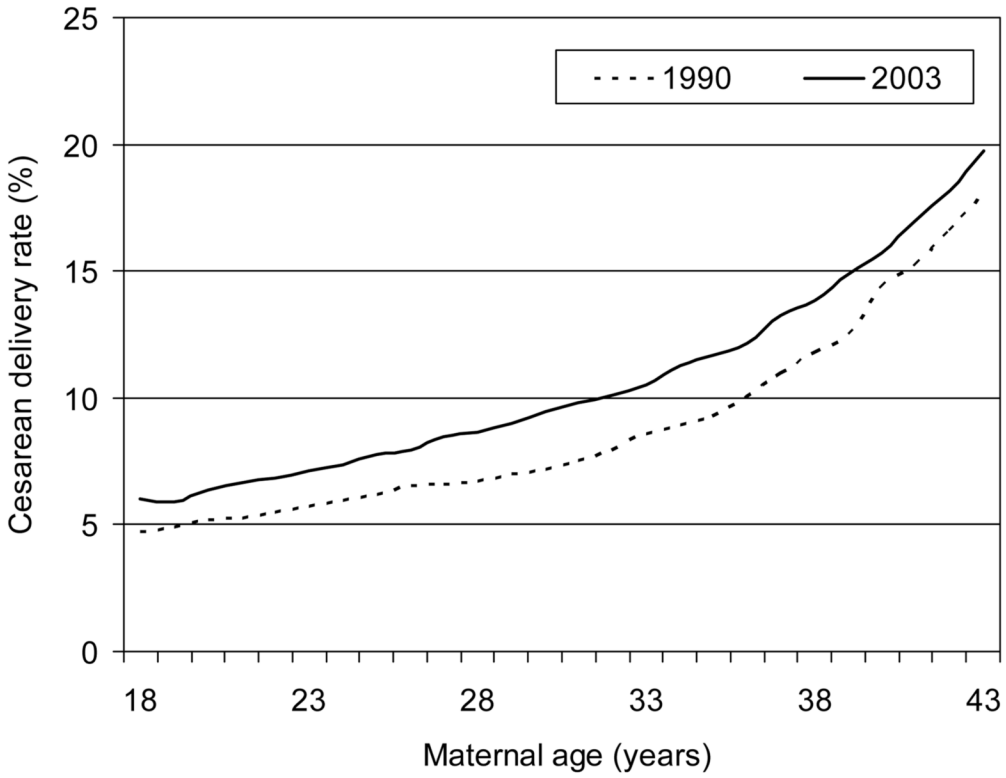

Figure 4.
Primary cesarean delivery rates among parous women with singleton pregnancies by maternal age: 1990 and 2003.

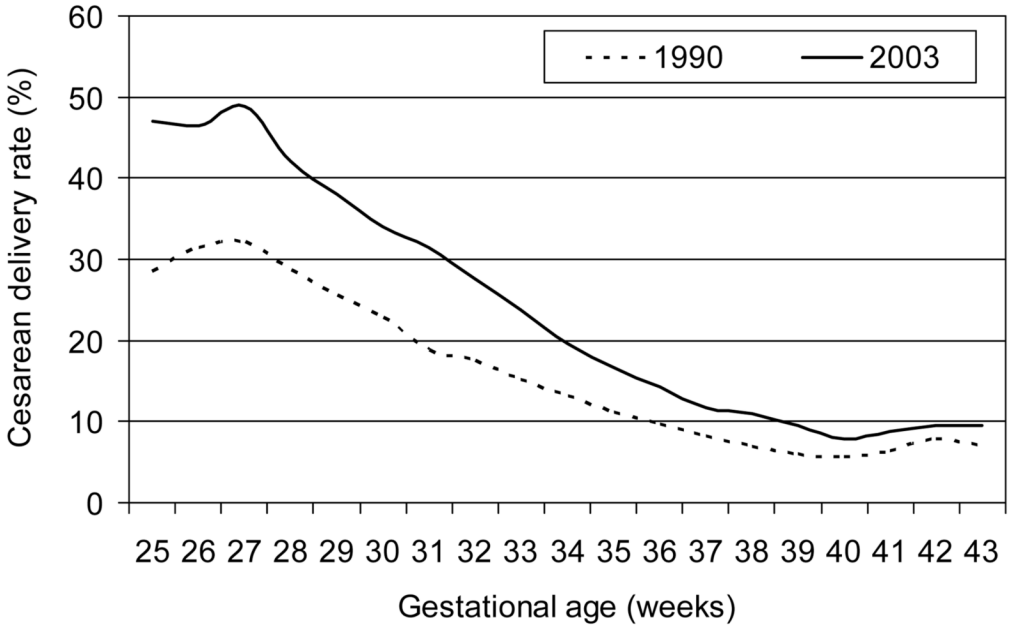

Figure 5.
Primary cesarean delivery rates among parous women with singleton pregnancies by gestational age: 1990 and 2003.

Table 1

Distribution of Selected Maternal Characteristics among Parous Women with Singleton Pregnancies who had no Previous Cesarean delivery in the U.S.

	1990 (N=1,875,397)	1996 (N=1,739,593)	2003 (N=1,818,603)
Maternal Age (mean)	27.8	28.4	28.6
Parity (%)			
1	53.8	55.2	54.2
2	27.8	27.0	27.8
3	11.0	10.5	10.9
4+	7.4	7.3	7.1
Race/Ethnicity (%)			
Hispanic	15.8	19.3	23.8
Non-Hispanic White	62.4	60.0	55.9
Non-Hispanic Black	17.5	15.6	14.6
Other	4.3	5.1	5.7
Region (%)			
New England	4.5	4.2	4.0
Mid Atlantic	13.3	13.2	12.1
East North Central	16.6	16.3	15.6
West North Central	6.9	6.8	6.8
South Atlantic	16.3	16.6	17.8
East South Central	5.5	5.6	5.7
West South Central	12.0	12.1	13.2
Mountain	6.4	7.2	8.3
Pacific	18.5	18.1	16.5
Primary Cesarean Delivery Rate (%)	7.1	6.6	9.3