



Primary Cesarean Delivery in New York State, 2003-2012

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Abstract

Objectives: To examine the trends and characteristics associated with primary cesarean delivery for all singleton live births to New York State resident mothers over the ten year period from 2003-2012, and to identify opportunities to safely reduce the state's primary cesarean delivery rate.

Methods: Data for 2003–2012 are based on all singleton births to resident mothers of New York State. Each birth certificate record was linked to the respective hospital birth discharge record and to any previous birth hospital discharge records to verify the primary cesarean indicator on the birth certificate. This longitudinal file was also used to make corrections in coding primary cesarean delivery that occurred in the transition from the 1989 to the 2003 U.S. Standard Certificate of Live Births.

Results: Based on corrected data, the primary cesarean delivery rate increased from 19.02 per 100 live singleton births in 2003 to 22.85 in 2009, and then declined to 21.57 per 100 live singleton births in 2012. By gestational age, in 2012 the primary cesarean delivery rate at 28-31 weeks gestation was 53.95 per 100 live singleton births - nearly three times the rate at 37-38 weeks which was 18.81 per 100 live singleton births. Additional findings and trends relative to other characteristics and risk factors for primary cesarean delivery are presented and discussed.

Conclusions: Safely lowering the primary cesarean delivery rates is an issue receiving both national and state attention and effort. Some of the decline noted in New York State in recent years may be attributable to the state's multifaceted approach to improving perinatal care that includes a collaborative quality improvement initiative with the state's maternity hospitals to reduce non-medically indicated scheduled deliveries (inductions and cesarean sections) between 36 and 38 weeks gestation; implementation of constraints on Medicaid reimbursement for performance of these elective surgical procedures; and community-based targeting of prenatal, postpartum, and inter-conception care and services to high risk women. Continuing the observed decline in the primary cesarean delivery rate in New York State since 2009 will depend, in part, on further understanding and targeting maternal characteristics and risk factors for prevention, and furthering the pursuit of both maternal and paternal life course health care.

Introduction

Cesarean delivery is the most common major surgical procedure performed in the United States [1]. In 2011, the U.S. cesarean delivery rate was 32.8% of all births. New York was tied for 12th highest among all states in the nation for cesarean deliveries with a rate of 34.3% in 2011 [2]. Cesarean deliveries are associated with higher morbidity and mortality than vaginal births, and with higher rates of surgical complications, maternal re-hospitalization, and with complications requiring neonatal intensive care unit admission [3]. In addition to health and safety risks for mothers and newborns, hospital charges for a cesarean delivery are almost double those for a vaginal delivery, imposing significant costs [4].

Primary cesarean deliveries - a first cesarean delivery regardless of parity - represent approximately 60% of all cesarean deliveries. In 2012 among 40 vital records jurisdictions using the 2003 U.S. Standard Certificate of Live Birth (revised), the overall primary cesarean delivery rate among singleton live births was 21.5% [5]. The rate for New York City was ranked 9th highest out of the 40 jurisdictions at 23.2% while New York State exclusive of New York City was ranked 13th highest at 22.0%.

Safely lowering low-risk first birth and total cesarean delivery rates is a U.S. Department of Health and Human Services Healthy People 2020 objective [6], and reducing the cesarean section rate for low-risk first births is a priority hospital performance measure promulgated by The Joint Commission [7]. Risk-adjusted primary cesarean section rates are used as a key perinatal health measure to assess New York State (NYS) Medicaid Managed Care health plan performance [8]. Since 2010, the NYS Department of Health has been conducting a collaborative quality improvement initiative with the state's Regional Perinatal Centers, focused on reducing non-medically indicated scheduled deliveries (inductions and cesarean sections) between 36 and 38 weeks gestation in all NYS maternity hospitals. This initiative's methods and measures have also been incorporated into a Medicaid Hospital Medical Home Demonstration Program involving training of medical resident staff. These efforts have been bolstered by the implementation of constraints on Medicaid reimbursement for their performance of these elective procedures without an acceptable indication [9].

Primary cesarean deliveries are a major driver of total cesareans, and they represent a substantial proportion of first birth cesarean deliveries (32.5% in 2012). Given New York's high rate of primary cesarean delivery, and national and state efforts to safely reduce these procedures, this report is prepared to provide a better understanding of the trends and factors associated with the state's primary cesarean deliveries. The primary cesarean delivery rate is considered a more accurate indicator of current practice than total cesarean delivery rate because the total cesarean delivery rate also reflects the now-routine repeat cesarean in women having a previous procedure [4]. That is, following a primary cesarean, a woman has only about a 10% chance of a vaginal birth for subsequent deliveries. This report focuses on primary cesarean deliveries for singleton births, which make up the bulk of all newborns (96.1% in 2012). Multiple births are excluded because of the much higher likelihood of cesarean delivery (2.5 times higher) compared with singletons.

Methods

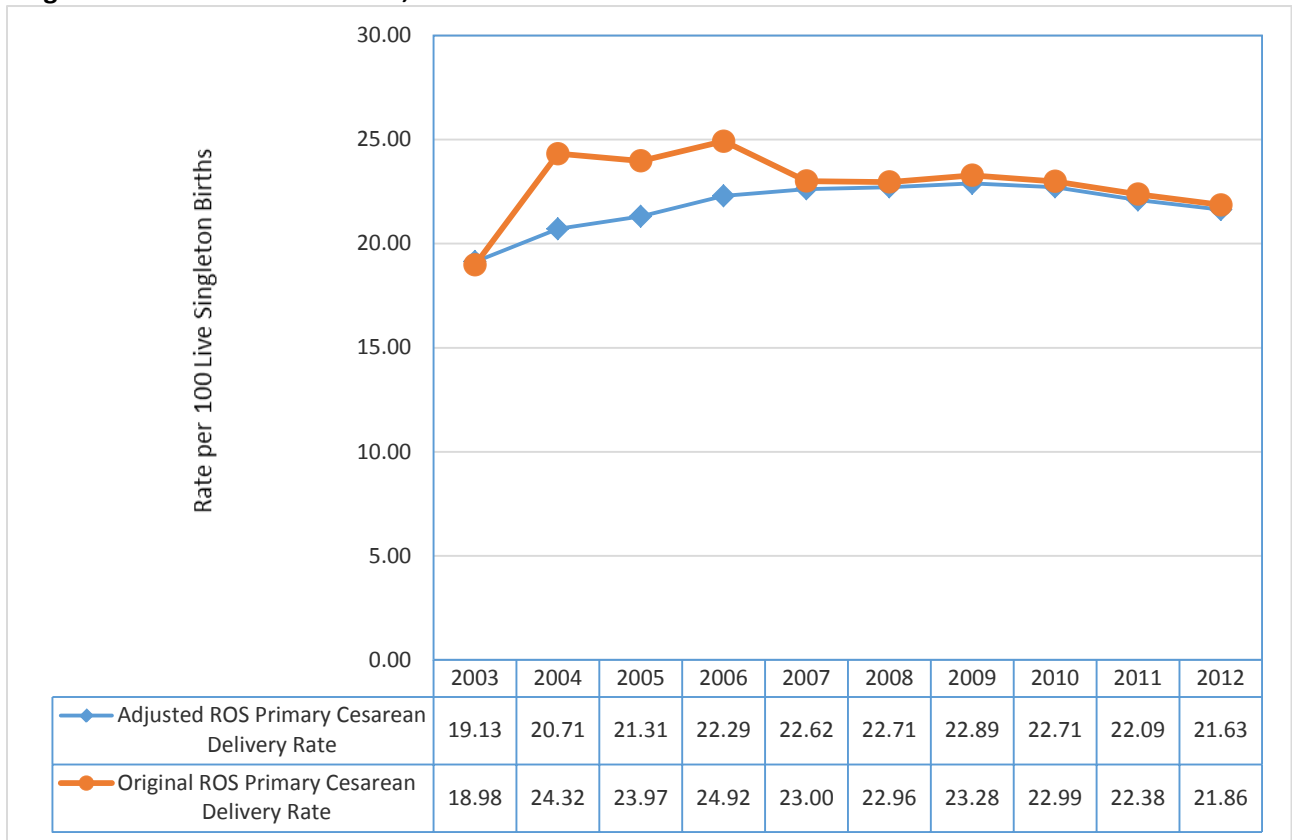
New York State Vital Records are administered by two separate jurisdictions. The New York City Department of Health and Mental Hygiene (NYCDOHMH) is responsible for Vital Records administration for the five NYC boroughs while the New York State Department of Health (NYSDOH) is responsible for areas outside of New York City – referred to as the Rest of State (ROS).

Information on primary cesarean delivery is reported in the “Method of Delivery” section on both the 2003 U.S. Standard Certificate of Live Birth (revised) and the 1989 U.S. Standard Certificate of Live Birth (unrevised). NYSDOH implemented the 2003 revision in 2004 while NYCDOHMH started in 2008. As a result, the data in this report for all 2008-2012 births to NYS residents and for 2004-2007 ROS births are based on the 2003 revision. Data for all other years are based on the 1989 (unrevised) standard.

The format and wording of the primary cesarean delivery item on the 2003 revised standard certificate differs from that of the 1989 unrevised standard certificate. The data on primary cesarean delivery between the two standards should be directly comparable when reported correctly. However, ROS facilities experienced significant problems reporting primary cesarean section from 2004-2006 resulting in over-reporting and rates that were not smooth for those years. To solve this problem, the birth certificate records for NYS residents were linked with the Statewide Planning and Research Cooperative System (SPARCS) inpatient discharges, based on mother’s first and last names, last four digits of social security number, date of birth, medical record number, and address. Mothers with records that had ICD 9 diagnosis code 654.2 were determined to have had a previous cesarean delivery. In addition, a longitudinal birth file was created for all births from 1998 to 2012. A maternal unique identifier was created based on the mother’s last name, first name, date of birth and social security number. These files were used to verify the presence of a previous cesarean delivery and the rates were adjusted for those years (Figure 1). Additional details regarding these methods can be found in the Technical Notes at the end of this report.

Race and Hispanic origin are reported separately on the birth certificate, and Hispanic persons may not be further classified by race. Therefore, race and ethnicity are combined for reporting purposes, with all persons identified as Hispanic classified separately as such, and additional classifications identified exclusively by race. When, for example, mothers are indicated only as white in the certificate data, then they are classified as white non-Hispanic. If more than one race is indicated in the data, then the mother is classified as other non-Hispanic race. The race and ethnicity values in this report include white non-Hispanic, black non-Hispanic, Hispanic, Asian and Pacific Islander (non-Hispanic), Native American (non-Hispanic), and other non-Hispanic.

Figure 1. Primary Cesarean Delivery Rate before and after Adjustment among Rest of State (ROS)¹ Singleton Births: New York State, 2003-2012



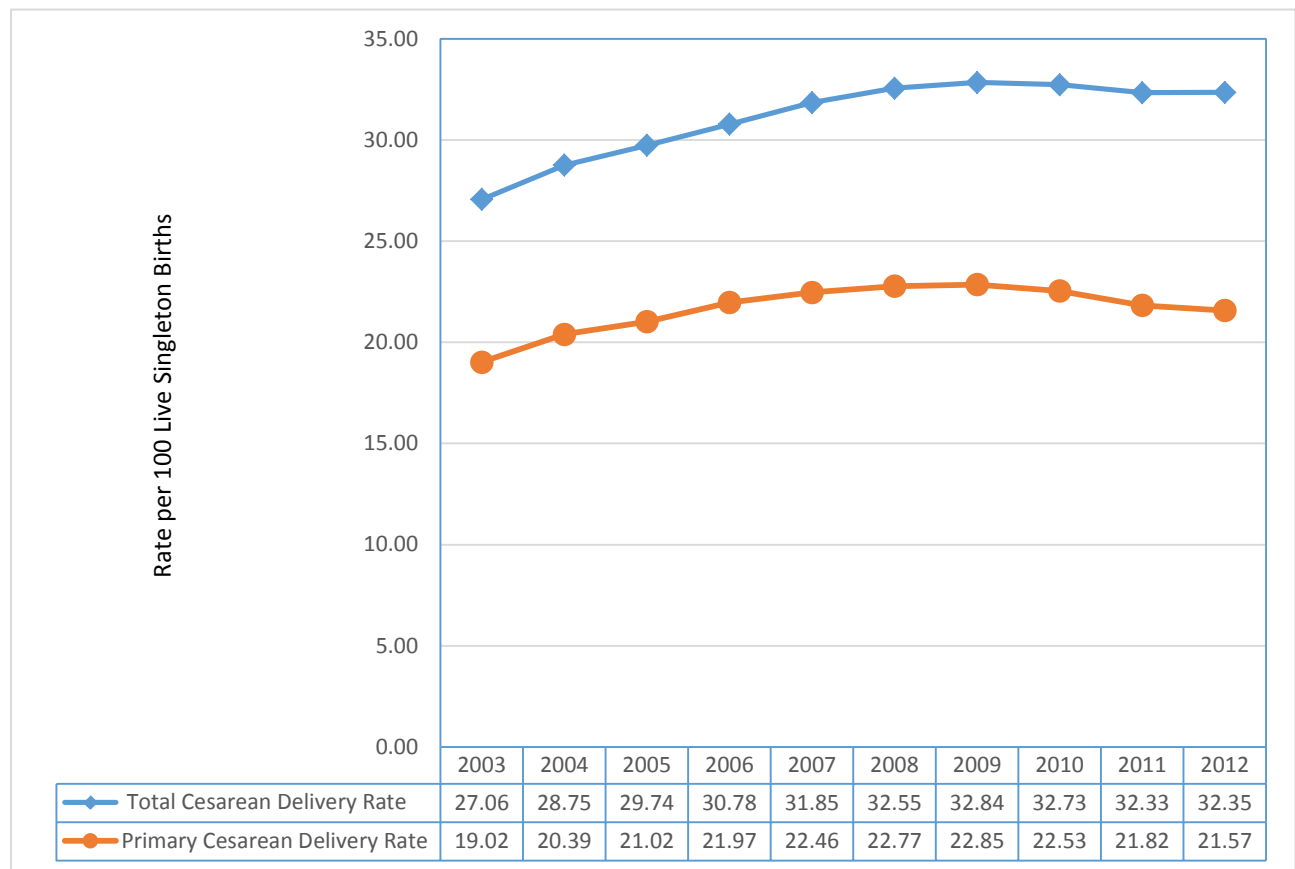
¹ Rest of State represents areas outside of New York City.

Results and Discussion

Trends in primary cesarean delivery

Both the total cesarean delivery rate and the primary cesarean delivery rate increased from 2003 to 2009. After 2009, the trends leveled or declined somewhat.

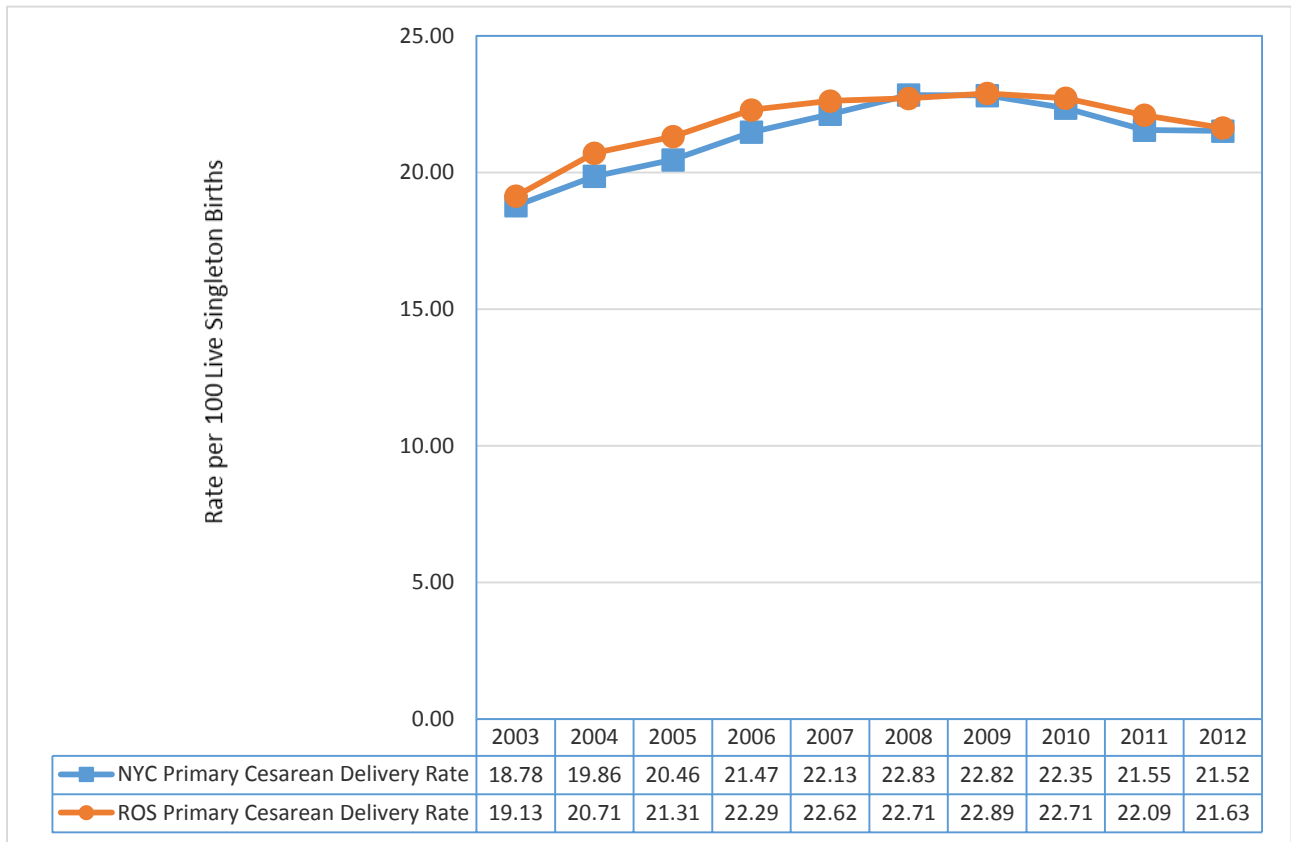
Figure 2. Total and Primary Cesarean Delivery Rates among Singleton Births: New York State, 2003-2012



- The New York State total cesarean delivery rate in 2012 was 32.35 per 100 live singleton births. This represents a 19.6% increase from a rate of 27.06 per 100 live singleton births in 2003. The highest rate was observed in 2009 at 32.84 per 100 live singleton births.
- The New York State primary cesarean delivery rate in 2012 was 21.57 per 100 live singleton births. This represents a 13.4% increase from a rate of 19.02 per 100 live singleton births in 2003. The highest rate was observed in 2009 at 22.85 per 100 live singleton births.
- Since peaking in 2009, the primary cesarean rate has declined by 5.6% and the total cesarean delivery rate has declined by 1.5%.

Mother's region of residence: New York City and Rest of State

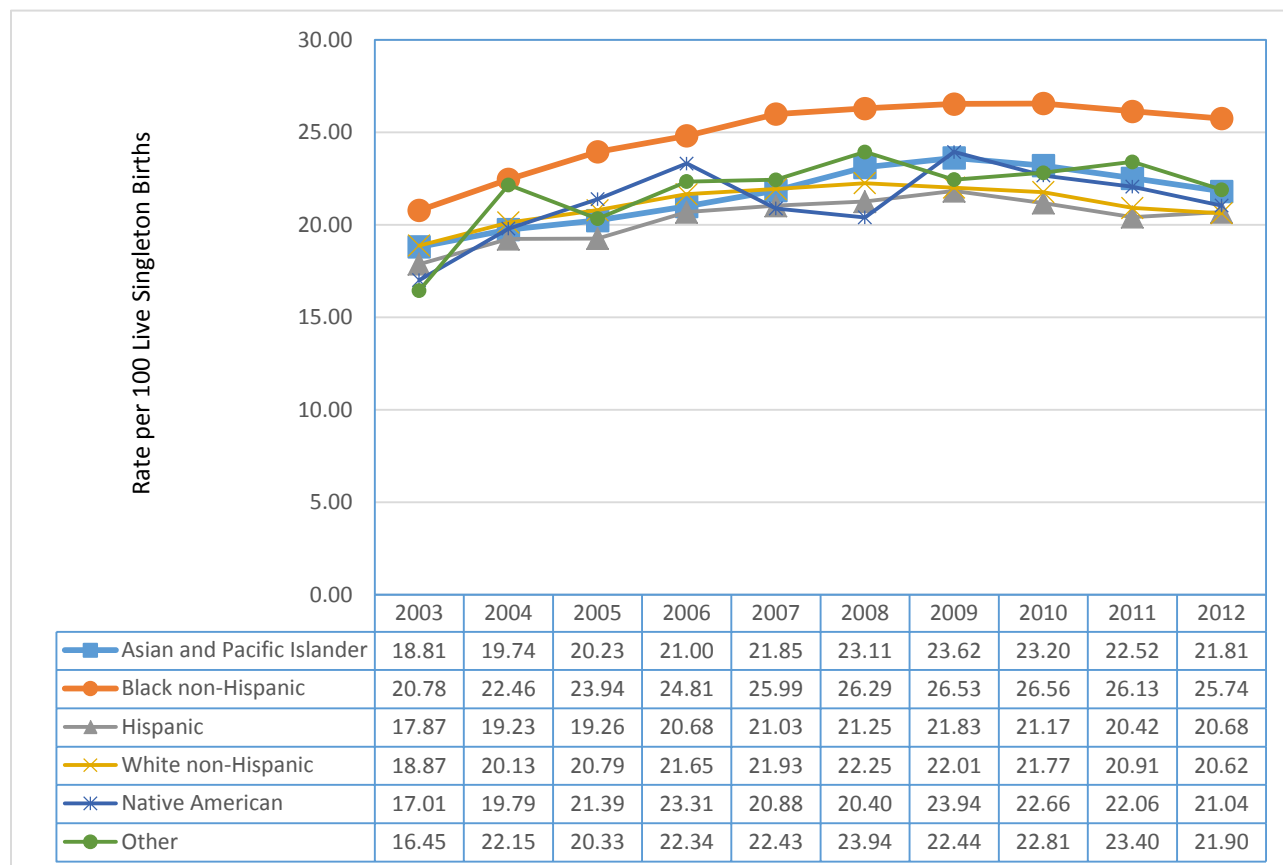
Figure 3. Primary Cesarean Delivery Rate by Residence Region: New York State, 2003-2012



- In 2012, the primary cesarean delivery rate was 21.52 per 100 live singleton births among mothers who were New York State residents and living in New York City (NYC), and 21.63 per 100 live births among mothers living in New York State exclusive of New York City referred to as Rest of State (ROS).
- Since 2003, the primary cesarean delivery rate increased 14.6% among mothers living in NYC, compared to 13.0% among mothers living in ROS.
- The highest annual rate by region was 22.89 per 100 singleton live births for ROS in 2009 and 22.83 per 100 live singleton births for NYC in 2008 - the only year in which the rate for NYC was higher than in the ROS.
- Since peaking, the primary cesarean delivery rate has declined 5.5% in the ROS and 5.7% in NYC.

Mother's race and ethnicity

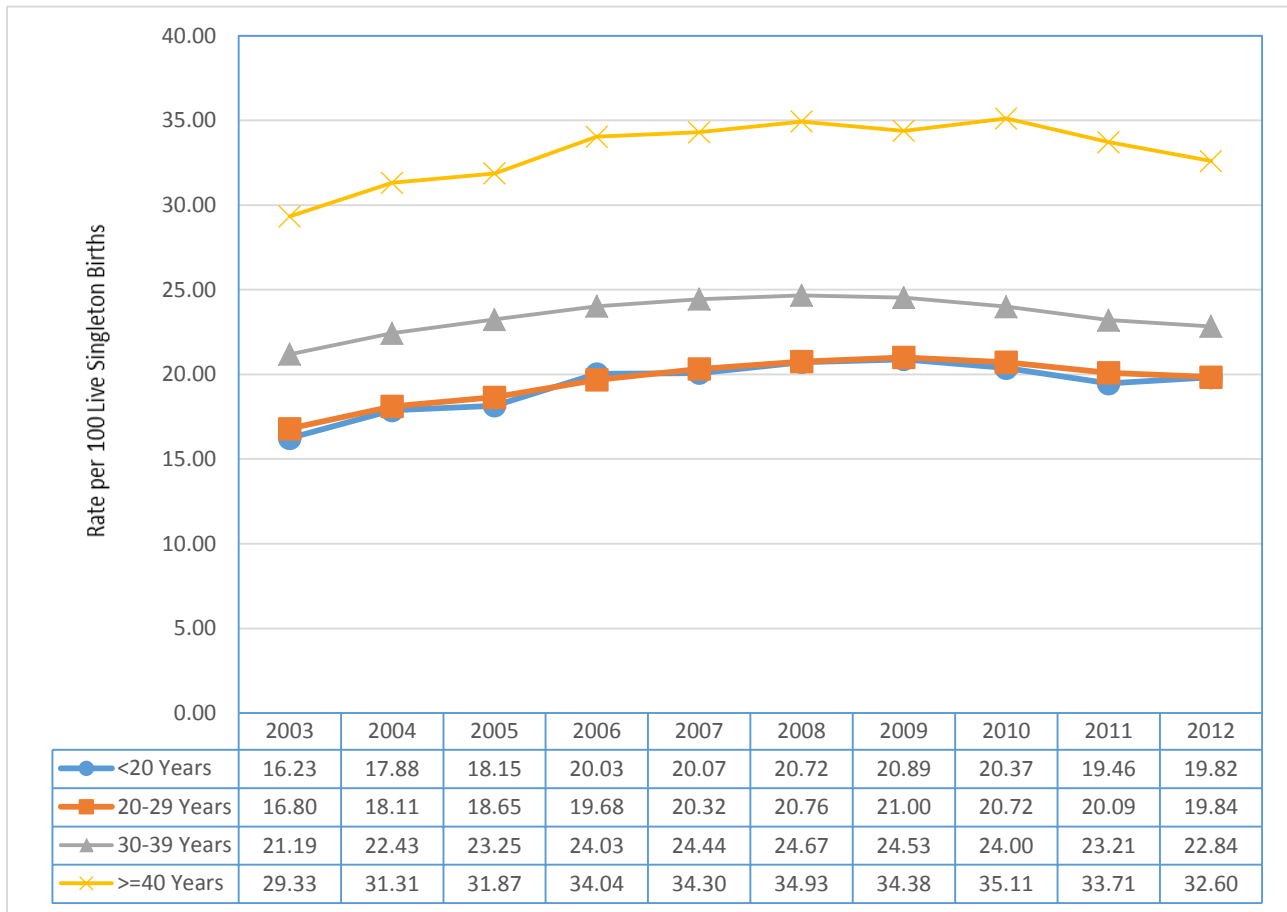
Figure 4. Primary Cesarean Delivery Rate by Maternal Race and Ethnicity: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among black non-Hispanics since 2003. In 2012, their rate was 25.74 per 100 live singleton births, followed by Other (21.90 per 100 live singleton births), Asian and Pacific Islanders (21.81 per 100 live singleton births), Native Americans (21.04 per 100 live singleton births), Hispanics (20.68 per 100 singleton births), and white non-Hispanics (20.62 per 100 live singleton births).
- From 2003 to 2012, the primary cesarean delivery rate increased 33.1% among Other, followed by 23.9% among black non-Hispanics, Native Americans (23.7%), Asian and Pacific Islanders (16.0%), Hispanics (15.7%), and white non-Hispanics (9.3%).
- The highest annual rates by race and ethnicity were 26.56 per 100 live singleton births in 2010 among black non-Hispanics, 23.94 among Other in 2008, 23.94 among Native Americans in 2009, 23.62 among Asian and Pacific Islanders in 2009, 22.25 among white non-Hispanics in 2008, and 21.83 per 100 live singleton births among Hispanics in 2009.
- The declines observed in recent years varied by racial and ethnic classification. Along with the highest overall rates and latest peak, the smallest decline (3.1%) was noted among black non-Hispanics. Among the other two largest subpopulations, white non-Hispanics and Hispanics, the rates have declined 7.3% and 5.3% respectively from the peak.

Mother's age

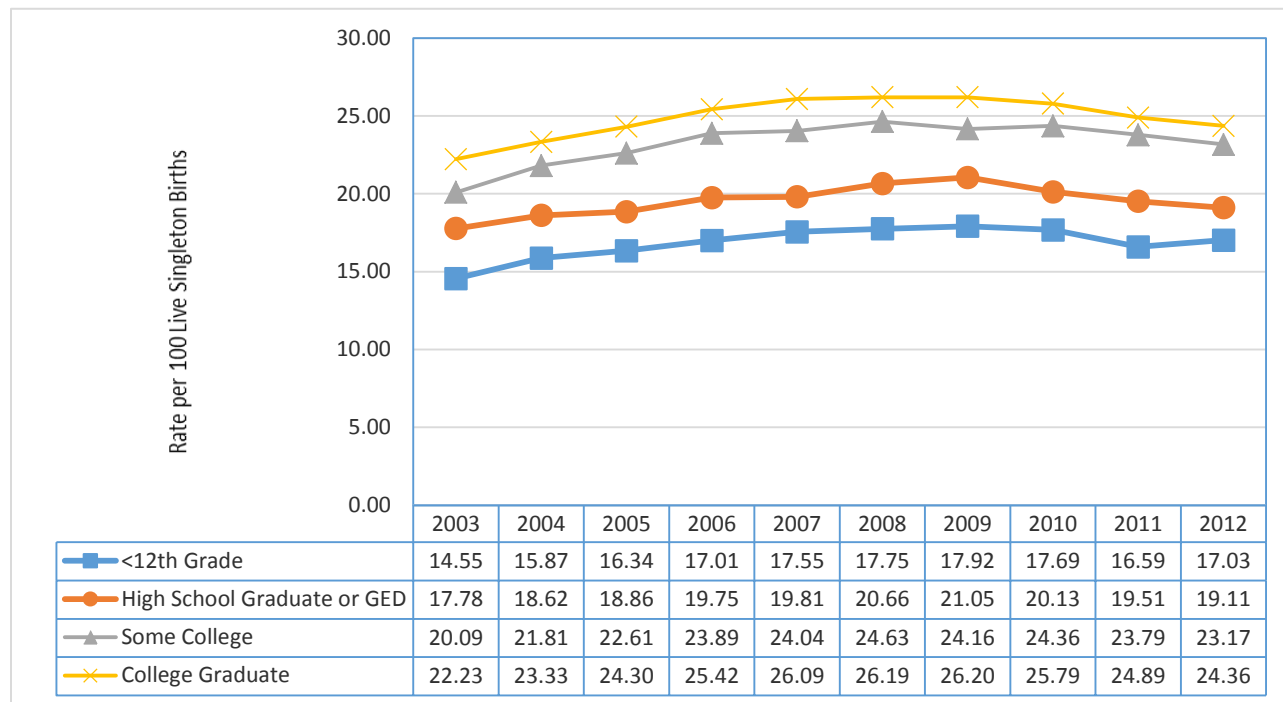
Figure 5. Primary Cesarean Delivery Rate by Maternal Age: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among mothers aged 40 years and older since 2003. In 2012, the rate was highest for this group at 32.60 per 100 live singleton births, followed by mothers aged 30-39 years at 22.84 per 100 live singleton births. Young mothers aged <20 years and aged 20-29 years had the lowest and most comparable rates at 19.82 and 19.84 per 100 live singleton births, respectively.
- From 2003 to 2012, the primary cesarean delivery rate increased in all age groups: 22.2% among mothers aged < 20 years; 18.1% among mothers aged 20-29 years; 11.1% among mothers aged 40 and older; and 7.8% among mothers aged 30-39 years.
- The highest annual rates by age group were 35.11 per 100 live singleton births in 2010 among mothers aged 40 years and older, 24.67 in 2008 among mothers aged 30-39 years, 21.00 in 2009 among mothers aged 20-29 years, and 20.89 per 100 live births in 2009 among mothers aged <20 years.
- Since peaking, the observed decline was highest among mothers aged 30-39 years (7.4%), followed closely by those 40 years or older (6.7%). The percentage of decline were similar for mothers 20-29 years of age and under 20 years of age at 5.5% and 5.1% respectively.

Mother's educational attainment

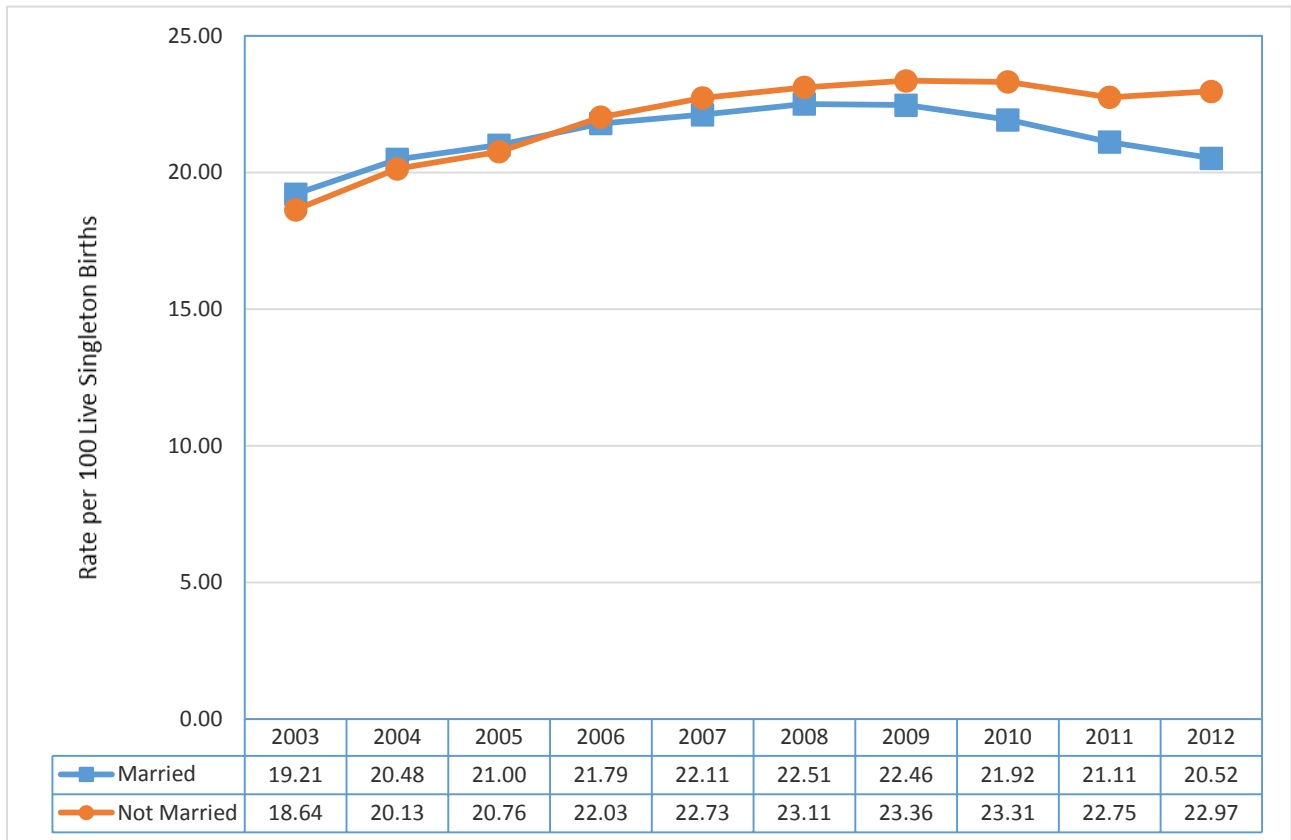
Figure 6. Primary Cesarean Delivery Rate by Maternal Educational Attainment: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among the most educated and lowest among the least educated since 2003. In 2012, the primary cesarean delivery rate was highest among college graduates (24.36 per 100 live singleton births), followed by mothers with some college education (23.17 per 100 live singleton births), high school graduates (19.22 per 100 live singleton births), and mothers not graduating high school (17.03 per 100 live singleton births).
- From 2003 to 2012, the primary cesarean delivery rate increased in all education groups: 17.0% among mothers with less than a high school education, 15.3% among those with some college education, 9.6% among college graduates, and 7.5% among high school graduates.
- The highest annual rates by educational attainment were 26.20 per 100 live singleton births in 2009 among college graduates, 24.63 in 2008 among mothers completing some college, 21.05 in 2009 among high school graduates, and 17.92 in 2009 among mothers with less than a high school education.
- The highest rate was observed in 2009 among mothers graduated from college at 26.20 per 100 live singleton births, followed by mothers with some college (24.63 in 2008), high school graduates (21.05 in 2009), and those with less than a high school education (17.92 in 2009).
- Since peaking, the rate has declined the most among high school graduates (9.2%), followed by those with a four-year college degree (7.0%), those with some college (5.9%), and was lowest for those having less than a high school education (5.0%).

Mother's marital status

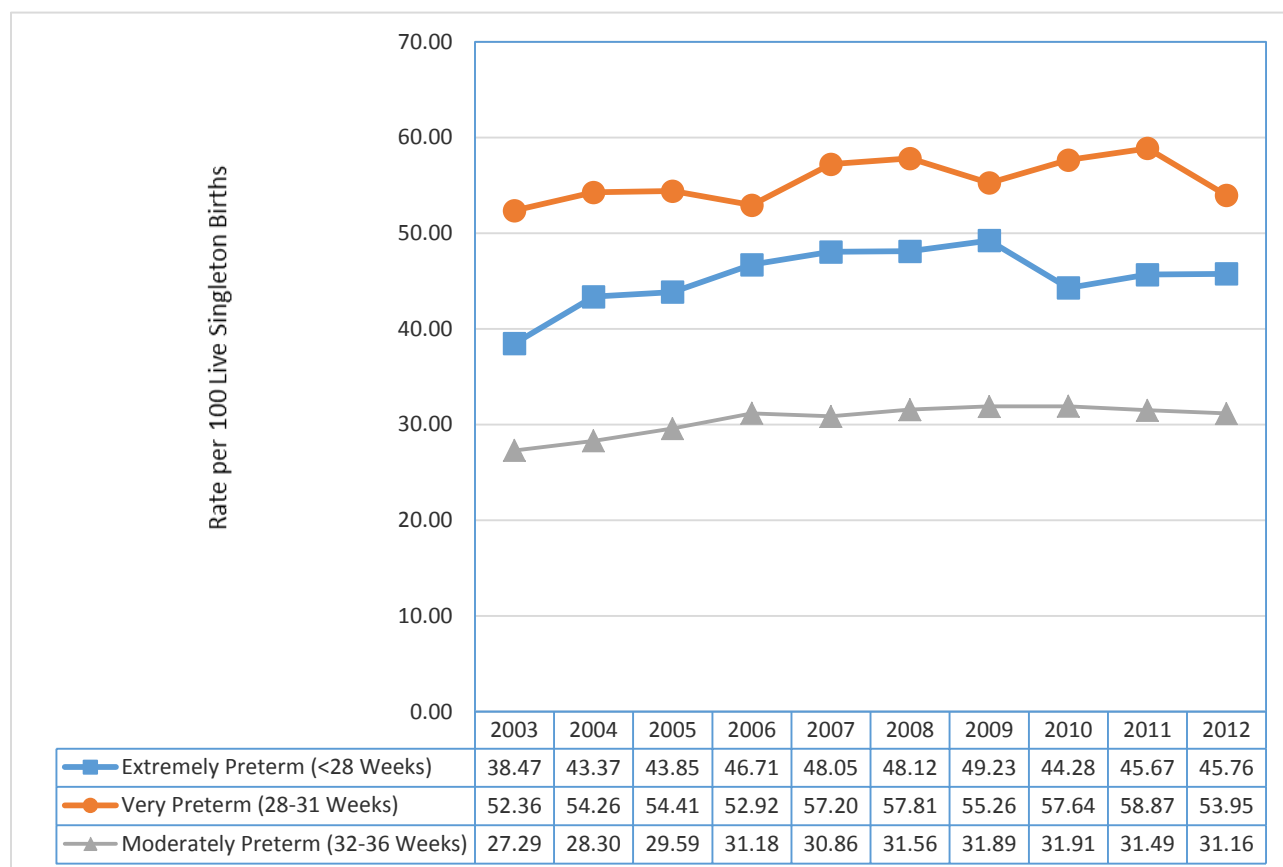
Figure 7. Primary Cesarean Delivery Rate by Maternal Marital Status: New York State, 2003-2012



- In 2012, 58.6% of all births were to married women and 41.4% to unmarried. For singleton births, 57.0% were to married women and 43.0% to unmarried. The primary cesarean delivery rate among unmarried women was 22.97 per 100 live singleton births compared to 20.52 per 100 live singleton births among married women.
- From 2003 to 2012, the primary cesarean delivery rate increased in both groups: 23.2% among unmarried women and 6.8% among married women.
- The highest annual rates were 23.36 per 100 live singleton births in 2009 among unmarried women and 22.51 per 100 live singleton births in 2009 among married women. Rates were higher among married women between 2003 and 2006, with the trend reversing thereafter.
- Since peaking, the rates have been declined much more for married women compared to unmarried women: 8.8% and 1.7%, respectively.

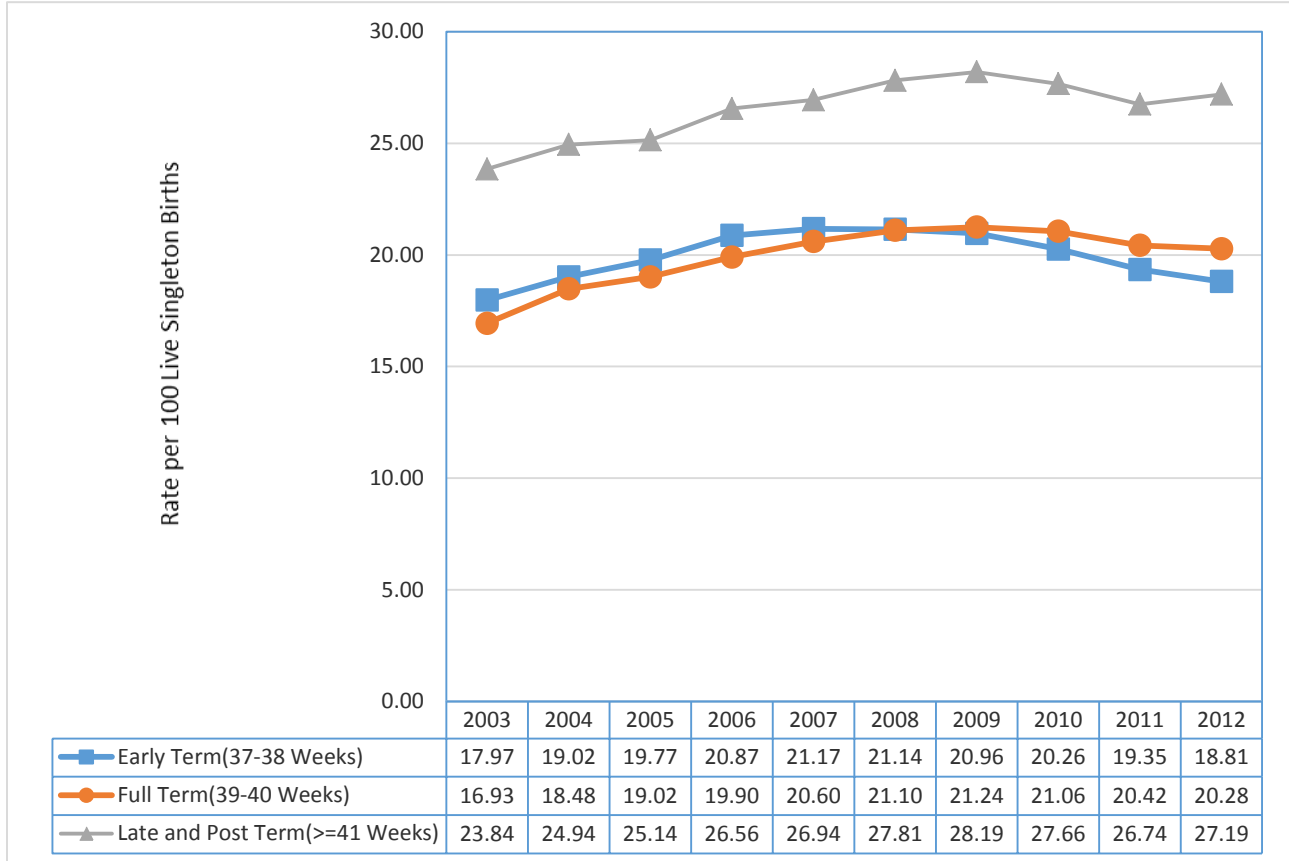
Preterm births

Figure 8. Primary Cesarean Delivery Rate by Preterm Birth Group: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among very preterm births (28-31 weeks gestation) since 2003. Lower rates among extremely preterm births may be explained by the fact that cesarean section before 28 weeks of gestation is associated with a high risk of postoperative complications and mothers being counseled accordingly [10].
- In 2012, the primary cesarean delivery rate for very preterm births (28-31 weeks in gestation) was 53.95 per 100 live singleton births, followed by extremely preterm births (<28 weeks) at 45.76 per 100 live singleton births, and moderately preterm births (32-36 weeks) at 31.16 per 100 live singleton births.
- From 2003 to 2012, the primary cesarean delivery rate increased in all preterm groups: 18.9% for extremely preterm births, 14.2% for moderately preterm births, and 3.0% for very preterm births.
- The highest annual rates by preterm delivery were 58.87 per 100 live singleton births in 2011 for very preterm births, 49.23 per 100 live singleton births for extremely preterm births in 2009, and 31.91 per live singleton births for moderately preterm in 2010.

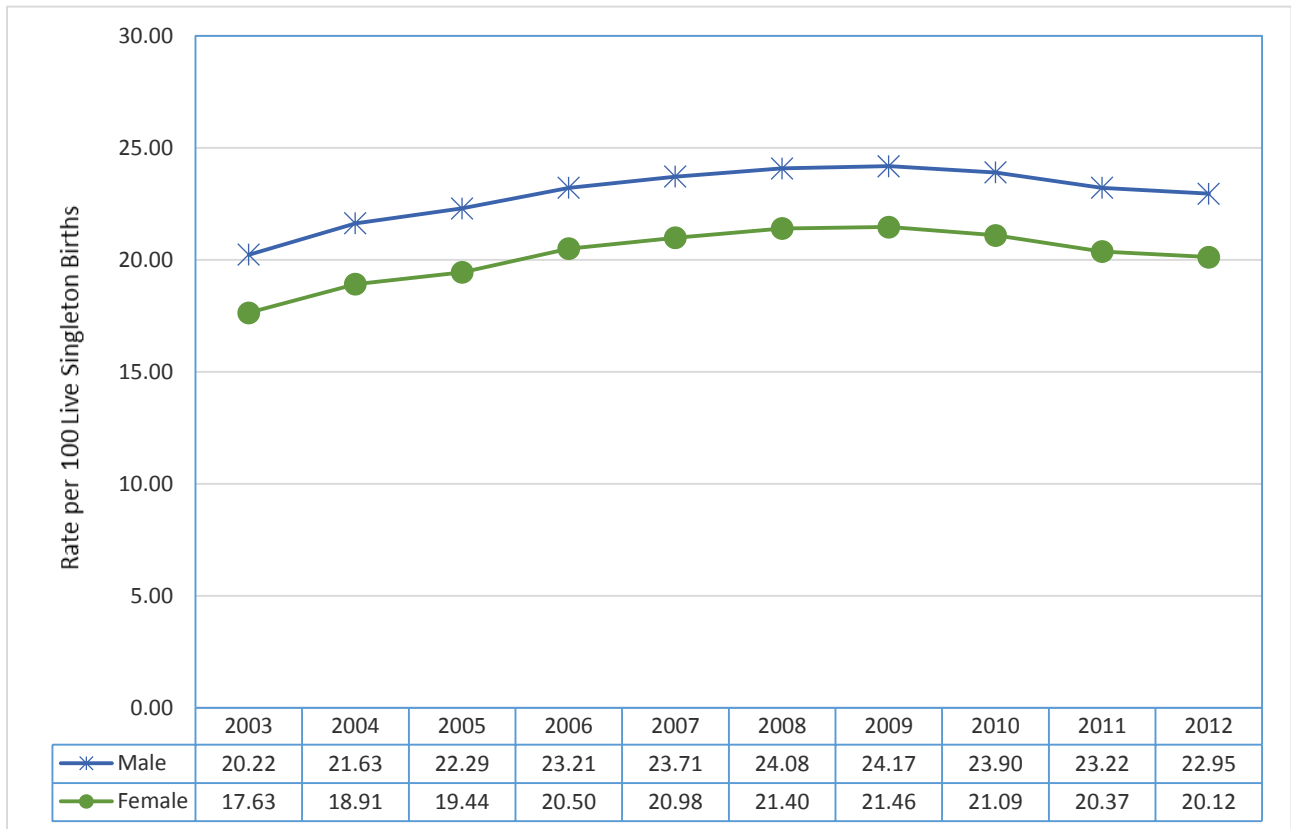
Figure 9. Primary Cesarean Delivery Rate by Term Birth Group: New York State, 2003-2012



- In 2012, the primary cesarean delivery rate was highest for late and post term births (≥ 41 weeks in gestation) was 27.19 per 100 live singleton births, followed by full term births (39-40 weeks) at 20.28 per 100 live singleton births, and early term births (37-38 weeks) at 18.81 per 100 live singleton births.
- From 2003 to 2012, the primary cesarean delivery rate increased in all term groups: 19.7% for full term births, 14.0% for late and post term births, and 4.6% for early term births.
- The highest annual rates for late and post term births (28.19 per 100 live singleton births) and full term births (21.24) were observed in 2009. The highest rate for early term births (21.17 per 100 live singleton births) was observed in 2007.
- Since peaking in 2009, primary cesarean delivery rates decreased by 3.5% for the late and post term group, 4.5% for the full term group, and 11.1% for the early term group. The larger decrease in early term deliveries may be due in part to multipronged efforts by the NYS Department of Health’s perinatal and Medicaid programs, in partnership with the state’s maternity hospitals, to reduce scheduled deliveries between 36 and 38 weeks gestation.

Infant's sex

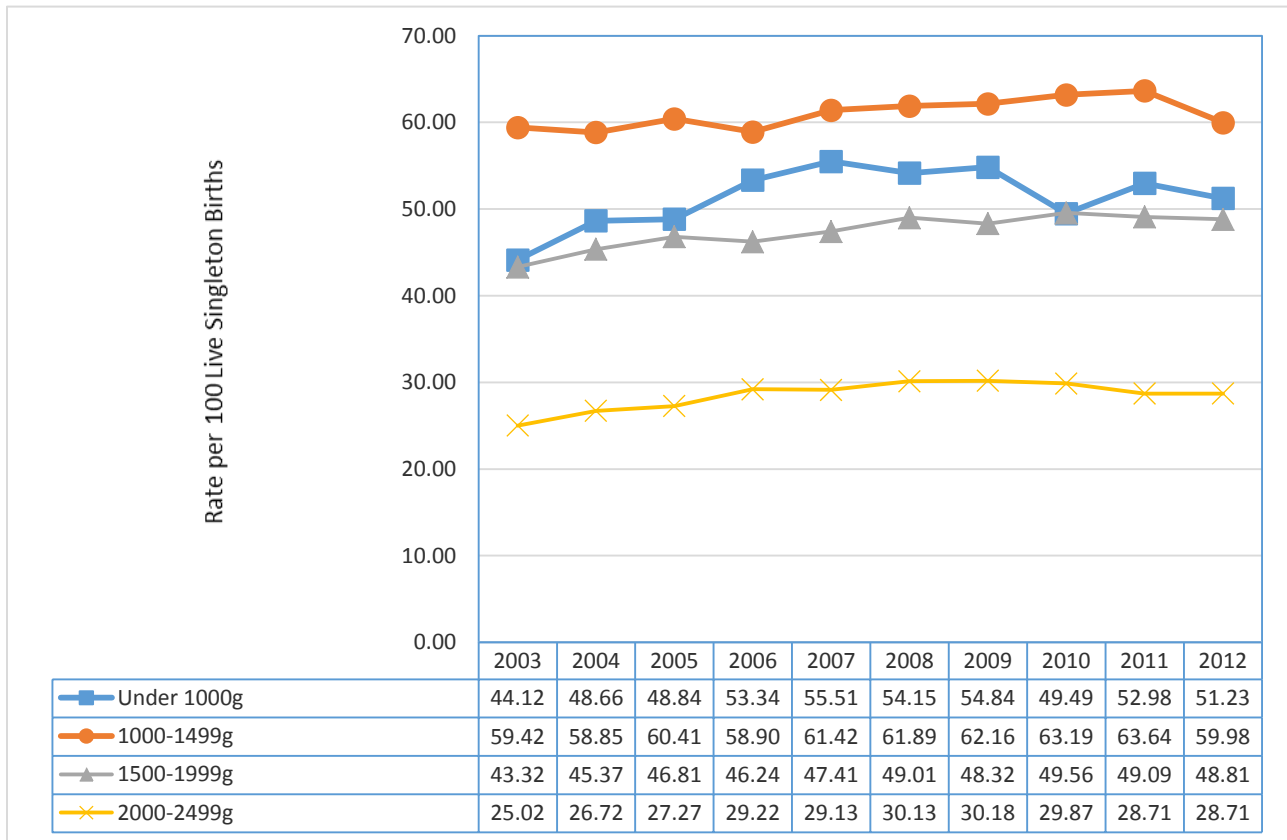
Figure 10. Primary Cesarean Delivery Rate by the Infant's Sex: New York State, 2003-2012



- Primary cesarean delivery rates have been higher among males since 2003. In 2012, the primary cesarean delivery rate among women delivering a male infant was 22.95 per 100 live births compared to 20.12 among women delivering a female infant.
- From 2003 to 2012, the primary cesarean delivery rate increased in both groups: 14.1% among women who had a female infant and 13.5% among women who had a male infant.
- The highest rates were observed in 2009, with mothers delivering a male infant at 24.17 per 100 live singleton births, and mothers delivering a female infant at 21.46 per 100 live singleton births.
- Since peaking, the decline in primary cesarean rates among mothers delivering males was 5.0% compared to 6.2% among mothers delivering females.

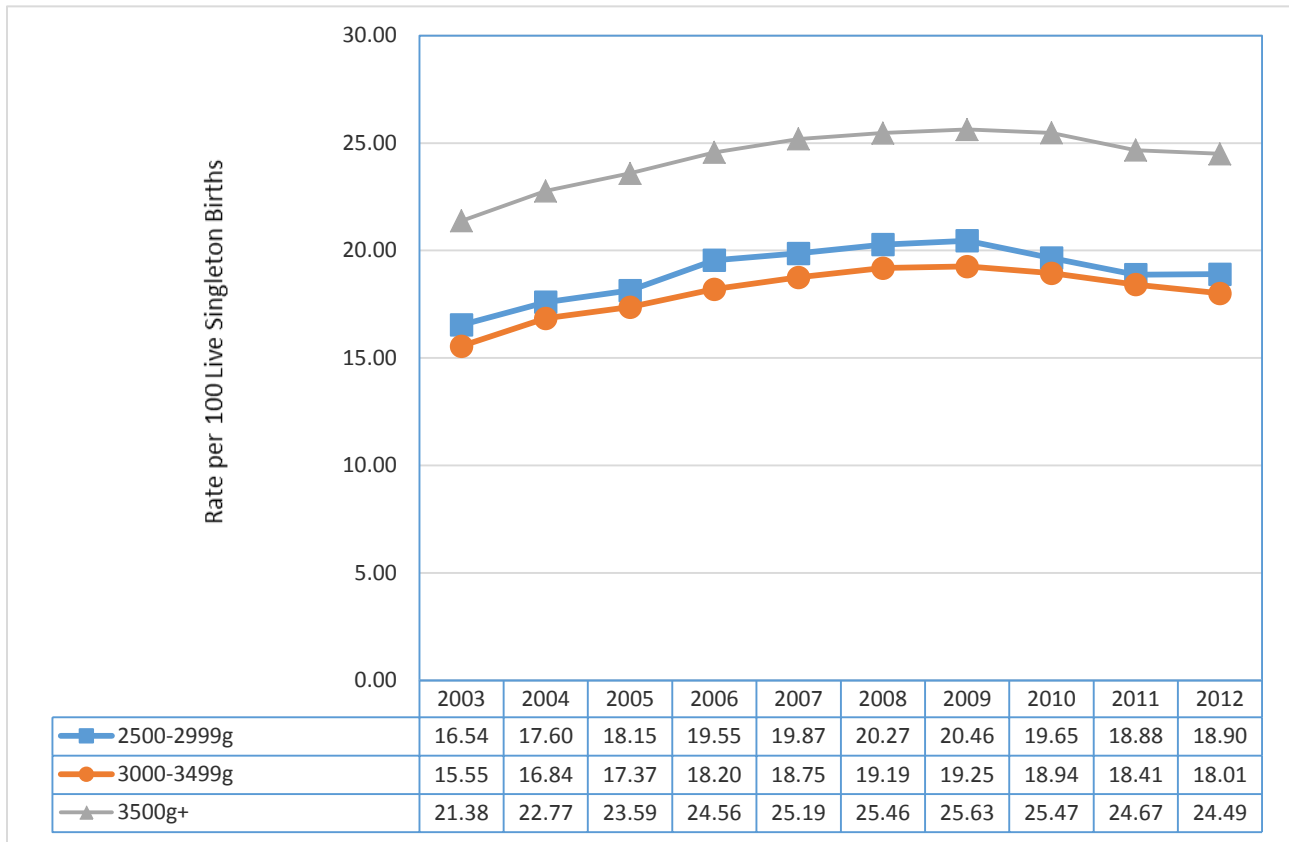
Birthweight

Figure 11. Primary Cesarean Delivery Rate by Low Birthweight: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among infants with birthweights 1,000-1,499 grams since 2003. Lower rates among lower birthweight births may be explained by that birthweight is strongly positively correlated with gestation weeks and cesarean section before 28 weeks of gestation is associated with a high risk of postoperative complications [10].
- In 2012, the primary cesarean delivery rate was 59.98 per 100 live singleton births among those with a birthweight 1,000-1,499 grams, 51.23 per 100 live singleton births among those under 1,000 grams, 48.81 per 100 live singleton births among those 1,500-1,999 grams, and 28.71 per 100 live singleton births among those 2,000-2,499 grams birthweight.
- From 2003 to 2012, the primary cesarean delivery rate increased for all low birthweight categories: 16.1% among those under 1000 grams, 14.8% among those 2,000-2,499 grams, 12.7% among those 1,500-1,599 grams, and 0.9% among those 1,000-1,499 grams birthweight.
- The highest annual rates by birthweight group were 63.64 per 100 live singleton births in 2011 among those with a birthweight 1,000-1,499 grams, 55.51 per 100 live singleton births for those under 1,000 grams in 2007, 49.56 per 100 live singleton births for those 1,500-1,999 grams in 2009, and 30.18 per 100 live singleton births for birthweights 2000-2499 grams in 2009.

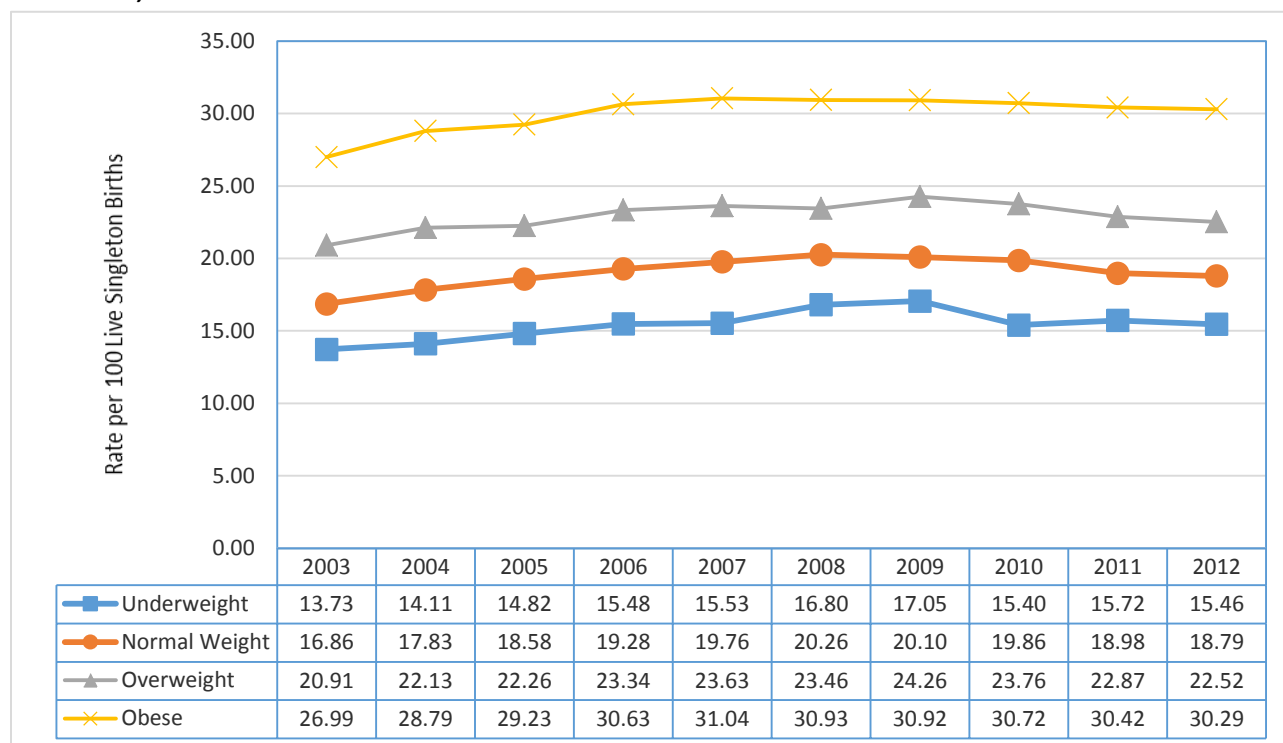
Figure 12. Primary Cesarean Delivery Rate Singleton Births by Normal Birthweight: New York State,



- Among normal weight births, primary cesarean delivery rates have been highest among infants with birthweights 3,500 grams or more since 2003.
- In 2012, the primary cesarean delivery rate was 24.49 per 100 live singleton births among those with a birthweight of 3,500 grams or more, 18.90 per 100 live singleton births among those 2,500-2,999 grams, and 18.01 per 100 live singleton births among those 3,000-3,499 grams birthweight.
- From 2003 to 2012, the primary cesarean delivery rate increased for all normal birthweight categories: 14.2% among those 2,500-2,999 grams, 15.8% among those 3,000-3,499 grams, and 14.6% among those 3,500 grams or more birthweight.
- The highest annual rates by birthweight group were observed in 2009 at 25.63 per 100 live singleton births among those with birthweights of 3,500 grams or more, 20.46 per 100 live singleton births for those 2,500-2,999 grams, and 19.25 per live singleton births for birthweights 3,000-3,499 grams.
- Rates of primary cesarean delivery have been consistently below average among infants born weight between 2500 and 3499 grams. Since peaking, the rate has declined the most in the 2500-2999 gram birthweight group (7.6%), compared to a decline of 6.4% for the 3000-3499 gram group, and 4.4% among those 3500 grams or greater.

Mother's pre-pregnancy weight status

Figure 13. Primary Cesarean Delivery Rate by Maternal Pre-pregnancy Body Mass Index (BMI)²: New York State, 2003-2012

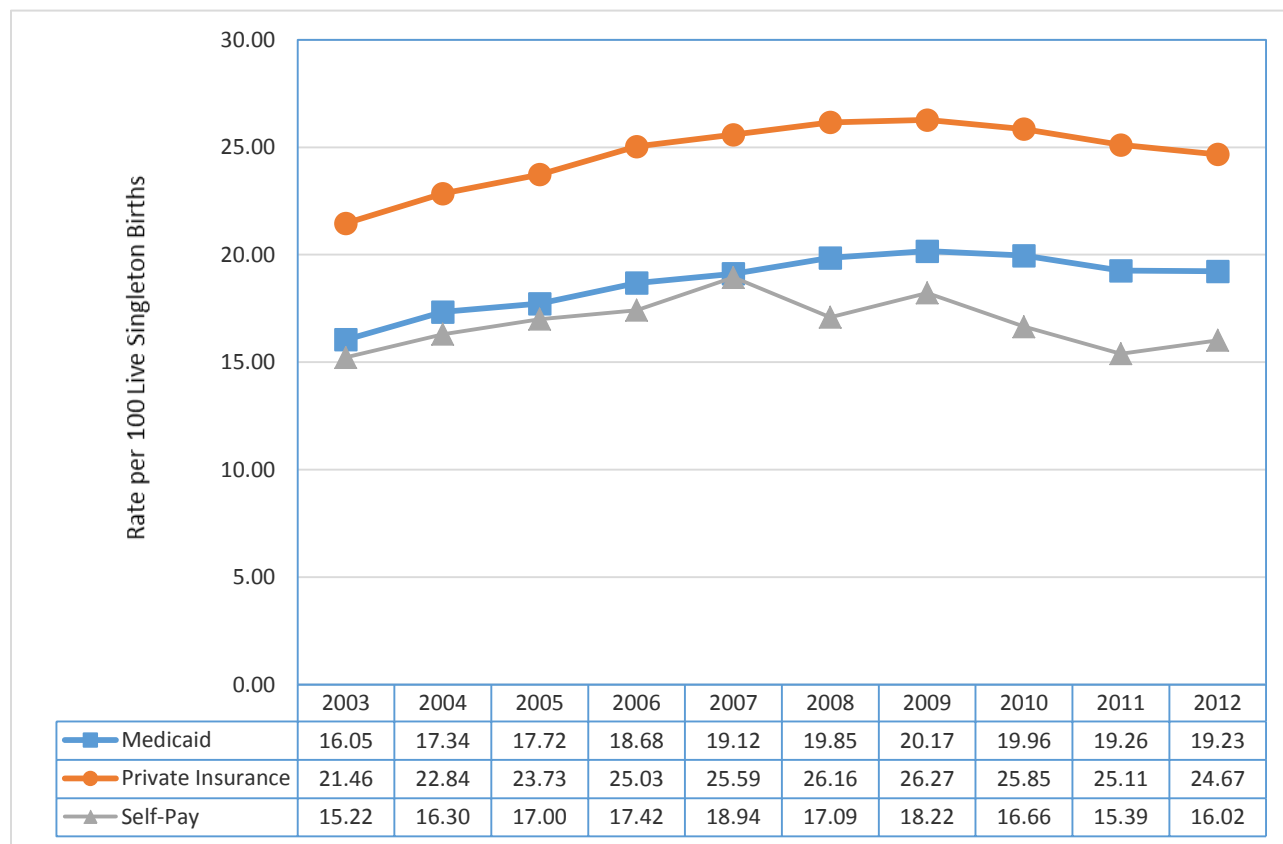


- Primary cesarean delivery rates are inversely related to mother's pre-pregnancy weight status and have been highest among obese mothers since 2003. In 2012, the primary cesarean delivery rate among pre-pregnancy obese mothers was 30.29 per 100 live singleton births, followed by those overweight (22.52 per 100 live singleton births), normal weight (18.79 per 100 live singleton births), and underweight (15.46 per 100 live singleton births).
- From 2003 to 2012, the primary cesarean delivery rate increased for all pre-pregnancy BMI categories: 12.2% for obese mothers, 11.4% for those underweight, 11.4% for those of normal weight, and 7.7% for those overweight.
- The highest annual rates were observed in 2007 among obese mothers at 31.04 per 100 live singleton births, in 2009 among overweight mothers (24.26), in 2008 among normal weight mothers (20.26), and in 2009 among underweight mothers (17.05).
- After peaking, the decline in cesarean deliveries was smallest (2.4%) among women who were obese prior to pregnancy, followed by comparable declines in women in the over- and normal weight groups (7.2% and 7.3% respectively), and highest (9.3%) among those who were underweight.

² Weight status categories were defined based on the body mass index (BMI) as Underweight (BMI<18.5), Normal weight (18.5≤BMI<25), Overweight (25≤BMI<30), and Obese (BMI≥30)

Payer information

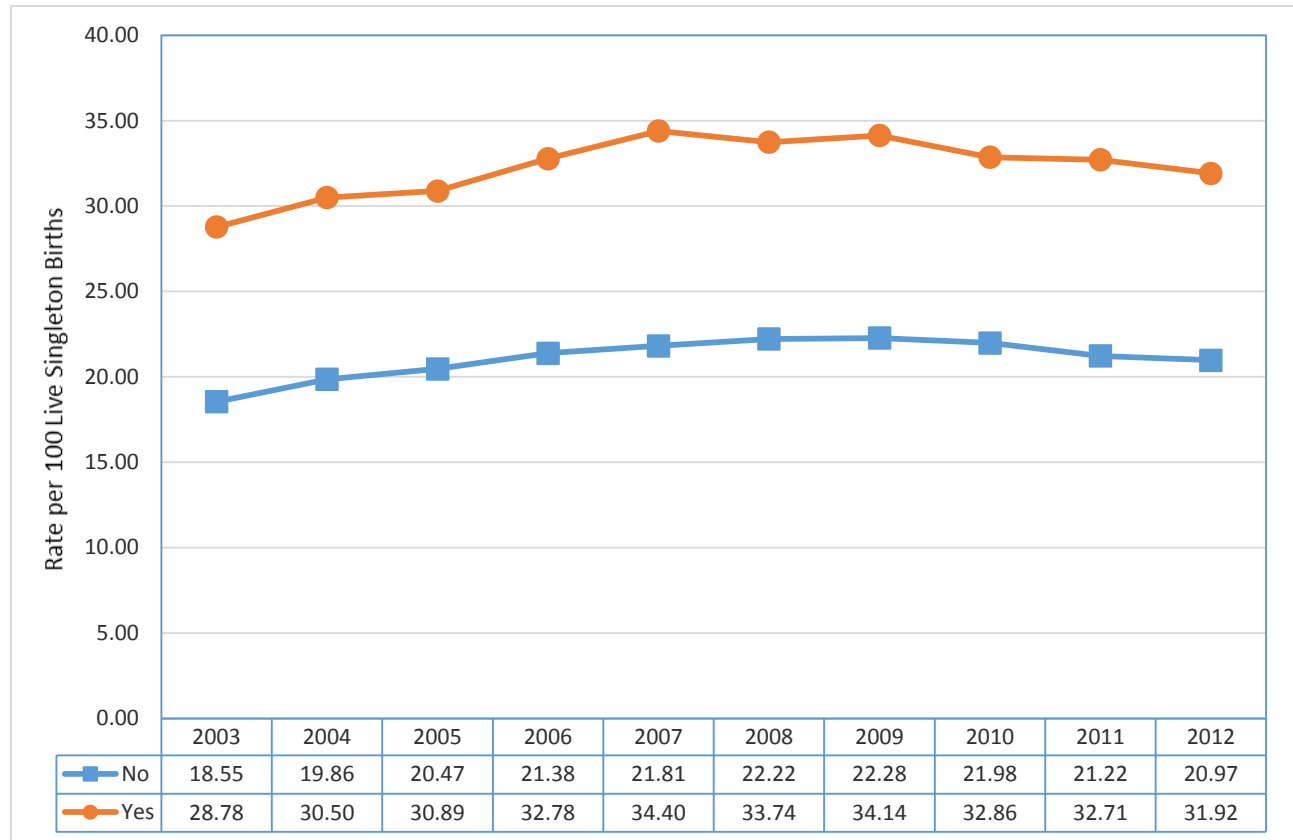
Figure 14. Primary Cesarean Delivery Rate by Payor Type: New York State, 2003-2012



- Primary cesarean delivery rates have been highest among mothers with private insurance since 2003. In 2012, the primary cesarean delivery rate was highest among the private insurance group (24.67 per 100 live singleton births), followed by Medicaid (19.23 per 100 live singleton births) and self-pay insurance (16.02 per 100 live singleton births).
- From 2003 to 2012, the primary cesarean delivery rate increased 19.8% for births covered by Medicaid, followed by private insurance (14.9%) and self-pay (5.2%).
- The highest rates were observed in 2009 among those covered by private insurance at 26.27 per 100 live singleton births, followed by those covered by Medicaid at 20.17. Self-paying women had their peak rate of 18.94 in 2007.
- Since peaking, rates have declined by 6.1% among privately insured women, 4.7% among Medicaid eligible women, and 15.4% among those self-paying.

Maternal diabetes³

Figure 15. Primary Cesarean Delivery Rate by Maternal Diabetes: New York State, 2003-2012

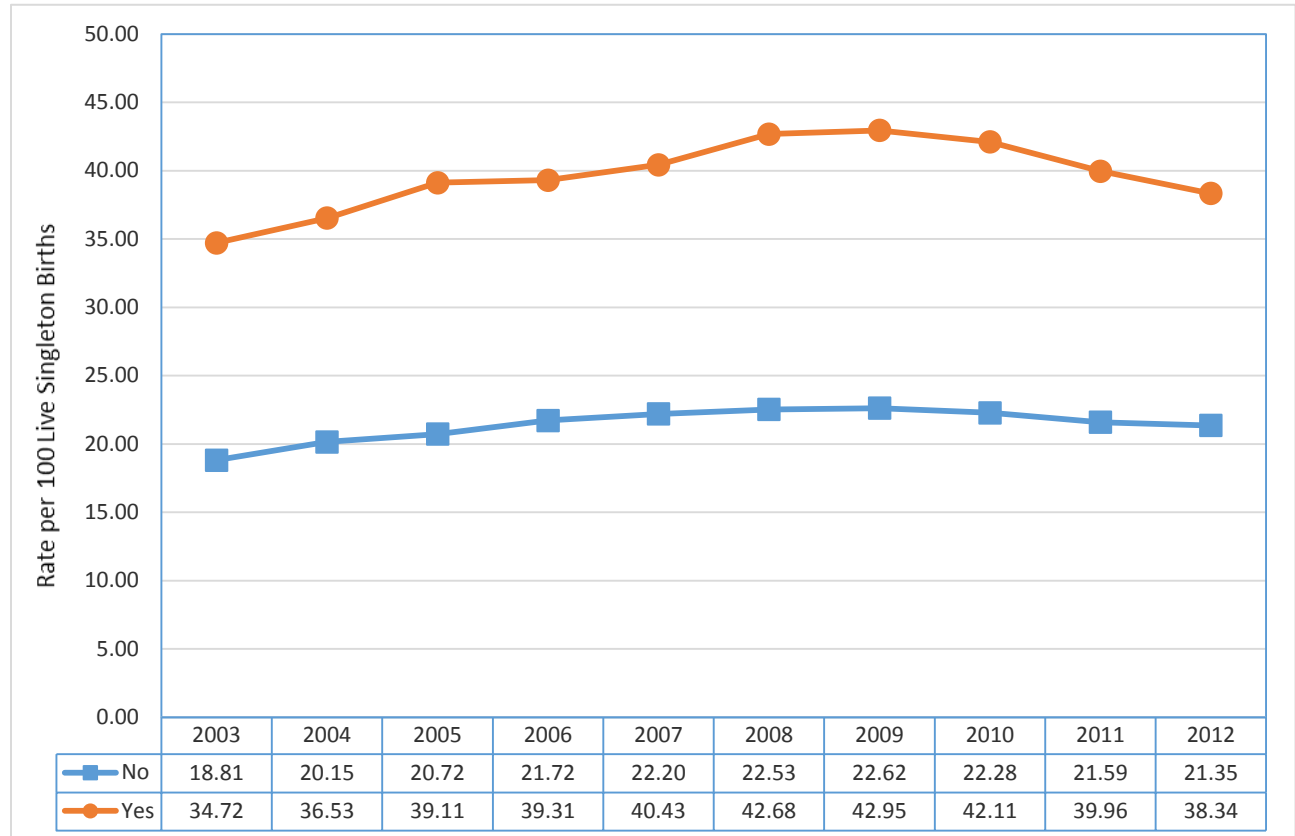


- Over the ten-year period 2003 to 2012, primary cesarean delivery rates among mothers with diabetes consistently ranged between 10% and 12% higher than the rates among those without the condition. In 2012, the primary cesarean delivery rate among women with diabetes was 31.92 per 100 live births compared to 20.97 per 100 live births among women without the condition.
- From 2003 to 2012, the primary cesarean delivery rate increased in both groups: 13.1% among women with no diabetes and 10.9% among women with the condition.
- The highest rate was observed in 2007 among mothers who had diabetes at 34.40 per 100 live singleton births; among mothers who did not have diabetes the highest rate, 22.28 per 100 live singleton births, occurred in 2009.
- Since peaking, primary cesarean delivery rates have declined by 7.2% among diabetic mothers and by 5.9% among non-diabetic mothers.

³ Diabetes include pre-pregnancy diabetes and gestational diabetes.

Fertility-enhancing therapy

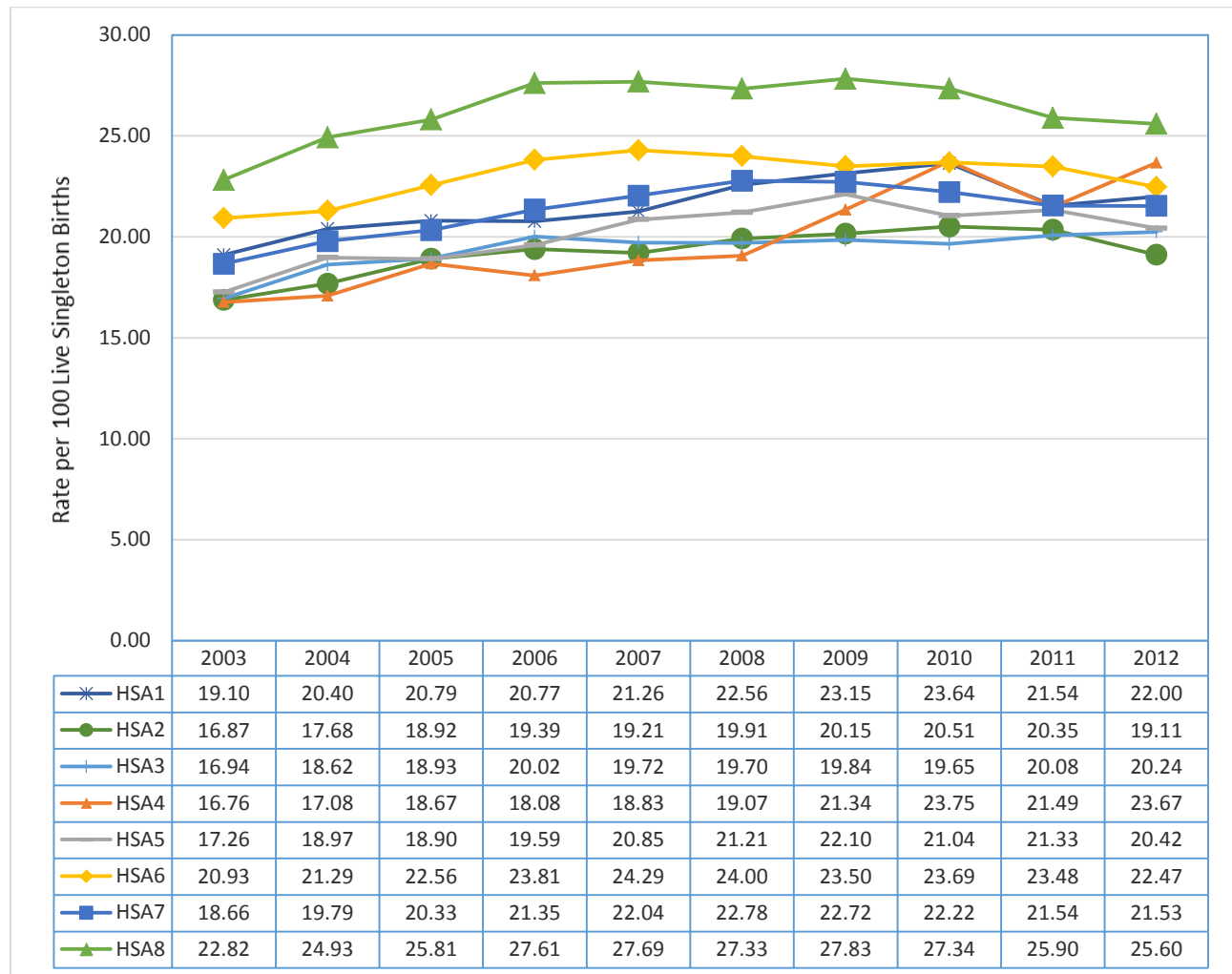
Figure 16. Primary Cesarean Delivery Rate by Maternal Fertility-Enhancing Therapy: New York State, 2003-2012



- Primary cesarean delivery rates among women who had fertility-enhancing therapy is consistently higher than the rates for those who did not. In 2012, the primary cesarean delivery rate among women who had fertility-enhancing therapy was 38.34 per 100 live births compared to 21.35 per 100 live singleton births among women who did not.
- From 2003 to 2012, the primary cesarean delivery rate increased in both groups: 13.5% among women not having fertility-enhancing therapy and 10.4% among women who did.
- The highest rates were observed in 2009, at 42.95 per 100 live singleton births among mothers who had therapy, nearly twice the rate of 22.62 for mothers who did not have any fertility enhancement.
- Since peaking in 2009, the rate among those receiving fertility enhancing therapy has declined by 10.7%, compared to 5.6% among other women.

Health Service Area

Figure 17. Primary Cesarean Delivery Rate by Health Service Area: New York State, 2003-2012



- Primary cesarean delivery rates varied by NYS Health Service Area (HSA), and are highest in HSA8 (Nassau and Suffolk County). In 2012, the primary cesarean delivery rate in HSA8 was 25.60 per 100 live births; followed by HSA4 (Broome, Chenango and Tioga County) at 23.67; HSA6 (Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster and Westchester County) at 22.47; HSA1 (Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Niagara, Orleans, Wyoming County) at 22.00; HSA7 New York City (Bronx, Kings, New York, Queens and Richmond County) at 21.53; HSA5 (Albany, Clinton, Columbia, Delaware, Essex, Franklin, Fulton, Greene, Montgomery, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Warren and Washington County) at 20.42; HSA3 (Cayuga, Cortland, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, St. Lawrence and Tompkins County) at 20.24; and HSA2 (Chemung, Livingston, Monroe, Ontario, Schuyler, Seneca, Steuben, Wayne and Yates County) at 19.11.

- From 2003 to 2012, the primary cesarean delivery rate increased in all HSA groups: HSA1 15.2%; HSA2 13.3%; HSA3 19.5%; HSA4 41.2%; HSA5 18.3%; HSA6 7.4%; HSA7 15.4%; and HSA8 12.2%.
- Rates have peaked at various times in different regions: 2009 in HSAs 1, 5, and 8; 2007 in HSA6; 2008 in HSA7; 2010 in HSA2 and in HSA4; and initially in 2006 in HSA3, where they have fluctuated since and again reached a high point in 2012.
- The percentage by which rates have declined varied by HSA as well, at 8.0% in HSA8, 7.6% and 7.5% in HSA5 and HSA6 respectively, 6.9% and 6.8% in HSA1 and HSA2 respectively, 5.5% in HSA7, and less than 1% in HSA4.

Conclusions

The New York State primary cesarean delivery rate increased steadily from 2003 to 2009 and then began declining. The increases may have been the result of many factors including an increase in the numbers and proportions of older mothers [11], a rise in the incidence of obesity [12], and diabetes [13], and other factors including the use of fertility-enhancing therapy and social-economic conditions. The increase in surgical delivery may also be reflective of physicians' and hospitals' financial incentive to perform cesareans, as well as patients' personal preferences for elective repeat cesarean sections for perceived convenience, especially when the cost does not matter [14].

Declines in the primary cesarean rates in recent years may be due in part to multipronged efforts of the NYS Department of Health's perinatal and Medicaid programs, in partnership with the state's maternity hospitals, to reduce scheduled deliveries between 36 and 38 weeks gestation.

The Department has a comprehensive maternal, infant, and child health program with an agenda for community-based targeting of prenatal, postpartum, and inter-conception care and services for high risk women. The findings in this report may be particularly useful to these endeavors in identifying potential targets to further reduce the primary cesarean delivery rate and, in turn, lower the total cesarean delivery rate. These potential targets include women of minority racial/ethnic background who are privately insured, unmarried, highly educated, diabetic, overweight or obese prior to pregnancy, had fertility enhancement treatment, resided on Long Island (HSA8) and delivering low weight (<2500 gram) or very high weight (>3500) or pre-, late, or post-term babies. Additionally, the method utilized in this report to identify primary cesarean deliveries may help to improve the quality of birth data since some of the deliveries coded as primary cesarean deliveries actually may have been repeat cesarean deliveries that were recorded incorrectly.

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Technical Notes

Corrected Previous Cesarean Rates for 2004-2006

Birth certificate records for New York State residents were linked with New York Statewide Planning and Research Cooperative System (SPARCS) inpatient discharges, using patient identifiers that included mother's first and last names, last four digits of social security number, date of birth, medical record number, address and infant date of birth. In order to reduce the number of false positive matches, a grading system was used to evaluate the quality of the matches. Each identifier variable was assigned a unique score, with the more distinct the variable, the higher the score assigned to it. This method was chosen to help ascertain the probability of a random match for some variables.

A longitudinal birth file was created for all births from 1998 to 2012. A maternal ID was uniquely created based on the mother's last name, first name, date of birth and social security number. The most important variable in this file is method of delivery: if cesarean delivery was coded, then a cut point date and a previous C-section indicator were assigned to this mother. There are three steps to confirm if the mother had a previous C-section. First, the current birth certificate records were checked: if the variable "previous C-section" was coded as "yes" or the number of previous C-sections was not missing and greater than zero, then we recorded the variable "previous C-section" as "yes"; second, with the mother ID, each mother in the birth and SPARCS matched file can get her birth history during 1998-2012. If a mother had a delivery on 2012 and no previous C-section recorded on the 2012 birth certificate, but the longitudinal file show this mother had another delivery on 2005 with a C-section delivery method, then we will revised the mother's previous C-section status as yes for her 2012 record; third, each ICD-9 diagnosis code of the SPARCS discharges was reviewed for previous C-section, if code of 654.20, 654.21, 654.23 were present, then the value of previous C-section should be yes. For each mother's current birth record, if certificate shows the method of delivery was C-section or the procedure code of SPARCS discharges was C-section, then the value of variable C-section is yes. And if no previous C-section, this C-section will be coded as primary C-section.