Published in final edited form as:
Obstet Gynecol. 2013 July ; 122(1): 33–40. doi:10.1097/AOG.0b013e3182952242.

Primary Cesarean Delivery in the United States

Dr. Annelee Boyle, MD, **Dr. Uma M. Reddy, MD, MPH**, **Dr. Helain J. Landy, MD**, **Dr. Chun-Chih Huang, PhD**, **Dr. Rita W. Driggers, MD**, and **Dr. S. Katherine Laughon, MD, MS**
Department of Obstetrics and Gynecology, MedStar Washington Hospital Center, Washington, DC (Drs. Boyle, Driggers, and Laughon); the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD (Drs. Reddy and Laughon); MedStar Health Research Institute, Hyattsville, MD (Dr. Huang); and the Department of Obstetrics and Gynecology, MedStar Georgetown University Hospital, Washington, DC (Dr. Landy)

Abstract

OBJECTIVES—To characterize the indications for primary cesarean delivery in a large national cohort and to identify opportunities to lower the U.S. primary cesarean rate.

METHODS—A retrospective cohort study of the 38,484 primary cesarean deliveries among the 228,562 deliveries at sites participating in the Consortium on Safe Labor from 2002 to 2008.

RESULTS—The primary cesarean rate was 30.8% for primiparous women and 11.5% for multiparous women. The most common indications for primary cesarean delivery were failure to progress (35.4%), nonreassuring fetal heart rate tracing (27.3%), and fetal malpresentation (18.5%), although frequencies for each indication varied by parity. Among women with failure to progress, 42.6% of primiparous women and 33.5% of multiparous women never progressed beyond 5cm of dilation prior to delivery. Among women who reached the second stage of labor, 17.3% underwent cesarean delivery for arrest of descent before 2 hours and only 1.1% were given a trial of operative vaginal delivery. Of all primary cesarean deliveries, 45.6% were performed on primiparous women at term with a singleton fetus in cephalic presentation.

CONCLUSION—Using 6 cm as the cutoff for active labor, allowing adequate time for the second stage of labor, and encouraging operative vaginal delivery, when appropriate, may be important strategies to reduce the primary cesarean delivery rate. These actions may be particularly important in the primiparous woman at term with a singleton fetus in cephalic presentation.

INTRODUCTION

Cesarean delivery is the most common major surgical procedure performed in the United States (1). The total cesarean rate, defined as the percentage of cesarean deliveries out of all births in a given year, has risen dramatically since 1996; in 2009, 32.9% of all U.S. deliveries were by cesarean (2). The United States has one of the highest cesarean rates in the world (3). Cesarean delivery is associated with higher morbidity and mortality than vaginal births (4). Cesarean delivery also increases the risk of subsequent uterine rupture, placenta accreta, hemorrhage, hysterectomy, and maternal death (5,6). Safely lowering the

Corresponding author: Annelee Boyle, MD, Department of Obstetrics and Gynecology, MedStar Washington Hospital Center, 110 Irving Street, NW, Washington, DC 20010, telephone: 202-877-3067, fax: 202-877-5435, Annelee.C.Boyle@medstar.net.

Financial Disclosure: The authors did not report any potential conflicts of interest.

total cesarean rate is a stated objective of the U.S. Department of Health and Human Services (7).

Similar to the *total* cesarean rate, the *primary* cesarean rate, defined as the percentage of cesarean deliveries out of all births to women who have not had a previous cesarean delivery, has also increased. In 1996, the U.S. primary cesarean rate was 14.5%, while in 2007 it was 23.4%—an increase of more than 60% (8). The primary cesarean rate has become a major driver in the total cesarean rate. Using data from the Consortium on Safe Labor, Zhang et al found that having a prior uterine scar contributed most to the overall cesarean rate, accounting for 30.9% of all cesarean deliveries (9). Barber et al found that 50% of the increase in cesarean deliveries at their institution was attributed to an increase in primary cesarean deliveries (10). Understanding the factors leading to primary cesarean deliveries is essential to reducing the total cesarean rate.

Many factors have been cited for the increase in cesarean rate, including delayed childbearing, multiple gestations, increasing maternal obesity, maternal request, and physicians' fear of litigation (11–14). The majority of U.S. studies to quantify these factors have been limited by sample size or geography; the contribution of factors on a national scale is unclear. The objectives of this study were to characterize the indications for primary cesarean delivery in a large national cohort and to identify opportunities to lower the U.S. primary cesarean rate.

METHODS

The current study examined a subset of the data collected by the Consortium on Safe Labor, a large, multisite, retrospective cohort study of contemporary labor and delivery practice. The Consortium on Safe Labor collected detailed information from electronic medical records in 228,562 deliveries at 23 weeks of gestation or greater from 12 clinical centers, including 19 hospitals, from 2002 to 2008. Centers were selected based on numerous criteria, including their geographic location (9 states and the District of Columbia), which encompassed nine American Congress of Obstetricians and Gynecologists districts, and their use of electronic medical records. The centers transferred data to a data coordinating center where the data were mapped to common categories for predefined variables. Data inquiries, cleaning, and logic checking were performed by the data coordinating center. Validation studies confirmed a high level of accuracy. Concordance with the medical chart was greater than 95% for 16 of 20 variables examined; the lowest concordance was 91.1% for the clinical diagnosis of shoulder dystocia (9).

The data coordinating center mapped the indications for primary cesarean delivery into 15 predefined categories: failure to progress (arrest of dilation in the first stage of labor or arrest of descent in the second stage of labor) and cephalopelvic disproportion; nonreassuring fetal heart rate (FHR) tracing and fetal distress; fetal malpresentation; suspected fetal macrosomia; preeclampsia and eclampsia; chorioamnionitis; fetal anomaly; multiple gestation; obstetric factors (uterine rupture, cord prolapse, placenta previa, vasa previa, abruption, or other obstetric emergency); prior uterine scar (including hysterotomy or myomectomy); human immunodeficiency virus (HIV) and herpes simplex virus (HSV); history of shoulder dystocia; shoulder dystocia this pregnancy; elective; and other. Indications in the "elective" category included maternal request, multiparity, women desiring a tubal ligation, advanced maternal age, diabetes mellitus, human papilloma virus, postterm or postdates, pregnancy remote from term, group B streptococcus, polyhydramnios, fetal death, and social or religious concerns. "Other" indications included all maternal factors not elsewhere specified.

To obtain the cohort for this study, the 228,562 deliveries in the Consortium on Safe Labor database were limited to first-recorded deliveries (n=208,695) to avoid intraperson correlation. Women who had a vaginal delivery (n=142,592) or underwent a repeat cesarean delivery (n=27,619) were excluded, leaving 38,484 women who had a primary cesarean as the study sample.

We further examined the timing of delivery relative to the first and second stages of labor. For any woman who had failure to progress or cephalopelvic disproportion as an indication for cesarean delivery, dilation at the last recorded cervical examination was noted. For any woman who had arrest of descent, the time between full dilation and birth of the neonate was recorded and a note was made about any attempted trial of operative vaginal delivery. Other potential factors for a primary cesarean were also explored in more detail, including fetal presentation in twin gestations and the actual birth weight of any neonate for whom a cesarean was performed for suspected fetal macrosomia. For women who underwent labor induction, we calculated the simplified Bishop score as described by Laughon et al (15) using the recorded cervical examination from admission.

We grouped the indications for primary cesarean delivery into three hierarchical, mutually-exclusive categories using the criteria of Zhang et al (9): clinically indicated, mixed, and truly elective. In cases where more than one reason for cesarean delivery was given, and the reasons straddled categories, the delivery was placed in the higher-ranking category, where clinically indicated out ranked mixed, which, in turn, outranked truly elective.

We stratified the results by parity and, for primiparous women, we further stratified the results into deliveries at term (37 weeks of gestation and beyond) with a singleton in cephalic presentation. All analyses were performed using SAS version 9.1.3 (SAS Institute Inc., Cary, NC). While this study is primarily descriptive, the chi-squared test was used to compare the characteristics of primiparous and multiparous women, with $P<.05$ considered statistically significant.

Of the 38,484 records in our cohort, 76 (0.20 %) lacked information about maternal age, 1,700 (4.4%) lacked mother's race or ethnicity, and 7,843 (20.4%) lacked data on body mass index. Birth weight was missing in 514 cases (1.3%), including three charts where the indication for cesarean delivery was suspected fetal macrosomia. Sufficient data to calculate a simplified Bishop score were unavailable for 5,365 women (36.2%) who underwent labor induction, and no cervical examination was documented for 945 women (6.9%) who underwent a primary cesarean for labor arrest. The length of the second stage of labor could not be calculated for 329 women (11.3%) with a diagnosis of arrest of descent. For each variable, we compared demographics, medical histories, and labor characteristics of women for whom the variable was available and those for whom it was missing. While some differences were statistically significant, we concluded that there were no clinically significant differences.

The institutional review boards of all participating institutions, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, and the data coordinating center (The EMMES Corporation, Rockville, MD) approved the Consortium on Safe Labor project. The MedStar Washington Hospital Center institutional review board approved the current analysis of primary cesarean delivery using Consortium on Safe Labor data.

RESULTS

Of the 38,484 women in the study cohort, 28,116 (73.1%) were primiparous and 10,368 (27.0%) were multiparous. The overall primary cesarean rate was 21.3 % (38,484/181,076). Among the 91,208 primiparous women in the Consortium on Safe Labor database, 28,116

had a cesarean delivery and 63,092 had a vaginal delivery; thus, the primary cesarean rate for primiparous women was 30.8% (28,116/91,208). Among the 89,868 multiparous women who had not had a prior cesarean, 10,368 had a cesarean delivery and 79,500 had a vaginal delivery; thus, the primary cesarean rate for multiparous women was 11.5% (10,368/89,868).

The demographic characteristics of women who had a primary cesarean differed by parity (Table 1). Primiparous women were more likely to be younger, thinner, and have private health insurance than multiparous women; they were also more likely to be non-Hispanic white. The medical histories and labor characteristics of women who had a primary cesarean also differed by parity. Primiparous women were more likely to have hypertension and be undergoing labor induction, while multiparous women were more likely to have diabetes mellitus, have a multiple gestation, and deliver preterm.

The most common indications for primary cesarean delivery were failure to progress (35.4%), nonreassuring FHR tracing (27.3%), and fetal malpresentation (18.5%), although frequencies for each indication varied by parity (Table 2). For primiparous women, failure to progress was the most common indication (41.3%), followed by nonreassuring FHR tracing (23.4%) and fetal malpresentation (15.8%). For multiparous women, the most common indication was fetal malpresentation (25.8%), followed by nonreassuring FHR tracing (24.6%) and failure to progress (19.5%).

Among women who had a primary cesarean for failure to progress, 42.6% of primiparous women and 33.5% of multiparous women never progressed beyond 5cm of dilation prior to delivery (Table 3). Among women with a primary cesarean who reached the second stage of labor, 17.3% underwent cesarean delivery for arrest of descent before 2 hours and only 1.1% were given a trial of operative vaginal delivery (Table 4). Among women who had a primary cesarean for suspected fetal macrosomia, 97.3% of neonates had an actual birth weight of less than 5,000 grams, 80.3 % less than 4,500 grams, and 41.9% less than 4,000 grams.

Of the 91,208 primiparous women in the Consortium on Safe Labor database, 69,485 were at term with a singleton gestation in cephalic presentation; 17,531 of these women underwent a primary cesarean, yielding a primary cesarean rate of 25.2%. Primiparous women at term with a singleton gestation in cephalic presentation contributed 45.6% of the primary cesareans in the study cohort (17,531/38,484). The top three indications for primary cesarean delivery in this subgroup were failure to progress (53.2%), nonreassuring FHR tracing (27.5%), and elective (7.6%).

Multiple gestation was the stated indication for a primary cesarean in 1,187 women (3.1% of primary cesareans, involving 1,035 sets of twins and 152 higher-order multiples). In the 1,035 sets of twins where multiple gestation was a cited indication for cesarean delivery, both fetuses were in the cephalic presentation in 263 cases (25.4%); Twin A was cephalic and Twin B was noncephalic in 255 cases (24.6%); Twin A was noncephalic in 276 cases (26.7%); and presentation was not recorded in 241 cases (23.3%).

Among the 14,821 women (38.5%) who had a primary cesarean after undergoing labor induction, the most common indication for cesarean delivery was failure to progress (59.3% of primiparous women and 40.4% of multiparous women), followed by nonreassuring FHR tracing (27.4% of primiparous women and 37.5% of multiparous women). Cervical examination information was available for 9,456 women who had a primary cesarean after labor induction; 70.2% (69.9% of primiparous women and 71.9% of multiparous) had an unfavorable cervix (simplified Bishop score less than 5). The induction was elective for 10.4% of primiparous women and 17.3% of multiparous women with an unfavorable cervix.

When grouped into hierarchical, mutually-exclusive categories, 61.3% of all primary cesarean deliveries were considered clinically indicated (65.7% of primiparous women and 49.3% of multiparous women); 36.1% were mixed (31.6% of primiparous women and 48.2% of multiparous women); and 2.7% were truly elective (2.7% of primiparous women and 2.6% of multiparous women).

DISCUSSION

To identify opportunities to reduce the primary cesarean rate and, in turn, lower the total cesarean rate, it is logical to scrutinize the most common indications for primary cesarean delivery. Of the three most common indications in our study, failure to progress, nonreassuring FHR tracing, and fetal malpresentation, failure to progress is of particular interest as it strongly affected the cohort of primiparous women at term with a singleton gestation in cephalic presentation. Of all primary cesareans in our study, 45.6% were performed on primiparous women at term with a singleton fetus in cephalic presentation, supporting prior findings that the cesarean rate among primiparous women at term with a singleton gestation in cephalic presentation contributes substantially to the overall cesarean rate (16,17).

In a previous analysis of Consortium on Safe Labor data, Zhang et al concluded that 6 cm should be considered the start of the active phase of labor (18). In our cohort, 42.6% of primiparous women and 33.5% of multiparous women underwent a primary cesarean for failure to progress when the cervix was less than 6 cm dilated. From this we deduce that waiting longer for labor to progress could have a major effect on decreasing the primary cesarean rate.

Of women in our study diagnosed with prolonged second stage, 20.5% were delivered in less than 3 hours (for primiparous women) and less than 2 hours (for multiparous women) from the time of complete dilation. Only 1.1% of these women were given a trial of operative vaginal delivery. This supports the idea that conservatively managing the second stage of labor, by allowing adequate time and encouraging operative vaginal delivery, when appropriate, may also have a major effect on decreasing the primary cesarean rate.

The second most common indication for primary cesarean delivery in our study was nonreassuring FHR tracing. Finding opportunities to lower the primary cesarean rate by targeting cesareans performed for this reason is difficult because interpretation of nonreassuring FHR tracing is highly subjective and strongly influenced by obstetric practice. Moreover, our data were collected before the introduction of the three-tiered interpretation of FHR tracing (19). Thus a limitation of this study is that we were unable to quantify cesarean deliveries that were performed for nonreassuring FHR tracing but were likely avoidable.

The third most common indication for cesarean delivery in our cohort was fetal malpresentation. The American College of Obstetricians and Gynecologists advocates offering external cephalic version to patients with fetal malpresentation (20). Since attempted external cephalic versions were not captured in the Consortium on Safe Labor data, we could draw no conclusions about their effect on the primary cesarean rate.

Turning to the less common indications for cesarean delivery, elective cesareans are an obvious target for reducing the primary cesarean rate. Although the percentage of women who elected a primary cesarean was relatively small, presumably many of these cesareans could have been avoided. In at least one fourth of primary cesarean deliveries performed on women carrying twins, both twins were in cephalic presentation. In another one fourth, the presenting twin was in cephalic presentation. Some providers may have limited experience

with the management of a noncephalic second twin during vaginal delivery; as a consequence, patients and providers may opt for a primary cesarean delivery to avoid cesarean delivery of the second twin after vaginal delivery of the first. A possible opportunity to reduce the primary cesarean rate is to increase training in the delivery of the noncephalic second twin through the use of breech extraction or external cephalic version.

Recognizing that 38.5% of women in our cohort had a primary cesarean delivery after induction of labor, it is tempting to assert that avoiding labor induction could reduce the rate of primary cesarean delivery. However our data neither support nor refute this claim. Further research is needed into the relationship between labor induction and primary cesarean delivery, with women undergoing induction being compared to those who are expectantly managed at a given gestational age, not to those in spontaneous labor (21).

Among women in our cohort who had a cesarean for suspected fetal macrosomia, 97.3% of neonates had a birth weight of less than 5,000 grams. The American College of Obstetricians and Gynecologists does not recommend offering a cesarean until the suspected fetal weight is more than 4,500 grams in diabetics and more than 5,000 grams in nondiabetics (22). Our findings highlight the well-described limitations of antenatal diagnosis of estimated fetal weight, both clinical and ultrasound (22).

A strength of this study is inclusion of women from multiple institutions in 9 states and the District of Columbia, thus providing a diverse population. Limitations included incomplete medical records and reliance upon data entered into specified fields of electronic medical records. In addition, since more than one indication for cesarean delivery was given for 11.3% of women in our cohort, our ability to determine the primary indication was limited. A prior uterine scar was described in 4.2% of multiparous women and 1.4% of primiparous women, and we were unable to determine the reason for the uterine scar. For primiparous women, it was assumed that the scars represented prior myomectomies, but the higher rate among multiparous women suggests that some primary cesareans may have actually been repeat cesareans that were recorded incorrectly.

To summarize, in this large cohort of women undergoing primary cesarean delivery, examination of indications as recorded in the medical record reveals potential targets to reduce the primary cesarean rate and, in turn, lower the total cesarean rate. Chief among these are decreasing the number of cesarean deliveries done for failure to progress by using 6 cm as the cutoff for active labor when assessing failure to progress and conservatively managing the second stage of labor by allowing adequate time and encouraging operative vaginal delivery, when appropriate. These actions may be particularly important in the primiparous woman at term with a singleton fetus in cephalic presentation.

Acknowledgments

From the Consortium on Safe Labor, which was supported by the Intramural Research Program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, National Institutes of Health, through contract number HHSN267200603425C. For a list of institutions involved in the Consortium on Safe Labor see the appendix online at http://links.lww.com/xxx.

Funded in part with Federal funds (grant number UL1RR031975) from the National Center for Research Resources and the National Center for Advancing Translational Science, and the National Institutes of Health, through the Clinical and Translational Science Awards Program, a trademark of the U.S. Department of Health and Human Services, part of the Roadmap Initiative, *Reengineering the Clinical Research Enterprise*.

The views expressed in this article are those of the authors and do not necessarily reflect the views of the National Institutes of Health or the *Eunice Kennedy Shriver* National Institute of Child Health and Development.

References

1. Hall MJ, DeFrances CJ, Williams SN, Golosinskiy AG, Schwartzman A. National Hospital Discharge Survey: 2007 Summary. Natl Vital Stat Report. 2010; 29:1–24.
2. Martin JA, Hamilton BE, Ventura SJ, Osterman MJK, Kirmeyer S, Mathews TJ, et al. Births: Final Data for 2009. Natl Vital Stat Report. 2011; 60(1):1–35.
3. Organisation for Economic Co-operation and Development. OECD Health Data 2011 –Frequently Requested Data. Available at: http://www.oecd.org/document/16/0,3746,en_2649_33929_2085200_1_1_1_1,00.htmlRetrieved February 28, 2012
4. Brown HL. Informing the patient and the community about the implications of primary cesarean. Semin Perinatol. 2012; 36:403–6. [PubMed: 23009977]
5. Silver RM, Landon MB, Rouse DJ, Leveno KJ, Spong CY, Thom EA, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. Obstet Gynecol. 2006; 107:1226–32. [PubMed: 16738145]
6. Clark EA, Silver RM. Long-term maternal morbidity associated with repeat cesarean delivery. Am J Obstet Gynecol. 2011; 205:S2–10. [PubMed: 22114995]
7. U.S. Department of Health and Human Services. Healthy People 2020 Maternal, Infant, and Child Health Objectives. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=26. Retrieved November 26, 2012
8. MacDorman M, Declercq E, Menacker F. Recent trends and patterns in cesarean and vaginal birth after cesarean (VBAC) deliveries in the United States. Clin Perinatol. 2011; 38:179–92. [PubMed: 21645788]
9. Zhang J, Troendle J, Reddy UM, et al. for the Consortium on Safe Labor. Contemporary cesarean delivery practice in the United States. Am J Obstet Gynecol. 2010; 203:326.e1–10. [PubMed: 20708166]
10. Barber EL, Lundsberg LS, Belanger K, Pettker CM, Funai EF, Illuzzi JL. Indications contributing to the increasing cesarean delivery rate. Obstet Gynecol. 2011; 118:29–38. [PubMed: 21646928]
11. Joseph KS, Young DC, Dodds L, O'Connell CM, Allen VM, Chandra S, et al. Changes in maternal characteristics and obstetric practice and recent increases in primary cesarean delivery. Obstet Gynecol. 2003; 102:791–800. [PubMed: 14551010]
12. Kominiarek MA, Vanveldhuisen P, Hibbard J, Landy H, Haberman S, Learman L, et al. The maternal body mass index: a strong association with delivery route. Am J Obstet Gynecol. 2010; 203:264.e1–7. [PubMed: 20673867]
13. Habiba M, Kaminshi M, Da Frè M, Marsal K, Bleker O, Librero J, et al. Caesarean section on request: a comparison of obstetricians' attitudes in eight European countries. BJOG. 2006; 113:647–56. [PubMed: 16709207]
14. Murthy K, Grobman WA, Lee TA, Holl JL. Association between rising professional liability insurance premiums and primary cesarean delivery rates. Obstet Gynecol. 2007; 110:1264–9. [PubMed: 18055719]
15. Laughon SK, Zhang J, Troendle J, Sun L, Reddy UM. Using a simplified Bishop score to predict vaginal delivery. Obstet Gynecol. 2011; 117:805–11. [PubMed: 21383643]
16. Brennan DJ, Robson MS, Murphy M, O'Herlihy C. Comparative analysis of international cesarean delivery rates using 10-group classification identifies significant variation in spontaneous labor. Am J Obstet Gynecol. 2009; 201:308.e1–8. [PubMed: 19733283]
17. Main EK, Moore D, Farrell B, Schimmel LD, Altman RJ, Abrahams C, et al. Is there a useful cesarean birth measure? Assessment of the nulliparous term singleton vertex cesarean birth rate as a tool for obstetric quality improvement. Am J Obstet Gynecol. 2006; 194:1644–52. [PubMed: 16643812]
18. Zhang J, Landy HJ, Branch DW, et al. for the Consortium on Safe Labor. Contemporary patterns of spontaneous labor with normal neonatal outcomes. Obstet Gynecol. 2010; 116:1281–7. [PubMed: 21099592]
19. Macones GA, Hankins GDV, Spong CY, Hauth J, Moore T. The 2008 National Institute of Child Health and Human Development workshop report on electronic fetal monitoring: updates on

definitions, interpretation, and research guidelines. Obstet Gynecol. 2008; 123:661–6. [PubMed: 18757666]

20. The American College of Obstetricians and Gynecologists. ACOG Practice Bulletin 13 External Cephalic Version. Available at: http://www.acog.org/Resources_And_Publications/Practice_Bulletins/Committee_on_Practice_Bulletins_--_Obstetrics/External_Cephalic_Version. Retrieved November 26, 2012
21. Cheng YW, Kaimal AJ, Snowden JM, Nicholson JM, Caughey AB. Induction of labor compared to expectant management in low-risk women and associated perinatal outcomes. Am J Obstet Gyncol. 2012; 207:502.e1–8.
22. The American College of Obstetricians and Gynecologists. ACOG Practice Bulletin 22 Fetal Macrosomia. Available at: http://www.acog.org/Resources_And_Publications/Practice_Bulletins/Committee_on_Practice_Bulletins_--_Obstetrics/Fetal_Macrosomia. Retrieved November 26, 2012

Apendix 1. Institutions in the Consortium on Safe Labor

Institutions involved in the Consortium include the following, in alphabetical order: Baystate Medical Center, Springfield, MA; Cedars-Sinai Medical Center Burnes Allen Research Center, Los Angeles, CA; Christiana Care Health System, Newark, DE; The EMMES Corporation (Data Coordinating Center), Rockville, MD; Indiana University Clarian Health, Indianapolis, IN; Intermountain Healthcare and the University of Utah, Salt Lake City, UT; Maimonides Medical Center, Brooklyn, NY; MedStar Georgetown University Hospital, Washington, DC; MetroHealth Medical Center, Cleveland, OH; Summa Health System, Akron City Hospital, Akron, OH; University of Illinois at Chicago, Chicago, IL; University of Miami, Miami, FL; and University of Texas Health Science Center at Houston, Houston, TX.

Table 1

Demographics, Medical Histories, and Labor Characteristics of Women With Primary Cesarean Delivery, Stratified by Parity

	Total (n = 38,484)	Primiparous Women (n = 28,116)	Multiparous Women (n = 10,368)	*P**
Age, y (missing data = 76)				
Younger than 20	3,875 (10.1)	3,674 (13.1)	201 (1.9)	<0.001
20–24	8,797 (22.9)	7,231 (25.8)	1,566 (15.1)	
25–29	9,535 (24.8)	6,785 (24.2)	2,750 (26.6)	
30–34	8,725 (22.7)	5,836 (20.8)	2,889 (27.9)	
35 or older	7,476 (19.5)	4,534 (16.2)	2,942 (28.4)	
Race or ethnicity (missing data = 1,700)				
Non-Hispanic white	17,600 (47.9)	13,434 (50.0)	4,166 (41.9)	<0.001
Non-Hispanic black	9,704 (26.4)	6,524 (24.3)	3,180 (32.0)	
Hispanic	6,595 (17.9)	4,625 (17.2)	1,970 (19.8)	
Asian or Pacific Islanders	1,809 (4.9)	1,479 (5.5)	330 (3.3)	
Other	1,076 (2.9)	782 (2.9)	294 (3.0)	
BMI at delivery, kg/m^2 (missing data = 7,843)				
Less than 25.0	3,267 (10.7)	2,459 (10.9)	808 (9.9)	<0.001
25.0–29.9	9,924 (32.4)	7,564 (33.7)	2,360 (28.9)	
30.0–34.9	8,707 (28.4)	6,318 (28.1)	2,389 (29.2)	
35.0–39.9	4,725 (15.4)	3,344 (14.9)	1,381 (16.9)	
40.0 or more	4,018 (13.1)	2,789 (12.4)	1,229 (15.1)	
Diabetes mellitus				
None	35,306 (91.7)	26,012 (92.5)	9,294 (89.6)	<0.001
Preexisting	1,402 (3.6)	927 (3.3)	475 (4.6)	
Gestational	1,776 (4.6)	1,177 (4.2)	599 (5.8)	
Hypertension				
None	32,466 (84.4)	23,556 (83.8)	8,910 (85.9)	<0.001
Unspecified HTN	444 (1.2)	359 (1.3)	85 (0.8)	
Chronic HTN	1,215 (3.2)	798 (2.8)	417 (4.0)	
Gestational HTN	1,049 (2.7)	854 (3.0)	195 (1.9)	
Preeclampsia or HEELP syndrome	2,594 (6.7)	2,058 (7.3)	536 (5.2)	
Chronic HTN with superimposed preeclampsia	645 (1.7)	440 (1.6)	205 (2.0)	
Eclampsia	71 (0.2)	51 (0.2)	20 (0.2)	
Gestational age, wk				
Less than 28	1,113 (2.9)	644 (2.3)	469 (4.5)	<0.001
28–32	2,141 (5.6)	1,288 (4.6)	853 (8.2)	
33–36	5,057 (13.1)	3,171 (11.3)	1,886 (18.2)	
37–38	10,017 (26.0)	6,996 (24.9)	3,021 (29.1)	

	Total (n = 38,484)	Primiparous Women (n = 28,116)	Multiparous Women (n = 10,368)	P*
39–41	19,794 (51.4)	15,739 (56.0)	4,055 (39.1)	
More than 41	362 (0.9)	278 (1.0)	84 (0.8)	
Birth weight, g (missing data = 514)				
Less than 500	108 (0.3)	70 (0.2)	38 (0.3)	
500–999	1,193 (2.9)	735 (2.5)	458 (4.1)	
1,000–1,499	1,514 (3.7)	936 (3.2)	578 (5.1)	
1,500–1,999	2,234 (5.5)	1,382 (4.7)	852 (7.6)	
2,000–2,499	3,725 (9.1)	2,415 (8.2)	1,310 (11.6)	
2,500–2,999	7,278 (17.9)	5,187 (17.6)	2,091 (18.6)	<0.001
3,000–3,499	11,958 (29.3)	9,186 (31.2)	2,772 (24.6)	
3,500–3,999	8,957 (22.0)	6,889 (23.4)	2,068 (18.4)	
4,000–4,499	3,075 (7.6)	2,242 (7.6)	833 (7.4)	
4,500–4,999	616 (1.5)	381 (1.3)	235 (2.1)	
5,000 or more	86 (0.2)	49 (0.2)	37 (0.3)	
Delivering institution				
University-affiliated teaching hospital	19,874 (51.6)	14,608 (52.0)	5,266 (50.8)	
Teaching community hospital	16,720 (43.5)	12,155 (43.2)	4,565 (44.0)	0.075
Nonteaching community hospital	1,890 (4.9)	1,353 (4.8)	537 (5.2)	
Health insurance				
Private	21,257 (55.2)	15,992 (56.9)	5,265 (50.8)	
Public	13,783 (35.8)	9,335 (33.2)	4,448 (42.9)	<0.001
Other or unknown	3,444 (9.0)	2,789 (9.9)	655 (6.3)	
Number of fetuses				
Singleton	35,843 (93.1)	26,510 (94.3)	9,333 (90.0)	
Twins	2,474 (6.4)	1,504 (5.4)	970 (9.4)	<0.001
Higher-order multiples	167 (0.4)	102 (0.4)	65 (0.6)	
Type of labor				
Prelabor cesarean delivery	10,342 (26.9)	6,579 (23.4)	3,763 (36.3)	
Spontaneous labor	13,321 (34.6)	9,562 (34.0)	3,759 (36.3)	<0.001
Induced labor	14,821 (38.5)	11,975 (42.6)	2,846 (27.5)	
Time from admission to delivery, h				
Less than 12	19,370 (52.5)	12,663 (46.7)	6,707 (69.8)	
12–23.9	10,817 (29.3)	9,028 (33.3)	1,789 (18.3)	
24–35.9	3,703 (10.0)	3,235 (11.9)	468 (4.8)	<0.001
36–47.9	1,196 (3.2)	973 (3.6)	223 (2.3)	
48 or more	1,782 (4.8)	1,214 (4.5)	568 (5.8)	

BMI, body mass index; HTN, hypertension; HELLP, hemolysis, elevated liver enzymes, and low platelet count.

Data are n (%) unless otherwise specified.

*Primiparous women compared with multiparous women.

Table 2

Indications For Primary Cesarean Delivery [*]

	Total (n = 38,484)	Primiparous Women (n = 28,116)	Multiparous Women (n = 10,368)
Failure to progress or cephalopelvic disproportion	13,635 (35.4)	11,616 (41.3)	2,019 (19.5)
Nonreassuring fetal heart rate tracing or fetal distress	9,123 (23.7)	6,569 (23.4)	2,554 (24.6)
Fetal malpresentation	7,125 (18.5)	4,453 (15.8)	2,672 (25.8)
Preeclampsia or eclampsia	1,306 (3.4)	1,004 (3.6)	302 (2.9)
Multiple gestation	1,187 (3.1)	702 (2.5)	485 (4.7)
Suspected fetal macrosomia	1,159 (3.0)	776 (2.8)	383 (3.7)
Obstetric factors [†]	1,054 (2.7)	475 (1.7)	579 (5.6)
Elective [‡]	1,028 (2.7)	756 (2.7)	272 (2.6)
Fetal anomaly	874 (2.3)	543 (1.9)	331 (3.2)
Prior uterine scar	829 (2.2)	390 (1.4)	439 (4.2)
HIV or HSV	396 (1.0)	233 (0.8)	163 (1.6)
Chorioamnionitis	349 (0.9)	290 (1.0)	59 (0.6)
History of shoulder dystocia	31 (0.08)	0 (0)	31 (0.3)
Shoulder dystocia (this pregnancy)	12 (0.03)	3 (0.01)	9 (0.09)
Other [§]	3,501 (9.1)	2,403 (8.6)	1,098 (10.6)

HIV, human immunodeficiency virus; HSV, herpes simplex virus.

Data are n (%).

[*] Of all women, 11.3% had more than one stated indication; thus totals are more than 100%.

[†] Obstetric factors are uterine rupture, cord prolapse, placenta previa, vasa previa, abruption or other obstetric emergency.

[‡] Elective indications include maternal request, multiparity, those who desired a tubal ligation, advanced maternal age, diabetes mellitus, human papilloma virus, postterm or postdates, remote from term, group B streptococcus, polyhydramnios, fetal death, and social or religious concerns.

[§] Other indications included all maternal indications not elsewhere specified.

Table 3

Last Recorded Cervical Dilation Among Women Undergoing Primary Cesarean Delivery For Failure to Progress or Cephalopelvic Disproportion

Cervical Dilation	Total (n = 13,635)	Primiparous Women (n = 11,616)	Multiparous Women (n = 2,554)
Less than 6 cm	5,629 (41.3)	4,953 (42.6)	676 (33.5)
6–9 cm	4,142 (30.4)	3,363 (29.0)	779 (38.6)
10 cm (second stage)	2,919 (21.4)	2,546 (21.9)	373 (18.5)
No dilation recorded	945 (6.9)	754 (6.5)	191 (9.5)

Data are n (%).

Table 4

Duration of Second Stage and Failed Operative Delivery Among Women With a Primary Cesarean Delivery For Arrest of Descent

	Total (n = 2,919)	Primiparous Women (n = 2,546)	Multiparous Women (n = 373)
Less than 2 h	505 (17.3)	390 (15.3)	115 (30.8)
2–2.9 h	614 (21.0)	521 (20.5)	93 (24.9)
3–3.9 h	587 (20.1)	535 (21.0)	52 (13.9)
4 or more h	884 (30.3)	817 (32.1)	67 (18.0)
Not recorded	329 (11.3)	283 (11.1)	46 (12.3)
Failed operative delivery	33 (1.1)	30 (1.2)	3 (0.8)

Data are n (%).