Original Research

Trends in Spontaneous and Indicated Preterm Delivery Among Singleton Gestations in the United States, 2005–2012

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OBJECTIVE: For the first time in decades, the rate of U.S. preterm delivery has declined consistently since 2005. Recent nationwide policies enforcing elective delivery at or beyond 39 weeks of gestation suggest this decrease may be the result of changes in practice patterns; however, this is not known. Thus, we sought to evaluate whether the decline in preterm delivery was the result of a decrease in indicated or spontaneous preterm delivery and to assess this decrease by race and ethnicity.

METHODS: This was a population-based retrospective analysis using U.S. vital statistics data restricted to singleton live births from 2005 to 2012. The main outcome measures were overall, indicated, and spontaneous preterm delivery rates. Preterm deliveries were defined as births from 24 to 36 weeks of gestation. We used an algorithm to designate births as indicated or spontaneous. Gestational age was further grouped into early preterm (24–31 weeks of gestation), moderate preterm (32–34 weeks of gestation), late preterm (34–36 weeks of gestation), early term (37–38 weeks of gestation), full term (39–40 weeks of gestation), late term (41 weeks of gestation), and postterm (42–44 weeks of gestation). Analyses were based on the best obstetric estimate of gestational age.

RESULTS: Of 19,984,436 included births, the spontaneous preterm delivery rate declined by 15.4% between 2005 (5.3%) and 2012 (4.5%), whereas indicated preterm delivery rates declined by 17.2% (3.9 to 3.2%). The largest decline was in the postterm pregnancies (−38.5%) followed by early term (−19.1%), early preterm (−17.1%), moderate preterm (−12.4%), and late preterm (−15.8%) with concurrent increases in full term (+14.3%) and late term (+18.7%) gestations. The patterns were similar across race groups.

CONCLUSION: The noted decline in preterm delivery rates is accompanied by a concurrent decline in both spontaneous and indicated preterm deliveries of almost equal magnitudes.

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LEVEL OF EVIDENCE: II

For the first time in more than two decades, the rate of preterm delivery has consistently declined every year since 2005 in the United States.[1] Despite this decline, the proportion of women who deliver preterm remains high compared with other developed nations.[2] The onset of preterm delivery is from one of two antecedent causes: indicated preterm delivery, which results after labor is induced or cesarean delivery performed for maternal or fetal indications, or spontaneous preterm delivery, which can be subgrouped into preterm labor with intact membranes and preterm premature rupture of membranes (PROM).[3]

Recent nationwide policies enforcing elective delivery at or beyond 39 weeks of gestation suggest that the decrease in preterm delivery may be the result of changes in practice patterns advocating for pregnancy prolongation when possible, leading to a decline in indicated preterm deliveries. However, the introduction of progesterone therapies to decrease the rate of recurrent preterm delivery may have led to a decline in spontaneous preterm deliveries.[4,5] Understanding the

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reasons for the overall decline may help reinforce effective clinical practices and hopefully continue this downward trend. Furthermore, it is well known that race and ethnic disparities are associated with preterm delivery, yet the decline in preterm delivery rates within race and ethnicity subgroups also remains poorly described. Thus, we sought to describe the decline in preterm delivery in women with singleton gestations by indication for preterm delivery and by race and ethnicity.

MATERIALS AND METHODS

This is a population-based, cross-sectional analysis of singleton live births in the United States. We used U.S. vital statistics data based on the 2003 revision of the live birth certificates and restricted the analyses to women who delivered singleton live births from 2005 to 2012. In comparison to the 1989 revision, the 2003 revision of birth certificates contains greater detail enabling the assignment of preterm deliveries to their subtypes. The revised birth certificates were incorporated at different timeframes by different states. The revised birth certificate was used by 12 states in 2005 (Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York [excluding New York City], Pennsylvania, South Carolina, Tennessee, Texas, and Washington), 19 states in 2006 (adding California, Delaware, North Dakota, South Dakota, Ohio, Vermont, and Wyoming), 22 states in 2007 (adding Colorado, Indiana, and Iowa), 28 states in 2008 (adding Georgia, Michigan, Montana, New Mexico, and Oregon as well as New York City), 29 states in 2009 (adding Utah), 34 states plus the District of Columbia in 2010 (adding Illinois, Maryland, Missouri, Nevada, and Oklahoma), 37 states in 2011 (adding Louisiana, North Carolina, and Wisconsin), and all states in 2012. Thus, although the denominator of all births varies from year to year, the proportion of preterm deliveries should remain unaffected as a result of the differing number of births. Twins and higher-order multiples and pregnancies ending at less than 24 weeks of gestation were excluded. All analyses were based on the best obstetric estimate of gestational age. Because these are publically available, deidentified data, this study was exempt from institutional review board approval.

We used a prior algorithm to identify indicated and spontaneous preterm deliveries.[6,7] In the absence of ruptured membranes, women who had a check-box indication of a labor induction, a cesarean delivery at less than 37 weeks of gestation, or both were classified as "indicated" delivery. All other preterm deliveries were classified as spontaneous. Preterm deliveries were defined as births from 24 to 36 completed weeks of gestation. Temporal changes in the rate of preterm deliveries as well as the corresponding rates of indicated and spontaneous preterm deliveries were analyzed between 2005 and 2012.

We carried out two additional sets of analyses. In the first analysis, we examined changes in preterm delivery rates between 2005 and 2012 with gestational age at delivery grouped as follows: early preterm (24–31 weeks of gestation), moderate preterm (32–34 weeks of gestation), late preterm (34–36 weeks of gestation), early term (37–38 weeks of gestation), full term (39–40 weeks of gestation), late term (41 weeks of gestation), and postterm (42–44 weeks of gestation). In the second analysis, we examined trends in preterm deliveries within subgroups of maternal race or ethnicity defined as African American, Caucasian, Hispanic, and women of other ethnicities.

RESULTS

There were 33,204,114 births identified between 2005 and 2012 (Fig. 1). Of these births, we sequentially excluded births that were based on the 1989 revision of birth certificates, multiple births, births with missing gestational age based on the best obstetric estimate, and births that were delivered at less than 24 and 45 weeks of gestation or greater. After all exclusions, 19,984,436 singleton live births remained for analysis.

Maternal demographic characteristics of the women are described in Table 1. When compared

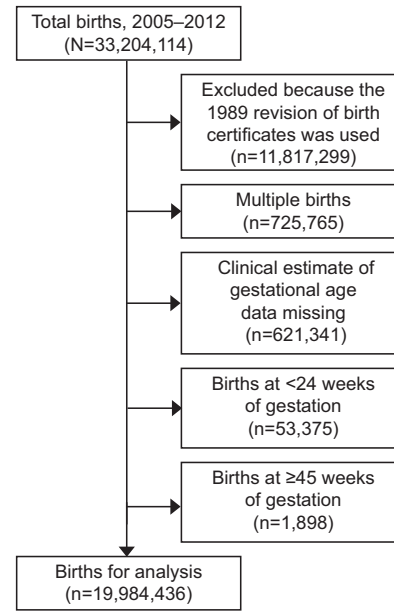

Fig. 1. Flow diagram of included births, 2005–2012.

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Table 1. Change in the Distribution of Maternal Risk Factors for Preterm Delivery Between 2005 and 2012 Among Singleton Live Births in the United States

Characteristic	Total Births in 2005–2012 (N=19,984,436)	Births in 2005 (n=1,230,127)	Births in 2012 (n=3,361,439)	RR (95% CI)
Maternal age (y)				
Younger than 20	1,926,932 (9.6)	136,042 (11.1)	262,229 (7.8)	0.74 (0.73–0.75)
20–24	4,921,624 (24.6)	324,583 (26.4)	784,475 (23.3)	0.92 (0.91–0.92)
25–29	5,675,409 (28.4)	336,906 (27.4)	964,587 (28.7)	1.00 (reference)
30–34	4,663,403 (23.3)	270,890 (22.0)	857,910 (25.5)	1.06 (1.05–1.06)
35–39	2,264,741 (11.3)	132,530 (10.8)	396,097 (11.8)	1.03 (1.02–1.04)
40 or older	532,327 (2.7)	29,176 (2.4)	96,101 (2.9)	1.14 (1.12–1.15)
Primigravida	6,704,188 (33.6)	407,443 (33.1)	1,115,625 (33.2)	1.00 (0.99–1.01)
Education (y)				
Less than 8	1,049,747 (5.3)	77,089 (6.3)	140,227 (4.2)	0.60 (0.59–0.61)
8–11	8,174,355 (40.9)	539,938 (43.9)	1,261,385 (37.5)	0.90 (0.89–0.91)
12–15	8,798,316 (44.0)	516,605 (42.0)	1,576,817 (46.9)	0.96 (0.95–0.96)
16 or greater	1,962,018 (9.8)	96,495 (7.8)	383,010 (11.4)	1.00 (reference)
Race or ethnicity				
Caucasian	11,817,969 (59.1)	734,334 (59.7)	2,046,834 (60.9)	1.00 (reference)
African American	2,705,218 (13.5)	164,718 (13.4)	484,568 (14.4)	1.05 (1.04–1.05)
Hispanic	5,310,181 (26.6)	325,500 (26.5)	803,128 (23.9)	0.92 (0.91–0.93)
Other ethnicity	151,068 (0.8)	5,575 (0.5)	26,909 (0.8)	1.72 (1.67–1.77)
Single marital status	8,113,563 (40.6)	460,483 (37.4)	1,370,773 (40.8)	1.09 (1.08–1.09)
Smoking during pregnancy	1,713,159 (9.8)	124,797 (12.4)	278,930 (8.7)	0.71 (0.70–0.71)

RR, risk ratio; CI, confidence interval.
Data are n (%) unless otherwise specified.

with women delivering in 2005, those who delivered in 2012 were more likely to be older, have achieved a higher level of education, and be of African American or "other" race or ethnicity (Table 1). Although both spontaneous and indicated preterm deliveries decreased during this period (15.4% compared with 17.2%, respectively), the decrease was more marked for indicated preterm delivery (P=.049; Table 2). However, the ratio of indicated to spontaneous preterm deliveries remained fairly constant between 2005 and 2012.

Among preterm deliveries, the largest decline was in the early preterm group (−17.1%) followed by late preterm (−15.8%) and moderate preterm (−12.4%) (P<.001; Fig. 2). When analyzing birth rates by all gestational age groups from 24 weeks of gestation onward, the declines noted in the delivery rates occurring in the early preterm, moderate preterm, late preterm, early term, and postterm (−38.5%) periods were accompanied by a concurrent increase in full term (+14.3%) and late term (+18.7%) births (Fig. 2).

Table 2. Changes in Rates of Indicated and Spontaneous Preterm Delivery: U.S. Singleton Live Births, 2005–2012

Year	Total Singleton Live Births	Preterm Delivery	Indicated Preterm Delivery	Spontaneous Preterm Delivery	% of Indicated Preterm Deliveries
2005	1,230,127 (6.2)	112,437 (9.1)	47,321 (3.9)	65,116 (5.3)	43
2006	1,464,502 (7.3)	133,146 (9.1)	55,646 (3.8)	77,500 (5.3)	42
2007	2,297,993 (11.5)	196,534 (8.6)	82,581 (3.6)	113,953 (5.0)	42
2008	2,664,166 (13.3)	224,435 (8.4)	93,155 (3.5)	131,280 (4.9)	42
2009	2,718,582 (13.6)	221,446 (8.2)	93,246 (3.4)	128,200 (4.7)	41
2010	2,980,569 (14.9)	237,257 (8.0)	99,803 (3.4)	137,454 (4.6)	43
2011	3,267,058 (16.4)	253,563 (7.8)	105,442 (3.2)	148,121 (4.5)	41
2012	3,361,439 (16.8)	259,483 (7.7)	108,016 (3.2)	151,467 (4.5)	42
Change 2005–2012		−15.5 (−16.1 to −15.0)	−17.2 (−18.3 to −16.3)	−15.4 (−16.2 to −14.8)	

Data are n (%) or % (95% confidence interval) unless otherwise specified.
Change in preterm delivery rate between 2005 and 2012 was different between indicated and spontaneous preterm delivery rates (P<.05).

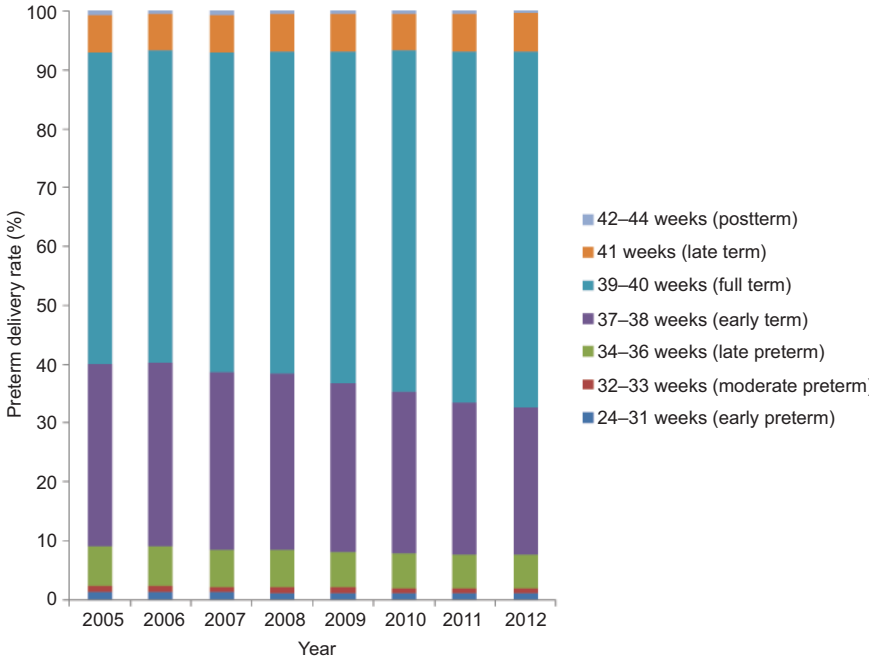

Fig. 2. Temporal changes in the distribution of deliveries based on gestational age: U.S. singleton live births, 2005–2012. Rates, shown on a logarithmic scale, were all calculated proportionate to the index year of 2005.

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Of particular interest in the past several years is late preterm delivery. The overall rate of late preterm delivery (34–36 weeks of gestation) decreased from 6.9% in 2005 to 5.8% in 2012. For this group we found a greater decline in indicated (17.8%) compared with spontaneous (14.2%) late preterm delivery (P=.009).

Because of the known health disparities regarding race and ethnicity and preterm delivery rates, we chose to assess whether the decrease in preterm delivery was noted across racial and ethnic groups. Of the racial and ethnic breakdown of births in our study period, 59.1% were Caucasian, 13.5% were African American, 26.6% were Hispanic, and 0.8% were "other." Figure 3 shows the decline in preterm delivery rate by race and ethnicity and year. The most marked decline was in the "other" race or ethnicity category (−23.9%) followed by African American (−15.5%), Caucasian (−15.3%), and Hispanics (−14.7%) (P=.005). Although the proportion of preterm deliveries decreased in a similar fashion for both spontaneous and indicated preterm deliveries among Caucasians and Hispanics, there was a greater decrease in spontaneous preterm delivery compared with indicated preterm delivery for African Americans (−14.8% compared with −10.7%) and for the "other" race or ethnicity group (−32.0% compared with −3.4%) (Table 3). When assessed by antecedent for preterm delivery (spontaneous compared with indicated), both Caucasians and African Americans showed decreases by subtype.

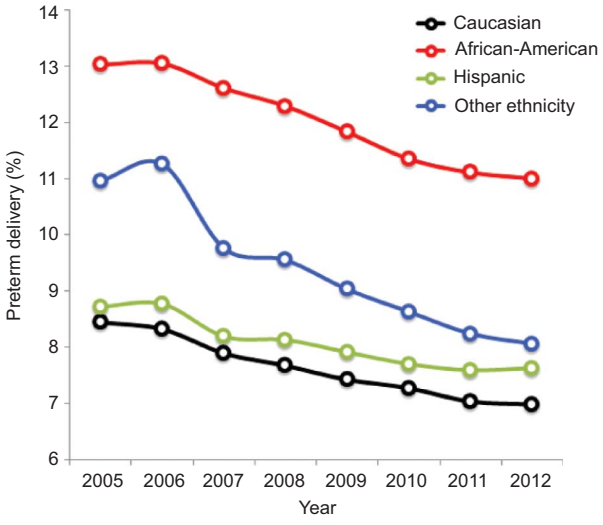

Fig. 3. Race and ethnicity-specific trends in preterm delivery rates in the United States among singleton live births, 2005–2012.

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DISCUSSION

We found that the decline in preterm delivery rates between 2005 and 2012 in the United States resulted from concurrent declines of both spontaneous and indicated preterm deliveries of almost equal magnitudes. Based on a PubMed search of the literature from January 2007 to August 2014 incorporating the search

Table 3. Changes in the Rate of Preterm Delivery Between 2005 and 2012 by Maternal Race and Ethnicity: U.S. Singleton Live Births

	Preterm Delivery at Less Than 37 Weeks of Gestation		Change Between 2005 and 2012	
Preterm Delivery	2005	2012	Unadjusted	Adjusted
All preterm deliveries	112,437 (9.1)	259,483 (7.7)	−15.5 (−16.1 to −15.0)	−15.0 (−15.6 to −14.4)
Indicated	47,321 (3.9)	108,016 (3.2)	−17.2 (−18.3 to −16.3)	−18.7 (−19.6 to −17.8)
Spontaneous	65,116 (5.3)	151,467 (4.5)	−15.4 (−16.2 to −14.8)	−13.4 (−14.2 to −12.6)
Caucasian women	61,983 (8.4)	142,705 (7.0)	−17.4 (−18.1 to −16.6)	−15.3 (−16.1 to −14.6)
Indicated	26,248 (3.6)	58,880 (2.9)	−20.2 (−21.3 to −19.0)	−19.3 (−20.3 to −17.9)
Spontaneous	35,735 (4.9)	83,825 (4.1)	−16.5 (−17.5 to −15.4)	−13.5 (−14.6 to −12.4)
African American women	21,473 (13.0)	53,306 (11.0)	−15.6 (−16.9 to −14.4)	−15.5 (−16.7 to −14.1)
Indicated	8,749 (5.3)	22,458 (4.6)	−14.0 (−16.1 to −11.9)	−17.7 (−19.7 to −15.6)
Spontaneous	12,724 (7.7)	30,848 (6.4)	−18.2 (−19.8 to −16.5)	−15.4 (−17.1 to −13.6)
Hispanic women	28,370 (8.7)	61,304 (7.6)	−12.4 (−13.5 to −11.2)	−14.7 (−16.0 to −13.5)
Indicated	12,143 (3.7)	25,787 (3.2)	−14.4 (−16.2 to −12.6)	−20.4 (−22.2 to −18.6)
Spontaneous	16,227 (5.0)	35,517 (4.4)	−11.8 (−13.4 to −10.2)	−11.3 (−13.0 to −9.6)
Other race or ethnicity	611 (11.0)	2,168 (8.1)	−26.5 (−32.5 to −20.0)	−23.9 (−30.4 to −16.8)
Indicated	181 (3.3)	891 (3.3)	−1.2 (−15.5 to 15.6)	−3.0 (−17.7 to 14.2)
Spontaneous	430 (7.7)	1,277 (4.8)	−38.4 (−44.6 to −31.6)	−34.2 (−41.2 to −26.5)

Data are n (%) or % (95% confidence interval).
The total number of births in 2005 and 2012 was 1,230,127 and 3,361,439, respectively.
The change in preterm delivery rates was adjusted for maternal age, single marital status, maternal education, and smoking during pregnancy.

terms "preterm birth," "preterm delivery," "decline," "decrease," "antecedents," and "etiology," this is the first article to examine antecedents to the recent temporal decline in the rate of preterm delivery. Furthermore, this temporal decline was noted in all racial and ethnic groups.

Of particular importance to the decline in preterm delivery is the decrease in late preterm delivery of 15.8%. We initially hypothesized that the decline in overall preterm delivery rates would be driven by a decline in late preterm delivery. This was not the case because the largest relative decline was seen in the very early preterm group. However, because late preterm delivery comprises the largest proportion of preterm delivery, any reduction in this group will have a large effect on overall preterm delivery rates.

Our study period, 2005–2012, is an important one in the history of obstetrics, particularly as it relates to preterm delivery. During this time period we began to understand neonatal morbidities related to late preterm and early term birth such that authorities such as the American College of Obstetricians and Gynecologists and the March of Dimes advocated against elective deliveries under 39 weeks of gestation.[8] Furthermore, we began to realize that many of these deliveries were elective[9–11]; thus, the morbidities associated with these deliveries were potentially avoidable. The decline in indicated preterm delivery is likely related to this cascade of events. Our study period was also important in that the use of progestogens became commonplace in the prevention of preterm delivery both for women with a prior preterm delivery and for those with an incidental finding of short cervix. The literature is replete with well-designed randomized trials, such as the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development's Meis study[12] or the U.K. study by Fonseca and collaborators,[13] that show progestogens in select populations will decrease the rate of preterm delivery in at-risk women.[12–15] Further studies of actual use of 17 alpha-hydroxyprogesterone caproate have found that the drug performed in a similar fashion to clinical trial data.[12,16] The authors further show that the reduction of recurrent preterm delivery by 17 alpha-hydroxyprogesterone caproate was similar among black compared with non-black women,[16] supporting the findings of our study. Taken together, these data support our findings that preterm delivery has been reduced both by a reduction in spontaneous and indicated preterm delivery. The effect of both on the reduction of preterm delivery will have a major public health effect that is yet to be understood in terms of health care dollars.

Our study has a few limitations that deserve discussion. Population-based cohorts such as those derived from U.S. Vital Statistics data are known to be

limited with respect to details related to each included pregnancy. Thus, ascertaining specifics such as whether a delivery was elective is difficult.[17] Nevertheless, we were able to discriminate indicated compared with spontaneous labor by whether the labor was induced or a nonlabor cesarean delivery was performed. When either of these situations occurred, the delivery was considered "indicated." We acknowledge that some women with preterm PROM may require induction of labor or may undergo nonlabored cesarean delivery in the setting of malpresentation, and it is accepted that delivery after preterm PROM is classified as spontaneous preterm birth. However, this potential misclassification of preterm PROM as indicated preterm birth only further supports that spontaneous preterm birth is declining. Finally, race and ethnicity are divided into four categories that do not fully represent the racial and ethnic diversity within the United States. We are limited in describing the "other" category, where the largest decreases were noted.

There are also several strengths to this study. Our sample size is large. Any smaller sample from a single-center or multicenter review, whether prospective or retrospective, would be generalizable only to the studied population. Our data provide a wider snapshot of trends in preterm delivery in the United States. The large sample size also allows us to detect more subtle, yet clinically relevant, changes than smaller studies would. Regardless of the limitations related to birth certificate data, we feel this is the best mechanism to understand these important changes in preterm delivery rates at the population level.

In summary, we found that the decrease in preterm delivery over our 7-year study period was related both to a decrease in spontaneous as well as indicated preterm delivery. Factors driving this decline remain poorly understood. Understanding the mechanisms that led to the decrease in spontaneous preterm delivery will be important to further affect preterm delivery rates. Once these mechanisms are revealed, incorporating the broadest eligible group should be a health care priority. Finally, understanding the origins of the decline in indicated preterm delivery is important. Knowledge of whether this may be that truly indicated preterm delivery is on the decline or whether possible misclassification of elective preterm delivery as indicated has decreased will help to further guide clinicians in decreasing preterm delivery rates.

REFERENCES

1. Hamilton BE, Martin JA, Ventura SJ. Births: preliminary data for 2012. Natl Vital Stat Rep 2013;62:1–20.
2. Zeitlin J, Szamotulska K, Drewniak N, Mohangoo AD, Chalmers J, Sakkeus L, et al. Preterm birth time trends in Europe: a study of 19 countries. BJOG 2013;120:1356–65.
3. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. Lancet 2008;371:75–84.
4. Use of progesterone to reduce preterm birth. ACOG Committee Opinion No. 419. American College of Obstetricians and Gynecologists. Obstet Gynecol 2008;112:963–5.
5. Petrini JR, Callaghan WM, Klebanoff M, Green NS, Lackritz EM, Howse JL, et al. Estimated effect of 17 alpha-hydroxyprogesterone caproate on preterm birth in the United States. Obstet Gynecol 2005;105:267–72.
6. Ananth CV, Joseph KS, Oyelese Y, Demissie K, Vintzileos AM. Trends in preterm birth and perinatal mortality among singletons: United States, 1989 through 2000. Obstet Gynecol 2005;105:1084–91.
7. Lisonkova S, Hutcheon JA, Joseph KS. Temporal trends in neonatal outcomes following iatrogenic preterm delivery. BMC Pregnancy Childbirth 2011;11:39.
8. Nonmedically indicated early term deliveries. Committee Opinion No. 561. American College of Obstetricians and Gynecologists. Obstet Gynecol 2013;121:911–5.
9. Tita AT, Landon MB, Spong CY, Lai Y, Leveno KJ, Varner MW, et al. Timing of elective repeat cesarean delivery at term and neonatal outcomes. N Engl J Med 2009;360:111–20.
10. Clark SL, Miller DD, Belfort MA, Dildy GA, Frye DK, Meyers JA. Neonatal and maternal outcomes associated with elective term delivery. Am J Obstet Gynecol 2009;200:156.e1–4.
11. Reddy UM, Ko CW, Raju TN, Willinger M. Delivery indications at late-preterm gestations and infant mortality rates in the United States. Pediatrics 2009;124:234–40.
12. Meis PJ, Klebanoff M, Thom E, Dombrowski MP, Sibai B, Moawad AH, et al. Prevention of recurrent preterm delivery by 17 alpha-hydroxyprogesterone caproate. N Engl J Med 2003;348:2379–85.
13. Fonseca EB, Celik E, Parra M, Singh M, Nicolaides KH; Fetal Medicine Foundation Second Trimester Screening Group. Progesterone and the risk of preterm birth among women with a short cervix. N Engl J Med 2007;357:462–9.
14. Hassan SS, Romero R, Vidyadhari D, Fusey S, Baxter JK, Khandelwal M, et al. Vaginal progesterone reduces the rate of preterm birth in women with a sonographic short cervix: a multicenter, randomized, double-blind, placebo-controlled trial. Ultrasound Obstet Gynecol 2011;38:18–31.
15. Keirse MJ. Progestogen administration in pregnancy may prevent preterm delivery. Br J Obstet Gynaecol 1990;97:149–54.
16. Sibai BM, Istwan NB, Palmer B, Stanziano GJ. Pregnancy outcomes of women receiving compounded 17 α-hydroxyprogesterone caproate for prophylactic prevention of preterm birth 2004 to 2011. Am J Perinatol 2012;29:635–42.
17. Bailit JL; Ohio Perinatal Quality Collaborative. Rates of labor induction without medical indication are overestimated when derived from birth certificate data. Am J Obstet Gynecol 2010;203:269.e1–3.