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Term Elective Induction of Labor and Perinatal Outcomes in Obese Women: Retrospective Cohort Study

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Abstract

Objective—To compare perinatal outcomes between elective induction of labor (eIOL) and expectant management in obese women.

Design—Retrospective cohort study.

Setting—Deliveries in California in 2007.

Population—Term, singleton, vertex, nonanomalous deliveries among obese women (n=74,725).

Methods—Women who underwent eIOL at 37 weeks were compared with women who were expectantly managed at that gestational age. Similar comparisons were made at 38, 39, and 40 weeks. Results were stratified by parity. Chi-square tests and multivariable logistic regression were used for statistical comparison.

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Contribution to Authorship
VRL performed the analyses and composed the majority of this manuscript. BGD and JMS provided knowledge regarding statistical analysis and helped compose this manuscript. EKM, WG, and JC facilitated access to the dataset and provided editorial assistance. ABC helped with developing the study design and with composition of the manuscript.

Details of Ethics Approval
This study was approved by the Institutional Review Board of Oregon Health & Science University (April 6, 2015, IRB #: 00010620)

Disclosure of Interests
The authors have no conflicts of interest to disclose. The ICMJE disclosure forms are available as online supporting information.

Main Outcome Measures—Method of delivery, severe perineal lacerations, postpartum hemorrhage, chorioamnionitis, macrosomia, shoulder dystocia, brachial plexus injury, respiratory distress syndrome.

Results—The odds of cesarean delivery were lower among nulliparous women with eIOL at 37 weeks (odds ratio [OR] 0.55, 95% confidence interval [CI] 0.34–0.90) and 39 weeks (OR 0.77, 95% CI 0.63–0.95) compared to expectant management. Among multiparous women with a prior vaginal delivery, eIOL at 37 (OR 0.39, 95% CI 0.24–0.64), 38 (OR 0.65, 95% CI 0.51–0.82), and 39 weeks (OR 0.67, 95% CI 0.56–0.81) was associated with lower odds of cesarean. Additionally, eIOL at 38, 39, and 40 weeks was associated with lower odds of macrosomia. There were no differences in the odds of operative vaginal delivery, lacerations, brachial plexus injury, or respiratory distress syndrome.

Conclusions—In obese women, term eIOL may decrease the risk of cesarean delivery, particularly in multiparas, without increasing the risks of other adverse outcomes when compared with expectant management.

Tweetable Abstract—Elective induction of labor in obese women does not increase risk of cesarean or other perinatal morbidities.

Keywords

Elective induction of labor; maternal obesity; cesarean delivery

Introduction

Maternal obesity, defined as a pre-pregnancy body mass index (BMI) ≥30 kg/m^2, is increasingly common worldwide. The prevalence of maternal obesity has increased from 13% in 1993 to 20.5% in 2009 in the US, and from 10% in 1990 to 16% in 2004 in the UK[1,2]. Obesity in pregnancy is associated with increased risk of several perinatal complications, including gestational diabetes, preeclampsia, cesarean delivery, postpartum hemorrhage, macrosomia, stillbirth, and infant death[3–6].

The risk of developing many of these adverse outcomes is also related to gestational age[7,8]. Thus, the timing of delivery in the obese population is of particular concern: an obstetric provider must balance the *in utero* risks of stillbirth, development of maternal morbidities, and complications associated with macrosomic infants against the respiratory morbidities and other neonatal risks associated with early term delivery.

Currently, maternal obesity in and of itself is not an indication for induction of labor in the United States, so women with no other indication whose labors are induced for this reason are classified as undergoing an elective induction of labor (eIOL)[9]. Prior research on eIOL and the risk of cesarean delivery has found that eIOL is associated with decreased odds of cesarean delivery compared to expectant management[10–12]. Two recent large population-based cohort studies have investigated the relationship between eIOL and other perinatal outcomes. This literature suggests that compared to expectant management, eIOL is associated with either no difference or a decrease in the odds of operative vaginal delivery, maternal morbidities, or perinatal mortality, whereas data on eIOL and the risk of neonatal intensive care unit admission are conflicting[11–12]. However, there is a dearth of literature on eIOL specifically in the obese population, and so given the large global burden of maternal obesity additional studies are needed before providers and obese patients can make informed choices about elective induction of labor. The objective of this study was to determine the impact of term elective induction of labor, compared to expectant management, on maternal and neonatal outcomes in a large population of obese women. We hypothesized that term elective induction of labor was associated with decreased risk of cesarean delivery and adverse perinatal outcomes in obese women.

Methods

This is a retrospective cohort study using 2007 California Department of Health Services vital statistics and hospital discharge data. The database contains de-identified linked birth records and patient discharge data for maternal and neonatal pairs and includes all deliveries in the given year. We obtained human subjects approval from the Institutional Review Board at Oregon Health & Science University, the California Office of Statewide Health Planning and Development, and the California Committee for the Protection of Human Subjects. Informed consent was exempted from this study, as the data did not contain any potential patient identification information.

We arrived at our analytic sample after a series of exclusions (Figure 1). We excluded pregnancies <37 or >42 weeks of gestational age, women with a prior cesarean delivery, missing values for parity, and pregnancies with multiple gestations, fetal anomalies, breech presentation, and chronic disease complicating pregnancy including hypertensive disease and diabetes. Additionally, we restricted the sample to women with a self-reported pre-pregnancy BMI ≥30 kg/m^2.

In the elective induction group, we included women who delivered between 37 and 40 completed weeks of gestation. To define elective induction, we used the Joint Commission criteria of indications possibly justifying delivery before 39 weeks of gestation[9]. Women who underwent an induction of labor as noted by ICD-9 codes, but who did not also have an ICD-9 code matching one of the Joint Commission indications, were therefore classified as being electively induced in our study. We compared electively induced women with those who were expectantly managed at a given gestational age. For example, at 37 weeks, the comparison is elective induction at 37 weeks versus expectant management and delivery between 38 and 42 weeks. The expectant management group thus includes women who will go on to have a spontaneous labor, an elective induction, or an indicated induction at a later gestational age. As we cannot assess temporality in these hospital discharge data, this classification scheme assumes that all medical indications were known before the decision to induce; as a result, deliveries with ICD-9 codes for conditions that could have arisen during the intrapartum period, such as abnormal fetal heart rate, were included in the expectant management group[12].

Our primary outcome of interest was cesarean delivery. We used birth certificate data to identify method of delivery. Secondary outcomes included operative vaginal delivery (vacuum- or forceps-assisted delivery) and macrosomia (birth weight ≥4000g) as recorded on the birth certificate, and severe perineal lacerations, postpartum hemorrhage, chorioamnionitis, shoulder dystocia, brachial plexus injury, and respiratory distress syndrome derived from ICD-9 codes in the hospital discharge file. Because the dataset only linked hospital discharge data with live birth certificates, we were unable to examine stillbirth or perinatal mortality. Covariates abstracted from hospital discharge or birth certificate files included maternal age at delivery, insurance status, maternal education, maternal race/ethnicity, and initiation of prenatal care in the first trimester.

We first compared the proportions of primary and secondary outcomes between elective induction and expectant management groups using chi-square statistics or, in the case of rare outcomes, the Fisher's exact test. Comparisons were made at 37, 38, 39, and 40 weeks, and we stratified our results at each gestational age by parity (nulliparous; multiparous with a prior vaginal delivery). We used multivariable logistic regression to estimate the association between elective induction of labor and perinatal outcomes adjusted for the previously listed covariates. Separate models were built to test the association between eIOL and each outcome at 37, 38, 39, and 40 weeks in nulliparous women and separately in multiparous women with a prior vaginal delivery. Additionally, to assess the robustness of our regression results and account for covariates leading to differences in eIOL and expectant management groups, we employed covariate adjustment using the propensity score. All analyses were conducted using STATA 13.

Results

The analytic sample included 74,725 obese women (40.8% nulliparas, 59.2% multiparas with a prior vaginal delivery). At nearly every term week of gestation, women who were electively induced were older and more likely to be Caucasian, multiparous, have some college education, have private insurance, and initiate prenatal care in the first trimester (Table 1).

Overall, the cesarean delivery rate was 18.0% in our sample (n=13,518; 32.2% among nulliparous women, 8.4% among multiparous women with a prior vaginal delivery). In bivariate analyses (Table 2), elective induction of labor at 37 and 39 weeks in nulliparous obese women was associated with a significantly lower cesarean rate compared to expectant management (37 weeks: 20.0% vs. 32.2%, p=0.01; 39 weeks: 29.9% vs. 34.9%, p=0.02). There were no significant differences in the proportions of cesarean delivery between elective induction and expectant management groups at 38 weeks or 40 weeks in nulliparous obese women. Among multiparous obese women with a prior vaginal delivery, elective induction of labor was associated with lower cesarean delivery rates compared to expectant management at 38 weeks (3.6% vs. 8.5%, p<0.0001), 39 weeks (4.5% vs. 8.6%, p<0.0001), and 40 weeks (5.6% vs. 9.3%, p=0.001).

The proportions of operative vaginal delivery or severe perineal lacerations were not significantly different between elective induction and expectant management groups at any gestational age, regardless of parity (Table 2). In nulliparous obese women, there were no differences or appreciable trends in the proportions of postpartum hemorrhage between elective induction and expectant management groups, but in multiparous obese women with a prior vaginal delivery, elective induction of labor at 38 weeks and 40 weeks was associated with lower proportions of postpartum hemorrhage compared to expectant management.

Elective induction of labor at 38, 39, and 40 weeks in nulliparous women, and at 40 weeks in multiparous women with a prior vaginal delivery, was associated with significantly lower proportions of chorioamnionitis. Elective induction of labor was associated with lower proportions of macrosomia compared to expectant management in nulliparous obese women. These differences were statistically significant at 37 weeks (2.9% vs. 9.8%, p=0.02), 38 weeks (7.1% vs. 10.9%, p=0.04), and 39 weeks (9.1% vs. 12.5%, p=0.03), but did not reach statistical significance at 40 weeks (14.2% vs. 14.4%, p=0.88). The same pattern was seen in multiparous obese women with a prior vaginal delivery. In multiparous women, elective induction of labor at 37, 38, or 39 weeks was associated with significantly lower proportions of macrosomia compared to expectant management (37 weeks: 6.4% vs. 13.5%, p=0.001; 38 weeks: 11.2% vs. 14.9%, p=0.01; 39 weeks: 13.2% vs. 17.1%, p=0.001).

There were no significant differences in the proportions of shoulder dystocia or brachial plexus injury across any gestational age comparisons, regardless of parity. Elective induction of labor was associated with similar proportions of respiratory distress syndrome compared to expectant management in nulliparous women. Among multiparous obese women, eIOL was associated with slightly higher proportions of respiratory distress syndrome compared with expectant management, but these differences were only statistically significant at 38 weeks of gestation.

After controlling for key confounders, elective induction of labor at 37 weeks was associated with 45% lower odds of cesarean delivery, and elective induction of labor at 39 weeks was associated with 23% lower odds of cesarean delivery compared to expectant management in nulliparous obese women (Table 3). Among multiparous obese women with a prior vaginal delivery, eIOL at 38, 39, or 40 weeks was associated with lower odds of cesarean delivery compared to expectant management (OR [95% CI] for 38 weeks 0.42 [0.29–0.62]; 39 weeks 0.44 [0.33–0.60]; 40 weeks 0.57 [0.42–0.79]). After controlling for key confounders in our multivariate analyses, there were no differences in the odds of operative vaginal delivery or severe perineal lacerations between eIOL and expectant management groups, regardless of parity. Among multiparous obese women with a prior vaginal delivery, eIOL at 40 weeks was associated with lower odds of postpartum hemorrhage compared to expectant management. Elective induction of labor at 39 and 40 weeks in nulliparous obese women was associated with lower odds of chorioamnionitis compared to expectant management, but there were no differences in the odds of chorioamnionitis in multiparous obese women with a prior vaginal delivery.

Elective induction of labor at 37, 38, or 39 weeks in nulliparous obese women was associated with lower odds of macrosomia compared to expectant management after controlling for key confounders (OR [95% CI] at 37 weeks: 0.26 [0.08–0.83], 38 weeks: 0.57 [0.35–0.92], 39 weeks: 0.66 [0.48=0.91]; Table 3). Similarly, in obese multiparous women with a prior vaginal delivery, eIOL at 37, 38, or 39 weeks was associated with lower odds of macrosomia compared to expectant management (OR [95% CI] at 37 weeks: 0.39 [0.24–0.64], 38 weeks: 0.65 [0.51–0.82], 39 weeks: 0.67 [0.56=0.81]). Elective induction of labor at 40 weeks was associated with similar odds of macrosomia in both nulliparous and multiparous obese women.

There were no differences in the odds of shoulder dystocia with eIOL compared to expectant management in obese nulliparous women at any term gestational age. However, in multiparous obese women with a prior vaginal delivery, after controlling for key confounders, eIOL at 38 weeks was associated with lower odds of shoulder dystocia compared to expectant management (OR 0.42, 95% CI 0.20–0.89). The odds of brachial plexus injury were not different between eIOL and expectant management groups at any gestational age comparison in our sample of obese women (although regression models would not converge at all gestational ages for this outcome and other rare neonatal outcomes, due to small cell sizes). Furthermore, although eIOL at 38 weeks in multiparous obese women with a prior vaginal delivery was associated with a higher proportion of respiratory distress syndrome compared with expectant management, this difference did not persist after controlling for key confounders (OR 2.61, 95% CI 0.81–8.46).

After propensity score adjustment, eIOL at 38 weeks was associated with increased odds of shoulder dystocia in nulliparous women and slightly increased odds of operative vaginal delivery in mulitiparous women. For all other outcomes, results of propensity score-adjusted analyses were similar to our main regression findings in magnitude and direction (Table S1).

Discussion

Main Findings

Our findings suggest that term elective induction of labor in obese women is not associated with increased risk of adverse perinatal outcomes. In fact, among nulliparous obese women, eIOL at 37 and 39 weeks was associated with lower odds of cesarean delivery compared to expectant management. Further, eIOL at 38, 39, or 40 weeks was associated with lower odds of cesarean delivery among mulitiparous women with a prior vaginal delivery. Additionally, eIOL was associated with lower odds of postpartum hemorrhage and chorioamnionitis in some subgroups, although it should be noted that the overall incidence of those outcomes was low in our study population. Regarding neonatal outcomes, eIOL at 37, 38, and 39 weeks of gestation was associated with decreased odds of macrosomia compared to expectant management in both nulliparas and multiparas with a prior vaginal delivery. Aside from eIOL at 38 weeks of gestation being associated with lower odds of shoulder dystocia in multiparous obese women with a prior vaginal delivery, there were no statistically significant differences in the odds of other neonatal morbidities between eIOL and expectant management groups at any term gestational age.

Strengths and Limitations

Strengths of our study include the large sample size of a racially and ethnically diverse population, clearly defined comparison groups, and stratified analyses by parity and gestational age that were robust to propensity score adjustment that accounted for inherent differences between eIOL and expectant management groups. Notably, this is among the first large population-based observational studies to examine eIOL in obese women, which carries public health significance given the severe and growing burden of maternal obesity.

This study is subject to the inherent limitations of retrospective designs. For example, we relied on vital statistics and hospital discharge data, which cannot assess temporality during the labor course. Additionally, there may be errors in gestational age dating, especially as dating ultrasounds can be more challenging in obese women, and there are known errors in self-reported pre-pregnancy BMI[13]. It is reasonable to assume that these misclassifications would be equally likely in eIOL and expectant management groups, thus biasing our results toward the null and making our estimated measures of association more conservative. We have controlled for measured potential confounding variables in our multivariate analyses, but there could be additional unmeasured confounding variables (e.g., cervical status), and we could not control for other clinical factors such as usual care at each hospital and provider-level differences regarding induction of labor and delivery timing in obese women.

Even in our large cohort, we were underpowered to examine rare secondary outcomes such as brachial plexus injury and respiratory distress syndrome in our multivariable analyses. However, bivariate analyses showed that the overall incidence of such outcomes was quite low in both eIOL and expectant management groups, so differences in the risks of these rare outcomes are not likely to be clinically significant. Furthermore, we were unable to examine perinatal mortality due to linkage with only live birth certificates in this dataset. Future studies on eIOL in the obese population should analyze samples large enough to adequately examine perinatal mortality, especially given the baseline increased risk of stillbirth and infant death in obese women[3,6].

Interpretation

Only one prior study to date has examined elective induction of labor specifically in the obese population. This study found that eIOL between 39–41 weeks of gestation in nulliparous obese women with an unfavorable cervix was associated with significantly higher rates of cesarean delivery compared to expectant management, whereas rates of other maternal and neonatal morbidities were similar between groups[14]. Our results regarding cesarean delivery contrast with this work, and provide new evidence in that we were able to examine multiple levels of parity, examine weekly differences in eIOL by gestational age, and account for key confounders by performing multivariable analyses.

The finding that term eIOL in obese women was associated with either no change or a decrease in the risk of cesarean delivery, without a concomitant increase in the risk of operative vaginal delivery or severe perineal lacerations, is important as clinicians may worry that obese women may have more complicated vaginal deliveries. Our results contradict such common perceptions; we have demonstrated that in the setting of term elective induction of labor, obese women were not at increased risk of operative vaginal delivery, severe perineal lacerations, shoulder dystocia, or postpartum hemorrhage as compared to expectant management. This is generally consistent with literature on eIOL versus expectant management in the general obstetric population[11,12], so clinicians may be reassured that electively inducing an obese patient at term is not associated with poor maternal outcomes following vaginal delivery.

Our study found no significantly increased odds of adverse neonatal outcomes following term eIOL compared to expectant management in obese women. This is largely consistent with the study by Darney and colleagues showing that term eIOL was not associated with significantly higher odds of shoulder dystocia, respiratory distress syndrome, neonatal intensive care unit (NICU) admission, or perinatal death as compared with expectant management in the general obstetric population[12,15–16]. Stock and colleagues found that eIOL at 37–41 weeks in low-risk pregnancies was associated with decreased risk of perinatal mortality compared to expectant management, with the caveat that eIOL appeared to increase the risk of NICU admission[11]. Our findings are encouraging in that we did not observed an increased risk of certain neonatal morbidities, but more research is needed to better elucidate the relationship between eIOL and more serious neonatal morbidities and morality in obese women. Knowing that perinatal morbidity and mortality rates are greater in the early term period compared with delivery at 39–40 weeks of gestation, future studies should continue to characterize these risks in the obese population so clinicians and patients can make informed management decisions about elective induction of labor[17].

Elective induction of labor at 37, 38 and 39 weeks was associated with lower odds of macrosomia, which makes sense given that continued fetal growth is a consequence of expectant management. Macrosomia is a well-established risk factor for shoulder dystocia and birth trauma, but although we report a decreased risk of macrosomia following eIOL, the proportions of shoulder dystocia and brachial plexus injury were not significantly different between eIOL and expectant management groups. The null findings in our study underscore the fact that these are rare and multifactorial outcomes.

Conclusions

In summary, term eIOL in obese women is not associated with increased risk of adverse perinatal outcomes compared to expectant management, and in some cases eIOL may reduce the risks of macrosomia and cesarean delivery in obese women. Elective induction of labor at 39 weeks of gestation, in particular, is associated with decreased odds of cesarean delivery in both nulliparous and multiparous patients, so delivery at this gestational age may be reasonable in obese patients. Future studies should further investigate the association between eIOL and adverse neonatal outcomes, including perinatal mortality, before a policy of routine eIOL at 39 weeks in obese women is recommended. Additionally, studies on the cost-effectiveness of eIOL at 39 weeks in the setting of maternal obesity would inform such policy considerations. Although our findings suggest that elective induction of labor in obese women is associated with either no difference or an improvement in cesarean delivery rates and perinatal morbidities compared to expectant management, ultimately a randomized controlled trial is needed to examine these relationships in a prospective, standardized fashion.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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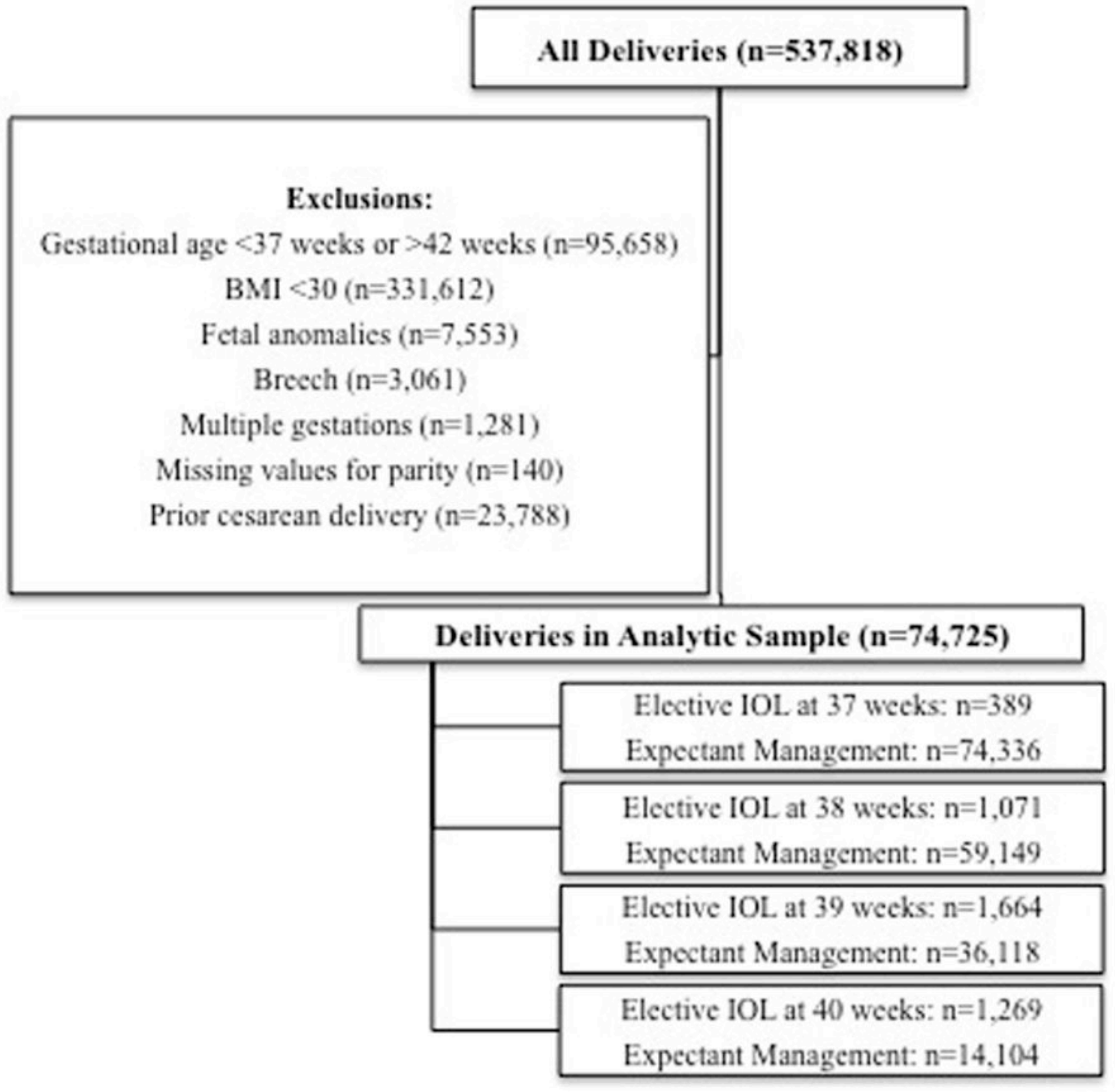

Figure 1.

Sample determination and comparison groups for elective induction of labor compared with expectant management, California deliveries, 2007. *BMI, body mass index; IOL, induction of labor.*

Table 1

Maternal Characteristics of California Deliveries to Obese Women, 2007

	37 weeks N=74,725		38 weeks N=60,220		39 weeks N=37,782		40 weeks N=15,373	
Characteristic	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**
Parity								
Nulliparous	27.3*	40.9	28.1*	41.8	29.4*	44.3	38.0*	46.7
Multiparous with a Prior Vaginal Delivery	72.7	59.1	71.9	58.2	70.6	55.6	62.0	53.3
Obesity Class								
BMI 30–35	41.9	35.8	43.6	36.1	40.6	36.7	41.2	36.9
BMI 35–39	12.6	12.8	16.5	12.9	16.3	13.4	14.9	14.2
BMI 40+	45.5	51.4	39.9	51.0	43.1	50.0	43.9	48.9
Maternal age								
15–19	8.2*	10.1	7.5*	10.2	5.7*	10.6	7.6*	10.8
20–24	21.8	27.3	24.3	27.7	23.5	28.6	28.0	29.3
25–29	30.1	29.3	28.9	29.4	33.1	29.5	29.3	29.8
30–34	23.9	21.1	25.0	20.8	23.6	20.2	22.0	19.9
35–44	15.7	12.1	14.3	11.8	14.0	10.9	13.0	10.1
45–49	0.26	0.11	0.09	0.11	0.06	0.11	0	0.11
Ethnicity								
White	31.6*	25.5	33.7*	25.8	33.8*	26.3	33.3*	27.4
Black	3.3	5.5	4.2	5.4	4.4	5.4	5.0	5.1
Hispanic	57.6	58.3	51.6	58.3	52.2	58.1	51.5	57.8
Asian	2.6	5.6	3.9	5.4	4.1	5.0	4.0	4.5
Other	5.0	5.1	6.5	5.1	5.3	5.2	6.1	5.3
Education								
Did not finish high school	11.9	12.6	8.3*	12.5	8.6*	12.2	8.4*	12.0
High school diploma	48.5	51.2	47.7	51.3	46.7	51.5	48.5	52.0

	37 weeks N=74,725		38 weeks N=60,220		39 weeks N=37,782		40 weeks N=15,373	
Characteristic	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**	**eIOL**	**Exp Mgmt**
Some college	36.1	32.2	39.4	32.3	40.7	32.5	39.5	32.2
College grad or above	3.4	3.9	4.5	3.9	4.1	3.8	3.6	3.8
Prenatal care								
First trimester	83.6	82.3	85.3*	81.9	85.7*	81.1	83.1*	79.2
Later than 1st trimester	16.4	17.7	14.7	18.1	14.3	18.9	16.9	20.8
Insurance Status								
Private	48.3*	43.2	50.1*	43.2	51.0*	43.0	47.8*	42.6
Public or none	51.7	56.8	49.9	56.8	49.0	57.0	52.2	57.4

All data are expressed as (%) unless otherwise noted. *eIOL, elective induction of labor; Exp Mgmt; expectant management.*

* p<0.05 for difference between elective induction and expectant management groups.

Table 2

Unadjusted Outcomes of Term Elective Induction of Labor Compared with Expectant Management

	Comparison group	Cesarean delivery (%)	Operative vaginal delivery (%)	3rd or 4th Degree laceration (%)	PPH (%)	Chorioamnionitis (%)	Macrosomia (%)	Shoulder Dystocia (%)	BPI (%)	RDS (%)
Nulliparous Women										
37 Weeks	eIOL(n=105)	20.0*	4.7	4.8	0	0.9	2.9*	0	0	0
	Exp Mgmt(n=30344)	32.2	5.9	3.7	3.3	3.8	9.8	1.1	0.1	0.3
38 Weeks	eIOL(n=296)	29.0	5.7	2.0	2.7	1.6*	7.1*	2.0	0.3	0.3
	Exp Mgmt(n=24704)	32.9	5.9	3.8	3.4	4.0	10.9	1.1	0.2	0.3
39 Weeks	eIOL(n=482)	29.9*	5.0	2.9	2.7	1.2**	9.1*	1.7	0.2	0
	Exp Mgmt(n=16003)	34.9	5.9	3.9	3.6	4.6	12.5	1.3	0.1	0.3
40 Weeks	eIOL(n=473)	34.7	6.3	3.6	3.1	2.1*	14.2	0.8	0.6	0
	Exp Mgmt(n=6580)	37.8	6.0	4.0	4.1	5.1	14.4	1.4	0.2	0.4
Multiparous Women with a Prior Vaginal Delivery										
37 Weeks	eIOL(n=282)	5.7	1.4	0.3	1.4	0	6.4*	2.5	0.3	0.3
	Exp Mgmt(n=43900)	8.4	2.6	0.7	2.3	0.6	13.5	1.9	0.1	0.2
38 Weeks	eIOL(n=767)	3.6**	3.0	1.0	1.3*	0.4	11.2*	1.2	0	0.5*
	Exp Mgmt(n=34375)	8.5	2.7	0.7	2.4	0.6	14.9	2.0	0.1	0.2
39 Weeks	eIOL(n=1163)	4.5**	2.5	0.5	1.7	0.7	13.2*	1.7	0.2	0.3
	Exp Mgmt(n=20075)	8.6	2.6	0.8	2.6	0.7	17.1	2.3	0.2	0.2
40 Weeks	eIOL(n=785)	5.6*	1.9	1.1	1.1*	0*	18.1	1.7	0	0
	Exp Mgmt(n=7511)	9.3	2.6	0.8	2.7	0.7	18.3	2.5	0.2	0.2

* p<0.05;

** p<0.0001.

eIOL, elective induction of labor; Exp Mgmt, expectant management; PPH, postpartum hemorrhage; BPI, brachial plexus injury; RDS, respiratory distress syndrome

Table 3

Adjusted Associations Between Elective Induction of Labor Compared to Expectant Management and Perinatal Outcomes

GA (Weeks)	Cesarean Delivery	Operative Vaginal Delivery	3rd or 4th Degree Laceration	Postpartum Hemorrhage	Chorioamnion-itis	Macrosomia	Shoulder Dystocia	BPI	RDS
Nulliparous Women									
37	0.55 (0.34–0.90)	0.82 (0.33–2.02)	1.34 (0.55–3.31)	n/a	0.24 (0.04–1.74)	0.26 (0.08–0.83)	n/a	n/a	n/a
38	0.83 (0.64–1.09)	1.00 (0.60–1.66)	0.54 (0.24–1.22)	0.83 (0.41–1.69)	0.42 (0.17–1.03)	0.57 (0.35–0.92)	1.87 (0.83–4.24)	2.00 (0.27–14.6)	1.43 (0.20–10.4)
39	0.77 (0.63–0.95)	0.78 (0.51–1.22)	0.69 (0.40–1.21)	0.70 (0.39–1.24)	0.27 (0.12–0.61)	0.66 (0.48–0.91)	1.14 (0.53–2.44)	1.51 (0.20–11.3)	n/a
40	0.85 (0.70–1.05)	1.05 (0.71–1.57)	0.95 (0.57–1.56)	0.76 (0.44–1.31)	0.34 (0.17–0.69)	0.93 (0.70–1.23)	0.60 (0.22–1.66)	3.36 (0.95–11.94)	n/a
Multiparous Women with a Prior Vaginal Delivery									
37	0.65 (0.39–1.08)	0.55 (0.20–1.49)	n/a	0.64 (0.24–1.72)	n/a	0.39 (0.24–0.64)	1.29 (0.61–2.75)	2.32 (0.32–16.87)	2.13 (0.29–15.4)
38	0.42 (0.29–0.62)	1.04 (1.03–1.18)	1.43 (0.70–2.91)	0.52 (0.30–1.05)	0.60 (0.19–1.88)	0.65 (0.51–0.82)	0.42 (0.20–0.89)	n/a	2.61 (0.81–8.46)
39	0.44 (0.33–0.60)	1.01 (0.69–1.49)	0.67 (0.29–1.52)	0.66 (0.42–1.05)	0.99 (0.48–2.04)	0.67 (0.56–0.81)	0.75 (0.48–1.18)	0.94 (0.22–3.94)	1.84 (0.55–6.12)
40	0.57 (0.42–0.79)	0.78 (0.46–1.33)	1.42 (0.70–2.93)	0.45 (0.23–0.88)	n/a	0.95 (0.78–1.15)	0.65 (0.37–1.15)	n/a	n/a

Data are presented as Odds Ratio (95% Confidence Interval). GA, gestational age; BPI, brachial plexus injury; RDS, respiratory distress syndrome; n/a, cell sizes too small to perform multiple logistic regression. Adjusted for maternal age, ethnicity, education level, initiation of prenatal care in the first trimester, and insurance status.