excluded previous CD, antepartum stillbirth, congenital anomaly, and BMI <18.5. Women were categorized according to BMI: normal weight (18.5-24.9), overweight (25.0-29.9), obese category I (30.0-34.9), category II (35.0-39.9), and category III (≥40). Chi-square and Cochran-Armitage Trend Test were used to compare indications. P-value (P) <.01 was considered as significant.

RESULTS: Of 66,502 nulliparas and 76,961 multiparas, 19,431 nulliparas (29.2%) and 7,329 multiparas (9.5%) underwent primary CD. In nulliparas, higher BMI was associated with increased rates of primary CD for elective, macrosomia, fetal indication, NRFHT, chorioamnionitis, HTN, FTP or CPD, and failed induction (P<.01 for all) but not for malpresentation (P=.02), multiple gestation (P=.03), HIV or active HSV (P=.70), uterine scar (P=.02), placental abruption (P=.05), and failed operative delivery (P=.27) (Figure 1). In multiparas, higher BMI was associated with increased rates of primary CD for malpresentation, elective, multiple gestation, macrosomia, fetal indication, NRFHT, HTN, FTP or CPD, and failed induction (P<.01 for all) but not for HIV or active HSV (P=.31), uterine scar (P=.07), chorioamnionitis (P=.06), placental abruption (P=.14), and failed operative delivery (P=.91) (Figure 2). Higher BMI was associated with decreased rate of primary CD for placenta previa or vasa previa regardless of parity (P<.01).

CONCLUSION: NRFHT and FTP or CPD were major contributors for the increased primary CD rates in obese women. Further evaluation is needed to attempt to reduce the CD rate.

Figure 1. Indications for primary cesarean delivery in nulliparas.

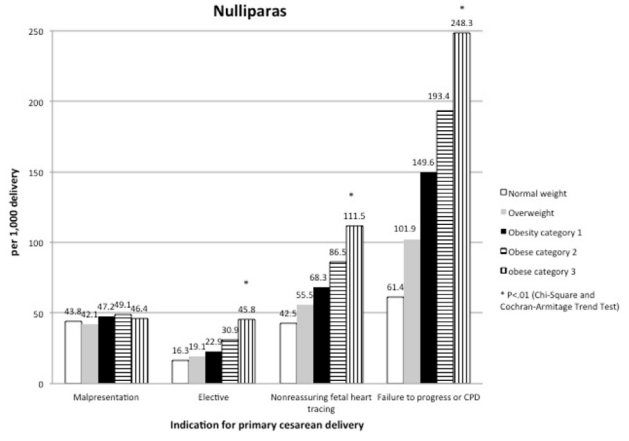
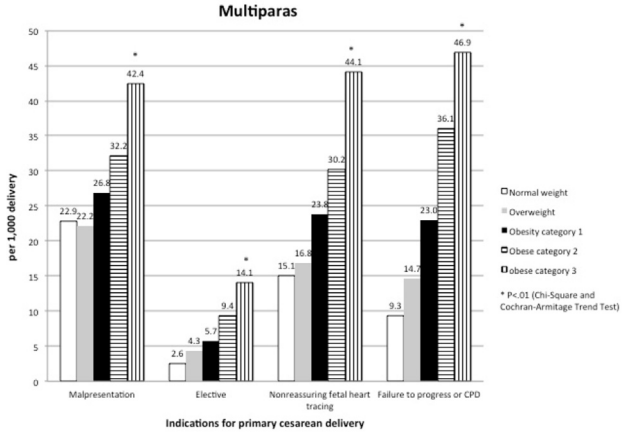


Figure 2. Indications for primary cesarean delivery in multiparas.



221 Maternal obesity and acute neonatal morbidity after cesarean delivery

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OBJECTIVE: To describe the association between maternal obesity and acute neonatal morbidity among neonates delivered via cesarean delivery (CD), and to estimate this association in women with Class III obesity.

STUDY DESIGN: A secondary cohort analysis of the MFMU Cesarean Registry stratified by maternal body mass index (BMI) at delivery, as non-obese (BMI 18.5-29.9), non-Class III obese (BMI 30-39.9) and Class III obese (BMI ≥ 40). Our primary outcome was defined as having one or more acute peripartum neonatal morbidities, including 5 min Apgar < 5, CPR or ventilator support within 24 hours of delivery, and neonatal injury (brachial plexus injury, fracture, facial nerve injury, skin laceration). Additional analyses assessed each outcome separately, including NICU admission and cord gas pH <7.1. We conducted a subgroup analysis of Class III obese women and defined BMI as 40-49.9, 50-59.9, and BMI ≥ 60. We compared maternal, neonatal and operative characteristics using $\chi 2$ analysis. Logistic regression models were used to estimate odds of acute neonatal morbidity among all pregnancies and for term pregnancies only (≥37 weeks) for each maternal BMI stratum. Models were adjusted for age, race, number of prior CD, CD after labor, birth weight, hemoglobin, cesarean indication, anesthesia, uterine and skin incision.

RESULTS: Of 49493 women-neonate dyads delivered via CD, 38% of women (n=18,786) were non-obese, 47% (n=23,279) were non-Class III obese and 15% (n=7428) were Class III obese. Among Class III obese women, 82% (n=6108) had BMI 40-49.9; 15% (n=1089) had BMI 50-59.9, and 3% (n=222) had BMI ≥ 60. With higher maternal BMI, unadjusted risk of NICU admission (p<.0001) and cord gas pH <7.1 (p<.0001) were higher. Class III obesity was associated with increased odds of acute neonatal morbidity (Table). Associations appeared similar whether or not we restricted to term deliveries, but were more consistently significant among term deliveries.

CONCLUSION: Maternal class III obesity is associated with higher odds of severe acute neonatal morbidity after CD. This information is important for maternal counseling and may guide in developing interventional studies aimed at decreasing neonatal morbidity among obese patients.

Maternal obesity and acute neonatal morbidity at time of cesarean

	All Deliveries (n=49493)			Term Deliveries (n=41262)		
	Severe acute morbidity n (%)	Crude OR (95% CI)	Adjusted OR (95% CI)	Severe acute morbidity n (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
Non-obese (BMI 18.5-29.9)	1665 (8.9)	1 (ref)	1 (ref)	323 (2.2)	1 (ref)	1 (ref)
Non-Class III obese (BMI 30-39.9)	1407 (6.0)	0.66 (0.61,0.71)	0.99 (0.91, 1.98)	480 (2.4)	1.10 (0.96, 1.27)	1.11 (0.95, 1.30
Class III obese (BMI ≥ 40)	518 (7.0)	0.77 (0.70,0.85)	1.21 (0.07,1.37)	187 (3.0)	1.38 (1.15, 1.65)	1.35 (1.10, 1.65)
BMI 40-49.9	431 (7.1)	0.78 (0.70, 0.87)	1.24 (1.09, 1.41)	151 (2.9)	1.35 (1.10,1.64)	1.33 (1.07, 1.65)
BMI 50-59.9	75 (6.8)	0.75 (0.59, 0.96)	1.25 (0.95, 1.66)	32 (3.5)	1.61 (1.12, 2.33)	1.54 (1.04, 2.28)
BMI≥ 60	12 (5.4)	0.59 (0.33, 1.05)	0.55 (0.28,1.10)	4 (2.2)	1.01 (0.33, 2.73)	0.74 (0.23, 2.35)

222 Development of a prediction model for cesarean-associated blood transfusion

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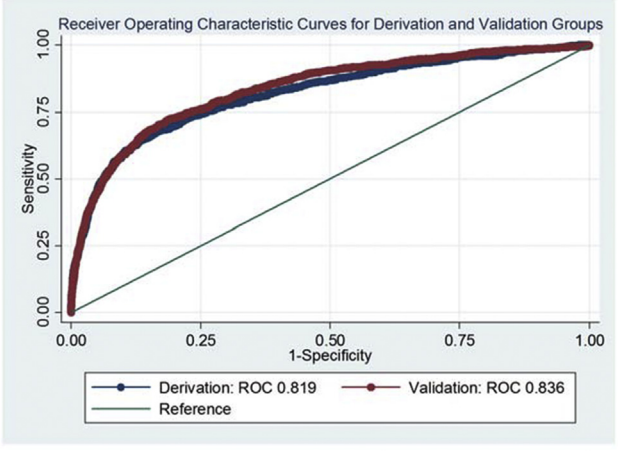
OBJECTIVE: To develop a model based on factors available at the time of cesarean delivery to predict risk of red blood cell transfusion in the intraoperative or postoperative period.

STUDY DESIGN: We performed a secondary analysis of all women who underwent a cesarean delivery in a large, prospectively-assembled cesarean delivery registry. We divided this cohort randomly into a derivation group and a validation group. Using factors readily available to the clinician and also known to be associated with cesarean-associated red blood cell transfusion, we analyzed different strategies, including logistic regression, decision tree modeling, and random forest learning, in order to create the model with the best predictive ability in the derivation group. We then tested the model using the validation group.

RESULTS: 59,468 women were available for analysis and were split evenly into the derivation and validation groups. The overall rate of red blood cell transfusion was 2.7%. The prediction model is based on a multivariable logistic regression which includes race, number of prior cesarean deliveries, pre-delivery hematocrit, and the presence or absence of the following characteristics: multiple gestation, placenta previa, preeclampsia, placental abruption, chorioamnionitis, and use of general anesthesia. The area under the receiver operator characteristic curve for the derivation and validation groups is 0.82 (95% CI, 0.80 - 0.84) and 0.84 (95% CI, 0.82 - 0.85), respectively ($p = 0.16$) (Figure). Predicted probabilities of blood transfusion for four hypothetical patients are presented (Table).

CONCLUSION: A regression model that incorporates variables readily available to the clinician at the time of cesarean delivery can accurately predict the need for intra- or post-operative red blood cell transfusion. Use of this model, easily adaptable as a simple online calculator, may allow more appropriate allocation of blood bank resources at the time of cesarean delivery.



Predicted Transfusion Rates for Four Hypothetical Patients

Variable	# 1	# 2	# 3	# 4
Demographic Data				
Race/Ethnicity	African American	Hispanic	African American	Caucasian
Pre-Hospital Data				
Multiple Gestation	Yes	No	No	No
Prior cesarean deliveries (#)	3	1	0	0
Placenta Previa	No	No	Yes	No
In-Hospital Data				
gHTN/PEC/HELLP/Eclampsia	HELLP	PEC	None	None
Placental Abruption	Yes	No	No	No
Clinical Chorioamnionitis	No	Yes	No	No
Pre-Delivery Hematocrit	24	28	33	35
General Anesthesia	Yes	No	No	No
Risk of Transfusion (%) (95% CI)	95 (91-97)	14 (11-19)	8 (6-11)	0.7 (0.6-0.8)

223 Is duration of operative vaginal delivery associated with adverse obstetric outcomes?

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OBJECTIVE: To determine whether the duration of operative vaginal delivery (OVD) is associated with adverse maternal and neonatal outcomes.

STUDY DESIGN: This is a secondary analysis of a multi-center prospective observational study of women who delivered at 25 hospitals over a 3-year period. Women who underwent an attempted low or outlet OVD with a single instrument type (i.e., vacuum or forceps) were included in analysis. Women were stratified by the duration of OVD (minutes from vacuum or forceps application to delivery) and the number of pop offs (vacuum) or pulls attempted (forceps). Severe (3rd or 4th degree) perineal lacerations, failed OVD, and a composite adverse neonatal outcome (brachial plexus injury, facial nerve palsy, clavicular fracture, skull fracture, other skeletal fracture, skin laceration, intracranial hemorrhage, seizure that required treatment, or neonatal death) were compared by the duration of OVD and number of pop offs or pulls. Multivariable logistic regression analyses were performed to adjust for confounders.

RESULTS: Of the 5325 women who had an attempted OVD, 3594 (67.5%) were with vacuum and 1731 (32.5%) were with forceps. 292 (5.5%) of the OVD attempts (5.8% of vacuums vs. 4.9% of forceps, $p = 0.20$) failed and required cesarean delivery. The results of multivariable analyses are presented in the Table. An increasing number of vacuum pop offs, but not number of forceps pulls or duration of OVD (for either vacuum or forceps), was associated with an increased risk of severe perineal lacerations. An increasing number of pop offs and forceps pulls, but not OVD duration generally was associated with an increased risk of failed OVD. Conversely, it was the duration of OVD that was most consistently associated with adverse neonatal outcomes.

CONCLUSION: The duration of OVD, rather than number of pop-offs or pulls, is more consistently associated with adverse neonatal outcomes.

Table: Multivariable analysis of duration of OVD for adverse outcomes

		Severe perineal laceration	Failed OVD	Composite adverse neonatal outcomes
Vacuum (n=3594)	Number of pop offs			
	0	referent	referent	referent
	1	0.95 [0.72, 1.25]	**2.10 [1.33, 3.33]**	1.52 [0.90, 2.56]
	2	1.07 [0.77, 1.48]	**3.58 [2.22, 5.77]**	**2.00 [1.11, 3.60]**
	3+	**1.65 [1.10, 2.49]**	**11.64 [7.07, 19.16]**	1.92 [0.87, 4.27]
	Duration (min)			
	0 to 2	referent	referent	referent
	3 to 5	1.22 [0.89, 1.65]	1.15 [0.59, 2.21]	**2.34 [1.03, 5.31]**
	6 to 8	1.09 [0.75, 1.57]	**2.39 [1.24, 4.59]**	**2.75 [1.12, 6.72]**
	9 to 11	1.08 [0.66, 1.76]	**2.94 [1.38, 6.27]**	**3.14 [1.07, 9.17]**
	12+	1.02 [0.69, 1.51]	**6.49 [3.58, 11.79]**	**3.89 [1.60, 9.47]**
Forceps (n=1731)	Number of pulls			
	1	referent	referent	referent
	2	**1.68 [1.23, 2.29]**	**2.61 [1.32, 5.18]**	0.61 [0.27, 1.40]
	3+	1.31 [0.91, 1.88]	**3.24 [1.59, 6.61]**	1.16 [0.54, 2.48]
	Duration (min)			
	0 to 2	referent	referent	referent
	3 to 5	1.11 [0.78, 1.60]	1.14 [0.44, 2.96]	1.78 [0.56, 5.71]
	6 to 8	0.95 [0.60, 1.48]	2.46 [0.92, 6.57]	1.95 [0.52, 7.31]
	9 to 11	1.04 [0.57, 1.90]	**3.44 [1.11, 10.63]**	3.39 [0.79, 14.63]
	12+	1.43 [0.83, 2.47]	2.96 [0.99, 8.83]	**5.37 [1.49, 19.32]**

Data are reported as aOR [95% CI] after adjusting for indication for OVD, fetal station and position, maternal age and race/ethnicity, chorioamnionitis, prior vaginal deliveries and prior cesareans

OVD = operative vaginal delivery

Emboldened text represents statistical significance