

**Development and Validation of a Predictive Nomogram for
Cesarean Delivery in Term Singleton Pregnancies Complicated
by Small for Gestational Age Undergoing Labor Induction**

Supplementary Materials

Supplementary Table S1. Corrected coding scheme of binary variables

Variable	Original coding	Recoded variable	Analytical coding
Cesarean delivery	1 = cesarean; 0 = vaginal delivery	cesarean	1 = cesarean delivery
Oligohydramnios	0 = yes; 1 = no	oligo_yes	1 = oligohydramnios
NICU admission	1 = yes; 2 = no	nicu_yes	1 = NICU admission
Intrapartum fever	3 = yes; 0 = no	fever_yes	1 = intrapartum fever
PROM	1 = yes; 0 = no	prom	1 = PROM
Oxytocin augmentation	1 = yes; 0 = no	oxytocin	1 = oxytocin augmentation

Abbreviations: NICU, neonatal intensive care unit; PROM, premature rupture of membranes.

Note: Binary variables were recoded to ensure consistent analytical direction in the supplementary analyses.

Supplementary Table S2. Baseline characteristics according to induction method

Variable	level	cook double balloon	dinoP valuerostone	P value	SMD
n		318	189		
Maternal age (mean (SD))		28.23 (4.36)	29.19 (4.30)	0.016	0.222
gravidity (mean (SD))		1.62 (1.00)	1.61 (0.87)	0.919	0.010
parity (%)	0	240 (75.5)	143 (75.7)	0.659	0.087
	1	69 (21.7)	43 (22.8)		
	2	9 (2.8)	3 (1.6)		
gest_age_adm (mean (SD))		38.95 (1.23)	39.06 (1.12)	0.301	0.096
prepreg_weight (mean (SD))		49.89 (6.68)	51.36 (8.26)	0.029	0.195
prepreg_BMI (mean (SD))		19.73 (2.44)	20.32 (3.01)	0.018	0.212
admit_weight (mean (SD))		59.01 (9.04)	64.93 (8.57)	<0.001	0.672
admit_BMI (mean (SD))		23.35 (3.41)	25.70 (3.13)	<0.001	0.716
bishop_adm (mean (SD))		2.87 (0.85)	2.81 (0.87)	0.459	0.068
EFW (mean (SD))		2599.39 (236.63)	2735.68 (291.72)	<0.001	0.513
GDM (%)	0	292 (91.8)	141 (74.6)	<0.001	0.473
	1	26 (8.2)	48 (25.4)		
HDP (%)	0	308 (96.9)	165 (87.3)	<0.001	0.359
	1	10 (3.1)	24 (12.7)		
oligo_yes (%)	0	291 (91.5)	157 (83.1)	0.006	0.255
	1	27 (8.5)	32 (16.9)		

Abbreviations: BMI, body mass index; EFW, estimated fetal weight; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; SMD, standardized mean difference.

Note: Continuous variables are presented as mean (SD); categorical variables are presented as n (%). SMDs are shown to assess the magnitude of between-group imbalance.

Supplementary Table S3. Parity-related sensitivity analysis

Section	Variable	Estimate / statistic	P value
A. Univariable association of parity	Multiparity (vs nulliparity)	0.83 (0.47–1.42)	0.507
	Maternal age	1.11 (1.04–1.18)	0.002
	Admission weight	1.02 (0.99–1.05)	0.218
B. Forced-entry multivariable model	Dinoprostone (vs cook double balloon)	2.08 (1.20–3.63)	0.009
	Bishop score after cervical ripening	0.66 (0.55–0.79)	<0.001
	Multiparity (vs nulliparity)	0.50 (0.26–0.95)	0.038
	Maternal age	VIF = 1.18	—
	Admission weight	VIF = 1.12	—
C. Collinearity diagnostics	induction_method	VIF = 1.17	—
	Bishop score after cervical ripening	VIF = 1.09	—
	parity_bin	VIF = 1.21	—
	Original post-ripening model	AIC = 381.57	—
D. Model fit	Parity-forced post-ripening model	AIC = 379.02	—

Abbreviations: AIC, Akaike information criterion; VIF, variance inflation factor.

Note: Odds ratios are shown as OR (95% CI). The forced-entry multivariable model additionally included parity regardless of its univariable significance. VIF values <5 indicate no meaningful multicollinearity.

Supplementary Table S4. BMI replacement sensitivity analysis

Variable	Odds ratio (95% CI)	P value
Maternal age	1.08 (1.02–1.14)	0.009
Admission BMI	1.02 (0.95–1.10)	0.561
Dinoprostone (vs cook double balloon)	2.14 (1.24–3.71)	0.006
Bishop score after cervical ripening	0.66 (0.55–0.78)	<0.001

Abbreviations: BMI, body mass index; CI, confidence interval.

Note: This sensitivity analysis replaced admission weight with admission BMI in the post-ripening multivariable model.

Supplementary Table S5. Pre-induction sensitivity model

Variable	Odds ratio (95% CI)	P value
Maternal age	1.12 (1.05–1.19)	<0.001
Admission weight	1.02 (0.99–1.05)	0.118
Multiparity (vs nulliparity)	0.44 (0.22–0.83)	0.014
Bishop score on admission	0.92 (0.68–1.23)	0.580
Dinoprostone (vs cook double balloon)	1.67 (0.98–2.86)	0.060
Oligohydramnios	1.67 (0.80–3.37)	0.160
Estimated fetal weight	1.00 (1.00–1.00)	0.034
Gestational age at admission	0.92 (0.73–1.16)	0.486

Abbreviations: CI, confidence interval; EFW, estimated fetal weight.

Note: The pre-induction sensitivity model included only variables available before or at the start of induction.

Supplementary Table S6. Additional performance metrics of the nomogram

Metric	Derivation cohort	Internal validation cohort
Selected cutoff probability	0.272	0.272
Accuracy	0.661	0.641
Sensitivity	0.684	0.641
Specificity	0.653	0.640
Positive predictive value	0.419	0.379
Negative predictive value	0.849	0.839
Calibration intercept	—	-0.126
Calibration slope	—	0.975
Brier score	—	0.174
Hosmer-Lemeshow test P value	—	0.608

Abbreviations: PPV, positive predictive value; NPV, negative predictive value.

Note: The selected cutoff probability was determined in the derivation cohort using the maximum Youden index. Calibration intercept, calibration slope, Brier score, and Hosmer-Lemeshow test were evaluated in the internal validation cohort.

Supplementary Table S7. Induction-method adjusted sensitivity model

Variable	Odds ratio (95% CI)	P value
Dinoprostone (vs cook double balloon)	2.31 (1.30–4.14)	0.005
Maternal age	1.11 (1.05–1.19)	<0.001
Admission weight	1.02 (0.99–1.05)	0.111
Bishop score after cervical ripening	0.63 (0.52–0.76)	<0.001
Bishop score on admission	1.19 (0.86–1.66)	0.298
Multiparity (vs nulliparity)	0.45 (0.23–0.87)	0.021
Gestational age at admission	0.95 (0.74–1.21)	0.671
Oligohydramnios	1.83 (0.83–3.92)	0.125
Estimated fetal weight	1.00 (1.00–1.00)	0.027

Abbreviations: CI, confidence interval; EFW, estimated fetal weight.

Note: This sensitivity model additionally adjusted for key baseline characteristics to evaluate the robustness of the association between induction method and cesarean delivery.

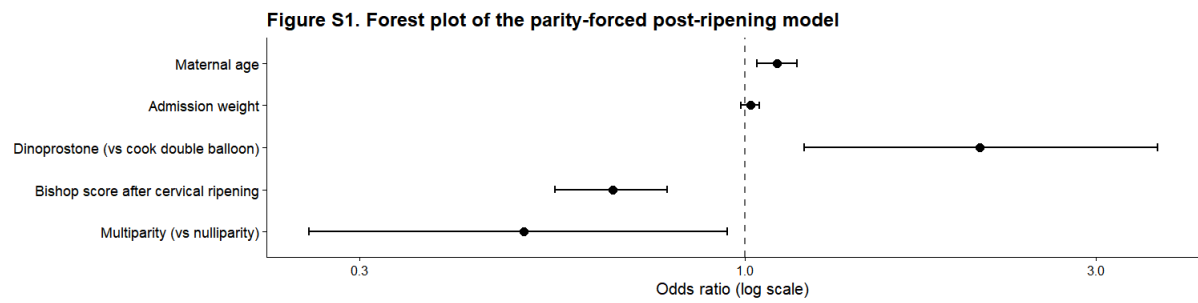


Figure S1. Forest plot of the parity-forced post-ripening model for cesarean delivery

Forest plot showing the odds ratios and 95% confidence intervals of predictors in the parity-forced post-ripening logistic regression model. The model included maternal age, admission weight, induction method, Bishop score after cervical ripening, and parity. Cook double balloon and nulliparity were used as the reference categories for induction method and parity, respectively. The dashed vertical line indicates an odds ratio of 1. Values to the right of the line indicate higher odds of cesarean delivery, whereas values to the left indicate lower odds.

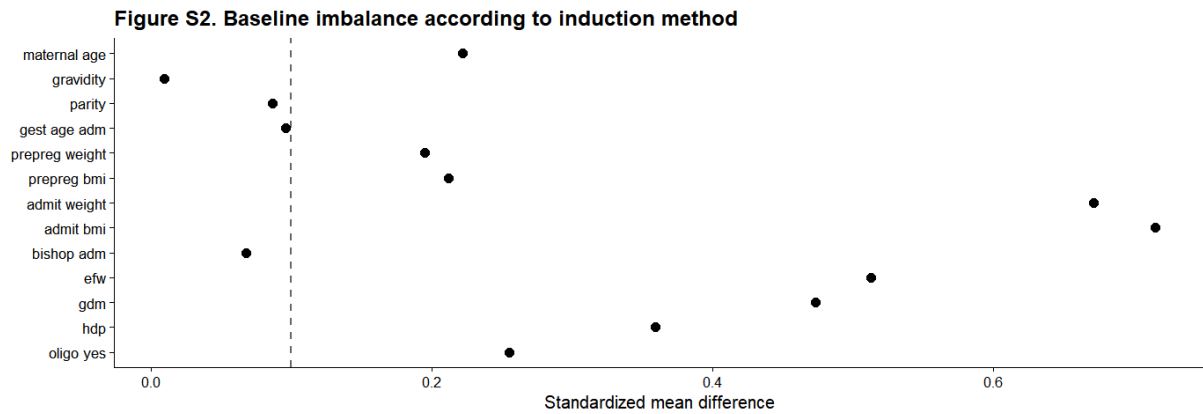


Figure S2. Baseline imbalance according to induction method

Standardized mean differences of baseline characteristics between women who underwent induction with dinoprostone and those who underwent induction with a Cook double balloon. The dashed vertical line indicates a standardized mean difference of 0.10, commonly used as a threshold for meaningful imbalance. Larger standardized mean differences indicate greater between-group imbalance, supporting the presence of potential selection bias related to non-random allocation of induction method. Maternal characteristics, obstetric variables, and pregnancy complications were evaluated before outcome modeling.