

Appendix 1. Group Information

List of participating centers and collaborators of the JUMODA (JUmeaux Mode d'Accouchement) study group and the GROG (Groupe de Recherche en Obstétrique et Gynécologie): **Alsace:** Coordinator: Pr Langer: CHU Hautepierre (Dr Sananes), CMCO de Schiltigheim (Dr Favre), CMC de Colmar (Dr Kutnahorsky), CHR de Mulhouse (Mme Fessler), CHR d'Haguenau (Dr Lehmann), Clinique Sainte-Anne, Strasbourg (Dr Adam, Dr Plemere) — **Aquitaine:** Coordinator: Dr Chabanier: CHU de Bordeaux (Dr Chabanier), Clinique Bagatelle, Talence (Dr Trebesses), CH de Bayonne (Dr Poumier-Chabannier), CH de Mont de Marsan (Dr Defert), CH de Pau (Dr Bohec), Polyclinique de Navarre, Pau (Dr Collin) — **Auvergne:** Coordinator: Dr Venditelli: CHU de Clermont-Ferrand (Dr Venditelli), Clinique de la Chataigneraie, Beaumont (Dr Deffarges, Dr Vidal), CH de Vichy (Dr Desvignes), CH du Puy-en-Velay (Dr Samuel) — **Basse Normandie:** Coordinator: Pr Dreyfus, CHU de Caen (Dr Beucher, Dr Dolley), Clinique du Parc, Caen (Dr Durin), CH d'Avranches (Dr Six), CH de Lisieux (Dr Beniada), CH de Saint-Lô (Dr Balouet), CH de Cherbourg (Dr Desprès, Mme Mathis) — **Bourgogne:** Coordinator: Pr Sagot: CHU de Dijon (Dr Yacoub), CH de Chalon-sur-Saône (Dr Bulot), CH d'Auxerre (Dr Dellinger), CH de Mâcon (Dr Spagnolo) — **Bretagne:** Coordinator: Pr Poulain: CHU de Rennes (Pr Poulain), Clinique de la Sagesse, Rennes (Dr Moquet, Mme Bourgault), CHP Saint-Grégoire (Dr Seconda), CH de Saint-Brieuc (Dr Moinon), CH de Saint-Malo (Dr Roy-Dahhou), CH Bretagne Sud, Lorient (Dr Pittion), CH Bretagne Atlantique, Vannes (Dr Chauveau), CHU de Brest (Dr Laurent, Dr Lelièvre), CH de Quimper (Dr Bellot), Polyclinique de Keraudren, Brest (Dr Salnelle) — **Centre:** Coordinator: Pr Perrotin: CHRU de Tours (Pr Perrotin), CH d'Orléans (Dr Ramos), CH de Blois (Dr Montmasson), CH de Chartres (Dr Ollivier), CH de l'agglomération montargoise (Dr Hooek, Dr Ben Romdhane) — **Champagne Ardennes:** Coordinator: Pr Graesslin: CHU de Reims (Pr Graesslin), CH de Charleville Mézières (Dr Méreb) — **Franche-Comté:** Coordinator: Pr Riethmuller: CHU de

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Besançon (Pr Riethmuller), CH de Pontarlier (Dr Boyadjian), CH de Dole (Dr Gannard), CH de Belfort (Dr Levy), CH de Lons le Saunier (Dr Reviron) — **Haute Normandie**: Coordinator: Pr Marpeau: CHU de Rouen (Pr Verspyck), Clinique Mathilde, Rouen (Dr Durand Reville), CH Le Havre (Dr Talbot), CH d'Elbeuf (Dr Mathieu), CH d'Evreux (Dr Machevin), CH de Vernon (Dr Truong Canh), CH du Belvédère, Mont Saint-Aignan (Dr Guillon) — **Ile-de-France**: Coordinator: Pr Schmitz: CHU Robert Debré (Pr Schmitz), CHU Cochin-Port Royal (Dr Ménard), CHU Bichat (Dr Bourgeois Moine), CHU Pitié Salpêtrière (Pr Nizard, Pr Dommergues), CHU Trousseau (Dr De Carné Carnavalet), CHU Necker Enfants Malades (Dr Lemerrier), CHU Tenon (Dr Bornes), CHU Lariboisière (Dr Ricbourg), Hôpital des Diaconesses (Dr Harvey), Institut Mutualiste Montsouris (Dr Azarian), Groupe Hospitalier Saint Joseph (Dr Azria), CHU Louis Mourier (Pr Kayem), CHU Antoine Béchère (Pr Benachi), CHU Beaujon (Dr Ceccaldi), CHU Bicêtre (Pr Sénat), CH de Neuilly (Dr Galimard), Hôpital Foch (Dr Picone), CH de Saint-Denis (Dr Bounan, Dr Hatem), CH de Montreuil (Pr Poncelet), CHU Jean Verdier (Pr Carbillon), CHI de Créteil (Pr Haddad), Hôpitaux de Saint Maurice Esquirol (Dr Pachy), CH de Pontoise (Mme Deshons), CH de Montmorency (Dr Colliat Espagne), CHI de Poissy (Pr Rozenberg), CH de Versailles (Dr Raynal), CH de Mantes la Jolie (Dr Godard), CH de Villeneuve Saint-Georges (Dr Soltane, Dr Piel), CH de Longjumeau (Dr Abbara), CH du Sud Francilien, Corbeil Essonne (Dr Rigonnot), CH de Melun (Dr Jault), CH de Fontainebleau (Dr Marchaudon), CH de Meaux (Dr Moumen), CH de Lagny (Dr Wafo) — **Languedoc-Roussillon**: Coordinator: Pr De Tayrac: CHU de Nîmes (Pr De Tayrac), Polyclinique Grand Sud, Nîmes (Dr Léonard), Polyclinique Kennedy, Nîmes (Dr Terschiporst), CHU de Montpellier (Dr Vintejoux), Clinique Clémentville, Montpellier (Dr Filippi), Clinique Saint-Roch, Montpellier (Dr Rouard), CH de Béziers (Dr Galtier), CH de Carcassonne (Dr Cogan), CH de Perpignan (Dr Koninck) — **Lorraine**: Coordinator: Pr Morel: CHU de Nancy (Pr Morel), CH de Metz (Dr Dahlhoff Rodriguez), CH de Thionville (Dr Collin) — **Midi Pyrénées**:

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Coordinator: Pr Parant: CHU de Toulouse (Pr Parant), Clinique Sarrus (Dr Thévenot, Dr Céré) —

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Yannouloupoulos), CHU de Limoges (Pr Aubard) — **Rhône Alpes**: Coordinators: Pr Rudigoz, Mme Dupont: CHU La Croix Rousse, Lyon (Pr Rudigoz), CHU Lyon Sud, Lyon (Pr Dupuis), CHU Mère-Enfant, Lyon (Dr Battie), Hôpital Natecia, Lyon (Dr Mein), Clinique du Val d'Ouest, Ecully (Dr Mossan-Lourcy), Clinique Saint-Vincent-de-Paul, Bourgoin-Jallieu (Dr Rane), CH de Valence (Dr Fernandez), CH de Villefranche (Dr Sayegh), CH de Montélimar (Dr Dirix), CH de Roanne (Dr Nord), CHU de Saint-Etienne (Pr Chauleur), CH de Bourg-en-Bresse (Dr Hugot, Dr Ferlay), CHU de Grenoble (Dr Equy), Clinique Belledonne, Grenoble (Dr Canonica), CH de Voiron (Dr Gaillard), CH de Chambéry (Dr Dubois), CH de Sallanches (Dr Dujardin), CH d'Annecy (Dr Braig), CH d'Annemasse (Dr Deramecourt), CH de Thonon (Dr Vincent-Génod).

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Appendix 2. Propensity Score Construction

In the primary analysis, we used a propensity score approach to limit indication bias resulting from the different risk levels in each planned delivery group and control for confounding factors that might influence both the planned mode of delivery and the primary outcome.¹ The propensity score was defined as the probability that a cesarean delivery would have been planned for the patient. Probability was estimated by a logistic regression model with planned cesarean delivery as the dependent variable and the following baseline maternal, pregnancy, infant, and center characteristics: maternal age, occupation, country of birth, body mass index, parity, smoking status, conception after IVF, fetal reduction, first-trimester sonography, previous cesarean, chorionicity, hospitalization during pregnancy, antenatal corticosteroids, pregnancy complications (one or more of the following: preeclampsia, placental abruption, suspected fetal growth restriction for either twin, insulin-treated diabetes, placenta previa, malformation of either twin, twin-to-twin transfusion syndrome), preterm labor, preterm rupture of membranes, presentation of second twin at delivery, gestational age at birth, either twin small for gestational age (defined by a birth weight below the 10th percentile according to French customized curves),² male gender for either twin, number of twin pregnancy deliveries annually per center, and academic status of the center. The proportion of patients with missing data ranged from 0% to 1%, except for first-trimester sonography (5%) and body mass index (4%).

Multiple imputation was used for missing data in the propensity score. Multiple imputation by Monte Carlo Markov chains, as implemented by the SAS procedure, used all baseline variables of the propensity score model, the planned mode of delivery, and the primary outcome, as recommended.³ We then generated 24 independent imputed data sets, estimated a propensity score for each, and used it to create two matched sets. We then analyzed each matched set and pooled the resulting estimates according to Rubin's rule.⁴

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For propensity score matching, we used a 1:1 matching algorithm without replacement to match women with planned cesarean and women with planned vaginal delivery for gestational age at delivery and for propensity score within a caliper width of 0.2 standard deviations of its logit. Imbalance after matching was checked. Because of a relative imbalance for previous cesarean between the groups after matching, the association between the planned mode of delivery and the primary outcome was quantified by estimating odds ratios (ORs) and their 95% confidence intervals (95% CIs) after adjustment for this variable.

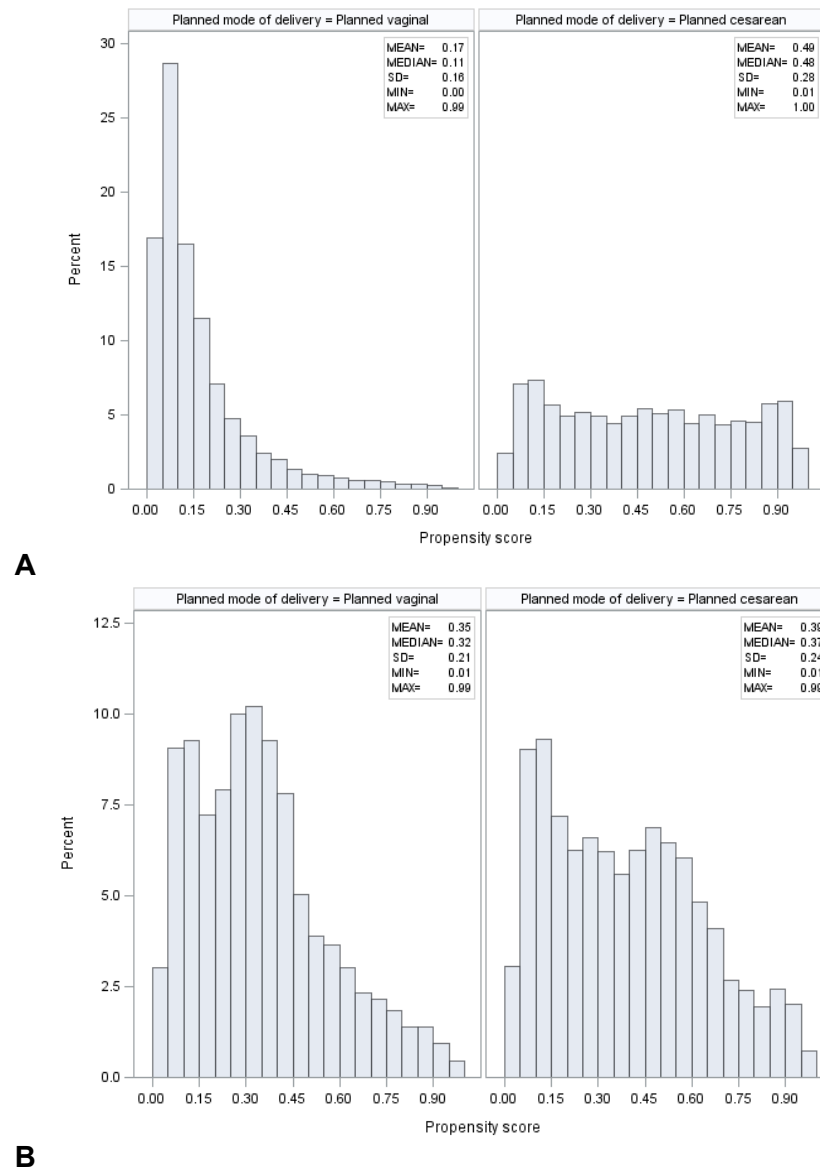
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Appendix 3. Propensity score distribution in the planned vaginal and planned cesarean delivery groups before (A) and after (B) matching in the overall population.

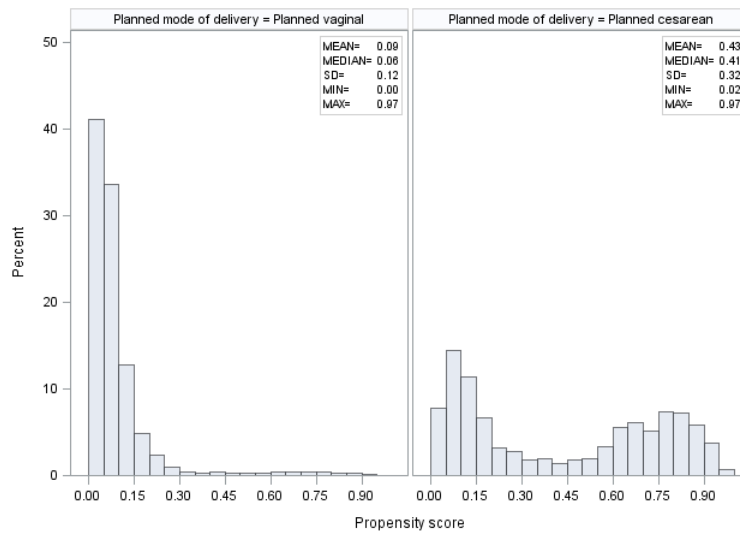


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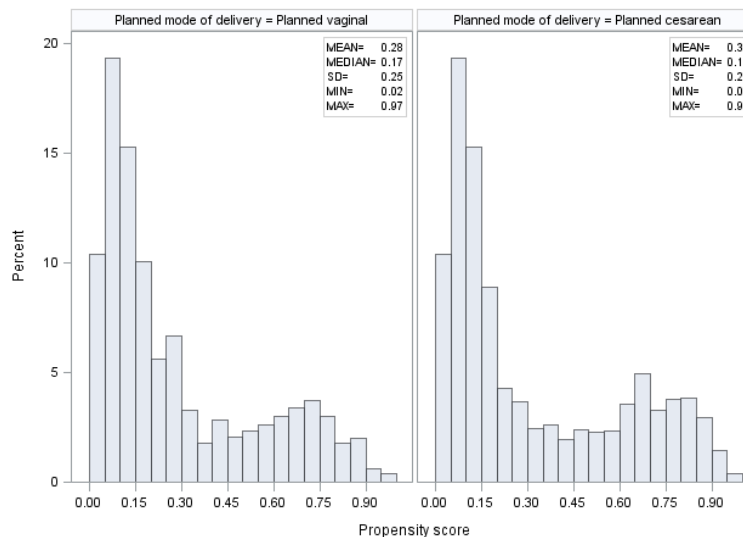
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Appendix 4. Propensity score distribution in the planned vaginal and planned cesarean delivery groups before (A) and after (B) matching in the low-risk population.



A

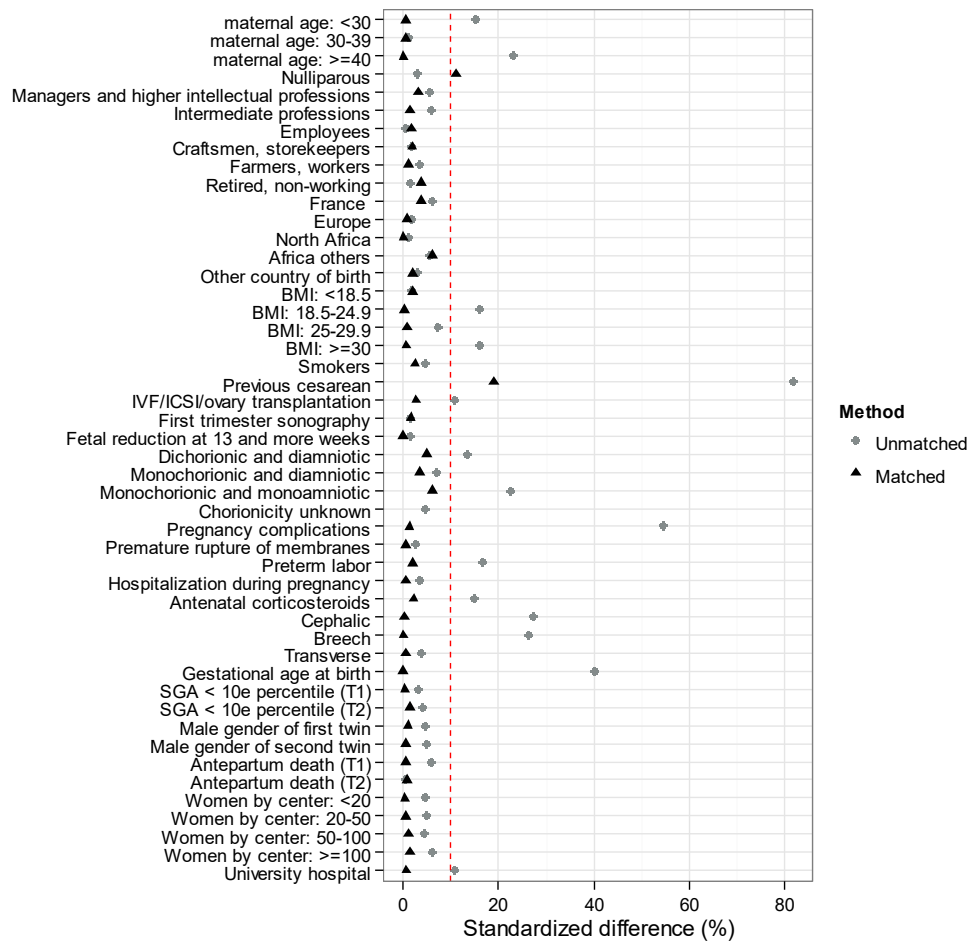


B

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Appendix 5. Absolute standardized differences for baseline maternal, pregnancy, delivery, and neonatal covariates in the planned vaginal and planned cesarean delivery groups in the overall and matched cohorts. BMI, body mass index; IVF, in vitro fertilization; ICSI, intracytoplasmic sperm injection; T1, twin 1; T2, twin 2; SGA, small for gestational age.



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Appendix 6. Selected Maternal, Pregnancy, Delivery, and Neonatal Characteristics in the Low-Risk Overall and Matched Cohorts

Characteristics	Low-risk overall cohort			Low-risk matched cohort		
	Planned Cesarean Delivery N=564	Planned Vaginal Delivery N=3410	Standardized difference %	Planned Cesarean Delivery N=420	Planned Vaginal Delivery N=420	Standardized difference %
Maternal						
Age (mean, yr)	33.0 ± 5.7	31.2 ± 5.0	32.6	32.5 ± 5.8	32.2 ± 5.3	4.6
Nulliparous — no. (%)	183 (32.5)	1526 (44.9)	25.7	176 (41.9)	198 (47.2)	10.9
BMI (Kg.m ⁻²) before pregnancy — no. (%)						
<18.5	32 (6.0)	216 (6.6)	2.5	24 (5.7)	27 (6.5)	3.3
18.5-24.9	288 (53.8)	2159 (65.9)	24.8	237 (56.5)	235 (56.0)	0.9
25-29.9	129 (24.1)	627 (19.1)	12.1	92 (21.8)	100 (23.7)	4.6
≥30	86 (16.1)	275 (8.4)	23.6	67 (16.1)	58 (13.8)	6.4
Smokers — no. (%)	69 (12.8)	464 (14.1)	3.8	53 (12.7)	59 (14.1)	4.1
Previous cesarean — no. (%)	285 (50.5)	121 (3.6)	124.6	142 (33.8)	117 (27.9)	12.8
Pregnancy and delivery						
IVF, ICSI — no. (%)	125 (22.3)	711 (21.0)	3.3	95 (22.7)	100 (23.8)	2.8
First trimester sonography — no. (%)	503 (95.8)	3081 (95.7)	0.8	395 (94.1)	399 (95.1)	4.3
Fetal reduction at 13 weeks or more — no. (%)	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	0.0
Chorionicity — no. (%)						
Dichorionic	467 (83.5)	2774 (81.7)	5.0	352 (83.8)	350 (83.4)	1.0
Monochorionic and diamniotic	92 (16.5)	619 (18.2)	4.7	68 (16.2)	70 (16.6)	1.0
Monochorionic and monoamniotic	0 (0.0)	0 (0.0)	-	0 (0.0)	0 (0.0)	-
Unknown	0 (0.0)	4 (0.1)	4.9	0 (0.0)	0 (0.0)	-
Complications — no. (%)	12 (2.1)	63 (1.9)	2.0	10 (2.4)	9 (2.1)	1.8
Hypertension	12 (2.1)	63 (1.9)		10 (2.4)	9 (2.1)	
Preeclampsia	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Placental abruption	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Suspected FGR for either twin	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Insulin-treated diabetes	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Placenta previa	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Malformation for either twin	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Twin-to-twin transfusion syndrome	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	

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Premature rupture of membranes — no. (%)	39 (6.9)	267 (7.9)	3.6	28 (6.7)	33 (7.9)	4.4
Preterm labor — no. (%)	126 (22.4)	1136 (33.4)	24.7	108 (25.7)	103 (24.4)	3.0
Hospitalization during pregnancy — no. (%)	141 (25.1)	1379 (40.6)	33.4	124 (29.5)	122 (29.0)	1.2
Antenatal corticosteroids — no. (%)	165 (29.4)	1274 (37.5)	17.3	137 (32.5)	136 (32.3)	0.5
Second twin presentation at delivery — no. (%)						
Cephalic	261 (46.3)	2122 (62.2)	32.4	196 (46.8)	190 (45.2)	3.2
Breech	228 (40.4)	859 (25.2)	32.9	167 (39.8)	178 (42.4)	5.4
Transverse	75 (13.3)	429 (12.6)	2.1	56 (13.4)	52 (12.4)	3.2
Neonatal						
Gestational age at birth (mean, wk)	36.7 ± 1.6	36.5 ± 1.8	12.9	36.7 ± 1.7	36.7 ± 1.7	0.0
32 wk 0 d to 34 wk 6 d — no. (%)	58 (10.3)	562 (16.5)	18.3	51 (12.2)	51 (12.2)	0.0
35 wk 0 d to 36 wk 6 d — no. (%)	136 (24.1)	865 (25.4)	2.9	101 (23.9)	101 (23.9)	0.0
≥37 wk 0 d — no. (%)	370 (65.6)	1983 (58.2)	15.4	268 (63.9)	268 (63.9)	0.0
First twin birth weight < 10 th centile — no. (%)	157 (27.8)	1070 (31.4)	7.8	126 (30.1)	121 (28.9)	0.1
Second twin birth weight <10 th centile — no. (%)	175 (31.0)	1307 (38.4)	15.5	134 (31.8)	136 (32.5)	0.1
Male gender, first twin — no. (%)	304 (53.9)	1767 (51.8)	4.1	193 (45.9)	192 (45.8)	2.7
Male gender, second twin — no. (%)	281 (49.8)	1713 (50.3)	0.9	210 (49.9)	196 (46.6)	2.7

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Appendix 7. Fetal and Neonatal Outcomes in the Overall and Low-Risk Populations Between 32 Weeks 0 Days and 34 Weeks 6 Days of Gestation

	Overall population		Low-risk population	
	Planned Cesarean Delivery N=900	Planned Vaginal Delivery N=1508	Planned Cesarean Delivery N=116	Planned Vaginal Delivery N=1124
Primary outcome				
Composite morbidity — no. (%)	104 (11.6)	110 (7.3)	20 (17.2)	77 (6.9)
Death — no. (%)				
Antepartum*	13 (1.4)	14 (0.9)	0	0
Per-partum	0	0	0	0
Neonatal	8 (0.9)	4 (0.3)	0	1 (<0.1)
Apgar score <4 at 5 min — no. (%)	8 (0.9)	11 (0.8)	1 (0.9)	6 (0.5)
Neonatal trauma — no. (%)	1 (0.1)	3 (0.2)	0	3 (0.3)
Long bone fracture	0	2 (0.1)	0	2 (0.2)
Brachial plexus palsy	0	0	0	0
Skull fracture	1 (0.1)	1 (<0.1)	0	1 (<0.1)
Spinal cord injury	0	0	0	0
Encephalopathy — no. (%)	2 (0.2)	3 (0.2)	0	3 (0.3)
≥2 seizures within 72 h after birth —no. (%)	0	0	0	0
Endotracheal tube >24 h within 72 hr after birth — no. (%)	47 (5.3)	40 (2.7)	8 (7.2)	26 (2.4)
Proven neonatal sepsis — no. (%)	35 (4.0)	45 (3.1)	9 (8.0)	30 (2.8)
Bronchopulmonary dysplasia — no. (%)	11 (1.2)	8 (0.5)	1 (0.9)	4 (0.4)
Intraventricular hemorrhage — no. (%)	22 (2.5)	29 (2.0)	2 (1.8)	26 (2.4)
Grade I-II*	21 (2.4)	26 (1.8)	2 (1.8)	23 (2.1)
Grade III-IV	1 (0.1)	3 (0.2)	0	3 (0.3)
Periventricular leukomalacia — no. (%)	1 (0.1)	3 (0.2)	0	3 (0.2)
Necrotizing enterocolitis — no. (%)	9 (1.0)	16 (1.1)	1 (0.9)	9 (0.8)

*Outcomes with * were not components of the composite primary outcome.

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Appendix 8. Fetal and Neonatal Outcomes in the Overall and Low-Risk Populations Between 35 Weeks 0 Days and 36 Weeks 6 Days of Gestation

	Overall population		Low-risk population	
	Planned Cesarean Delivery N=868	Planned Vaginal Delivery N=2552	Planned Cesarean Delivery N=272	Planned Vaginal Delivery N=1730
Primary outcome				
Composite morbidity — no. (%)	35 (4.0)	45 (1.8)	6 (2.2)	23 (1.3)
Death — no. (%)				
Antepartum*	4 (0.5)	16 (0.6)	0	0
Per-partum	0	0	0	0
Neonatal	4 (0.5)	4 (0.2)	0	0
Apgar score <4 at 5 min — no. (%)	7 (0.8)	3 (0.1)	2 (0.7)	0
Neonatal trauma — no. (%)	0	4 (0.2)	0	3 (0.2)
Long bone fracture	0	2 (<0.1)	0	1 (<0.1)
Brachial plexus palsy	0	1 (<0.1)	0	1 (<0.1)
Skull fracture	0	1 (<0.1)	0	1 (<0.1)
Spinal cord injury	0	0	0	0
Encephalopathy — no. (%)	4 (0.5)	2 (<0.1)	0	1 (<0.1)
≥2 seizures within 72 h after birth —no. (%)	1 (0.1)	1 (<0.1)	0	0
Endotracheal tube >24 h within 72 hr after birth — no. (%)	11 (1.3)	13 (0.5)	3 (1.1)	5 (0.3)
Proven neonatal sepsis — no. (%)	16 (1.9)	15 (0.6)	0	9 (0.5)
Bronchopulmonary dysplasia — no. (%)	1 (0.1)	8 (0.3)	1 (0.4)	5 (0.3)
Intraventricular hemorrhage — no. (%)	3 (0.3)	5 (0.2)	0	1 (<0.1)
Grade I-II*	3 (0.3)	5 (0.2)	0	1 (<0.1)
Grade III-IV	0	0	0	0
Periventricular leukomalacia — no. (%)	1 (0.1)	0	0	0
Necrotizing enterocolitis — no. (%)	2 (0.2)	2 (<0.1)	0	1 (<0.1)

*Outcomes with * were not components of the composite primary outcome

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The authors provided this information as a supplement to their article.

Appendix 9. Fetal and Neonatal Outcomes in the Overall and Low-Risk Populations at or After 37 Weeks 0 Days of Gestation

	Overall population		Low-risk population	
	Planned Cesarean Delivery N=1140	Planned Vaginal Delivery N=4862	Planned Cesarean Delivery N=740	Planned Vaginal Delivery N=3966
Primary outcome				
Composite morbidity — no. (%)	11 (1.0)	44 (0.9)	2 (0.3)	33 (0.8)
Death — no. (%)				
Antepartum*	6 (0.5)	25 (0.5)	0	0
Per-partum	0	0	0	0
Neonatal	4 (0.3)	3 (<0.1)	1 (0.1)	1 (<0.1)
Apgar score <4 at 5 min — no. (%)	3 (0.3)	11 (0.2)	2 (0.3)	10 (0.3)
Neonatal trauma — no. (%)	1 (<0.1)	4 (<0.1)	0	3 (0.2)
Long bone fracture	0	2 (<0.1)	0	2 (0.1)
Brachial plexus palsy	0	1 (<0.1)	0	0
Skull fracture	0	1 (<0.1)	0	1 (<0.1)
Spinal cord injury	1 (<0.1)	0	0	0
Encephalopathy — no. (%)	1 (<0.1)	8 (0.2)	1 (0.1)	6 (0.2)
≥2 seizures within 72 h after birth —no. (%)	0	0	0	0
Endotracheal tube >24 h within 72 hr after birth — no. (%)	1 (0.1)	9 (0.2)	1 (0.1)	6 (0.2)
Proven neonatal sepsis — no. (%)	4 (0.4)	16 (0.3)	0	11 (0.3)
Bronchopulmonary dysplasia — no. (%)	2 (0.2)	1 (<0.1)	1 (0.1)	1 (<0.1)
Intraventricular hemorrhage — no. (%)	0	0	0	0
Grade I-II*	0	0	0	0
Grade III-IV	0	0	0	0
Periventricular leukomalacia — no. (%)	0	1 (<0.1)	0	0
Necrotizing enterocolitis — no. (%)	1 (0.1)	0	0	0

*Outcomes with * were not components of the composite primary outcome.

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