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1 **Incidence and risk factors of caesarean section in preterm breech births: a population-**
2 **based cohort study**

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31 **Condensation:** Breech presentation is common in preterm infants and is associated with
32 widespread use of cesarean delivery despite the absence of recommendations for mode of
33 delivery.

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50 **Abstract**

51 **Objectives:** To describe the incidence of breech presentation at 22 to 34 weeks' gestation,
52 estimate the incidence of cesarean section delivery by cause of prematurity, and assess the
53 factors associated with caesarean delivery in preterm breech births with preterm labor or
54 preterm premature rupture of membranes.

55 **Study design:** EPIPAGE 2 is a French national prospective population-based cohort study of
56 preterm births that occurred in 546 maternity units in 2011. We estimated the overall
57 incidence of breech presentation and the incidence of cesarean delivery by cause of
58 prematurity. Among the 579 singletons with breech presentation born at 22 to 34 weeks in a
59 context of spontaneous preterm labor or membrane rupture, multivariable logistic regression
60 was used to assess the association between individual and institutional characteristics and
61 caesarean delivery.

62 **Results:** Among the 3,660 singletons born at 22 to 34 weeks' gestation in the EPIPAGE 2
63 study, 20.1% (n=911) were breech presentation. Among these births, the rate of cesarean
64 section was 99.6% with vascular pathologies, intrauterine growth retardation or placental
65 abruption as compared with 60.1% with spontaneous preterm labor or membrane rupture. The
66 main indication for caesarean delivery was gestational age associated with breech presentation
67 (61.0%). Delivery mode varied by region of birth. Other characteristics associated with
68 caesarean delivery were hospital status (public teaching, public non-teaching or private),
69 clinical chorioamnionitis, hospital admission after labor onset, and gestational age.

70 **Conclusion:** Breech presentation is common in preterm infants and is associated with
71 widespread use of cesarean delivery with significant regional disparities that could reflect the
72 lack of consensus and recommendations on the preferential mode of delivery. Other factors

73 associated with caesarean delivery are the status of the maternity unit, clinical
74 chorioamniotitis, admission after labor onset and gestational age.

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76 **Keywords:** EPIPAGE 2, breech presentation, preterm birth, mode of delivery, caesarean
77 section

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92 **Introduction**

93 Mode of delivery of preterm fetuses with breech presentation remains controversial (1–5).
94 Obstetricians are often faced with this situation because the prevalence of the breech
95 presentation is elevated with low gestational age: from 3% to 4% at term to 28% at 25 to 28
96 weeks' gestation (6,7). This issue is crucial in obstetrical management. Indeed, the condition
97 of the child, already exposed to the specific risks of prematurity, can worsen because of the
98 potential complications associated with labor and vaginal delivery (anoxia, obstetric trauma,
99 head entrapment, death) (8–10). In addition, caesarean section, which is technically difficult
100 because of the absent or thicker lower uterine segment, is associated with non-negligible
101 maternal risks both in the short term (2,11–13) and long term (14).

102 Results of a randomized controlled trial published in 2000 (15), concluded that the risk of
103 neonatal death with term breech presentation was reduced with planned caesarean delivery as
104 compared with planned vaginal delivery. This study included 2,183 women from 121
105 maternity units and 26 countries. Nevertheless, external validity was limited because of the
106 large variation in local policies and individual skills and by the analysis of neonatal deaths
107 unrelated to delivery route (16–18). These results largely contributed to changes in practices
108 (19), with a greater use of caesarean delivery with breech presentation, at term but also before
109 term, although the study did not provide any specific information concerning preterm breech
110 presentation. Because of this lack of evidence, the National College of French Gynecologists
111 and Obstetricians (CNGOF), in its guidelines of 1998 and 2016, does not recommend one
112 delivery mode over another for preterm breech presentation (20–22).

113 The objectives of this work were to (1) describe the incidence of breech presentation in
114 deliveries between 22 and 34 weeks' gestation, (2) estimate the incidence of caesarean section

115 delivery with preterm breech presentation by cause of prematurity and (3) study the individual
116 and institutional factors associated with caesarean delivery in preterm breech fetuses.

117 **Methods**

118 *Setting and data collection*

119 This study is based on data from the EPIPAGE2 (Etude épidémiologique sur les petits âges
120 gestationnels) cohort study (23), a prospective, national, population-based cohort study
121 implemented to describe the short- and long-term outcomes of preterm infants in terms of
122 birth circumstances, medical practices and organization of care. Infants were included from
123 March to December 2011 in 546 maternity units, representing 98% of French maternity units.
124 Infants born at 22 to 26 weeks, 27 to 31 weeks, and 32 to 34 weeks were included for 8
125 months, 6 months and 5 weeks, respectively. Different stages of follow-up are planned up to
126 age 12 years. Individual perinatal data were collected from medical records in both maternity
127 and neonatology units. The data for centers were obtained from a specific questionnaire sent
128 to obstetrics and neonatology departments that included at least one live birth in the cohort
129 (i.e., 413 centers).

130 *Participants*

131 Among the 7,804 infants born at 22 to 34 weeks' gestation included in the EPIPAGE2 study,
132 we included all singletons who were alive at the beginning of labor or during the caesarean
133 section performed before labor, who were in breech presentation. Exclusion criteria were
134 multiple pregnancies, home births, terminations of pregnancy and stillbirths before labor.
135 Because the use of caesarean section delivery is almost systematic in situations of prematurity
136 induced for a maternal indication (e.g., hypertensive pathology) and/or fetal indication (e.g.,
137 intrauterine growth retardation [IUGR]), we focused on cases of spontaneous preterm labor

138 (SPL) and preterm premature rupture of membranes (PPROM), these two case groups being
139 mutually exclusive.

140 *Outcome and other studied factors*

141 The primary outcome was caesarean section delivery, performed before or during labor, as
142 reported in the medical record.

143 The variables analyzed first focused on maternity unit characteristics: region, type (type I:
144 without neonatal department; types IIa & IIb: with neonatal department; type III: with
145 neonatal intensive care unit) and status of the institution (public teaching, public non-teaching
146 or private). We then studied maternal characteristics (age, nationality, employment, marital
147 status, parity, previous caesarean section) and obstetric characteristics (cause of preterm birth,
148 antenatal steroids, *in utero* transfer, clinical chorioamnionitis, admission after labor onset,
149 gestational age).

150 SPL was defined as preterm labor with intact membranes and PPRM as membranes ruptured
151 more than 24 hr before delivery. Gestational age was determined from a first trimester
152 ultrasound or the date of the last menstrual period. Antenatal steroids use was a binary
153 variable classified as at least one injection versus no injection of betamethasone or
154 dexamethasone before delivery.

155 *Statistical analysis*

156 We first estimated the incidence of breech presentation by gestational age and that of
157 caesarean section by cause of prematurity. We then described the respective frequencies of
158 vaginal and caesarean deliveries and compared institutional and individual characteristics by
159 mode of delivery. To account for the inclusion scheme of the study and for representative
160 preterm births in France, a weighted coefficient was allocated to each individual (1 for births

161 between 22 and 26 weeks, 1,346 for births between 27 and 31 weeks, and 7 for births between
162 32 and 34 weeks). The association between maternal or obstetric characteristics and caesarean
163 section was estimated by univariate and multivariate logistic regression models and quantified
164 by crude odds ratios (ORs) and adjusted ORs (aOR) and their confidence intervals (95% CIs).
165 The variables included in the multivariate model were chosen according to their clinical
166 relevance. Data were missing for 0% to 9.5% of patients for each covariate. A missing data
167 indicator class was added to each relevant categorical variable in the multivariate analysis.
168 The adjustment of the multivariate model to the data was tested by the Hosmer-Lemeshow
169 test; its discriminating power was evaluated by the area under the receiver operating
170 characteristic curve. Data were analyzed by using Stata/SE 13.0 (StataCorp LP, College
171 Station, TX). Statistical significance was set at 2-tailed $p < .05$.

172 **Results**

173 *Incidence of breech presentation*

174 Among the 3,660 singletons born at 22 to 34 weeks included in the EPIPAGE 2 study, 911
175 (weighted percentage 20.1%) were in breech presentation (Figure 1). The overall frequency of
176 breech presentation varied by gestational age at birth: 47.1% to 37.4% at 22 to 26 weeks,
177 29.5% to 24.2% at 27 to 29 weeks, and 20.5% to 12.5% at 30 to 34 weeks (Figure 2).

178 *Incidence of caesarean section delivery with breech presentation by cause of prematurity*

179 The main causes of premature birth, mutually exclusive, were SPL (41.1%), PPRM
180 (28.1%), vascular or hypertensive pathology (22.1%), IUGR (5.6%) or placental abruption
181 (3.1%). With breech presentation, caesarean delivery was almost systematic with vascular
182 pathologies, IUGR and placental abruption (99.6% of patients). It was performed for 60.1% of

183 patients (95% CI [54.6-65.7]) with breech presentation and SPL or PPRM with variations by
184 week of gestational age (Figures 1, 2).

185 *Factors associated with caesarean delivery with breech presentation and SPL or PPRM*

186 The births included in this analysis occurred in 170 maternity units. Regional disparities
187 existed: in Rhône-Alpes, Auvergne, Martinique and Limousin districts, more than 80% of
188 births were caesarean deliveries as compared with less than 33% in French Guiana, Picardie,
189 Centre and Haute-Normandie (Figure 3). Nearly one-third of births occurred in other than
190 type III maternity units (Table 2). Before 32 weeks, 4.2%, 7.8% and 6.2% of infants were
191 born in type I, IIa or IIb maternity units, respectively. Most deliveries occurred in a public
192 institution: a public teaching hospital for 49.6% or a public non-teaching hospital for 41.5%.
193 After adjustment, region ($p<.001$) and hospital status ($p=.005$) were significantly associated
194 with caesarean delivery (Tables 1, 2).

195 Among socio-demographic characteristics, the age of the mother and her nationality were not
196 associated with the mode of delivery. However, single patients or housewives less often had a
197 caesarean section delivery than patients in a couple relation or who were employed,
198 respectively. These associations disappeared after adjusting for confounding factors (Table 2).

199 In terms of obstetrics history, nearly half of the mothers were multiparous; in total, 7.1% had
200 a scarred uterus and 3.3% had had two or more previous caesarean sections. Parity was not
201 associated with caesarean delivery. There was a gradient with an increase in caesarean
202 deliveries by number of previous caesarean sections. This association was not found on
203 multivariate analysis.

204 Concerning the current pregnancy, the cause of preterm birth, *in utero* transfer and antenatal
205 corticosteroids were not associated with the delivery mode (Table 2). After adjustment, risk of

206 caesarean delivery was increased with clinical chorioamnionitis (aOR 2.0 [1.1-3.7]) but
207 reduced with admission after labor onset, representing 25.2% of patients, as compared with
208 labor occurring during hospitalization (aOR 0.3 [0.1-0.5]).

209 Finally, risk of caesarean delivery was strongly associated with gestational age ($p < .001$), even
210 after adjusting for individual and institutional characteristics (Table 2). No caesarean section
211 was performed at 22 and 23 weeks' gestation (Figure 2). From 24 to 25 weeks, 1 in 5 patients
212 had a caesarean section delivery. From 26 to 34 weeks, the frequency of caesarean delivery
213 varied from 59.8% to 80.0%. Gestational age associated with breech presentation was the
214 main indication for caesarean section, reported in 61.0% of cases. Other non-mutually
215 exclusive indications were maternal pathology (18.6%), abnormal fetal heart rate before or
216 during labor (18.3%), fetal pathology (14.3%) and/or stagnated dilation (1.7%).

217 **Comment**

218 *Main findings*

219 Among singletons born at 22 to 34 weeks, 20.1% were breech presentations, with significant
220 variations depending on gestational age. Most of these preterm deliveries were caesarean
221 sections, 99.6% with vascular pathologies, IUGR or placental abruption as compared with
222 60.1% with SPL or PPROM. Delivery mode appeared to vary by region of birth in France.
223 Childbirth occurred in other than a type III maternity unit for nearly 20% of births before 32
224 weeks. Other characteristics associated with caesarean deliveries with preterm breech
225 presentation were the status of the maternity unit, clinical chorioamnionitis, admission after
226 labor onset, and gestational age.

227 *Strengths and limitations*

228 The main strength of this study is related to the design of the EPIPAGE2 cohort, a large
229 national, prospective, population-based study. The strong involvement of families (93%
230 participation among all eligible children) and the systematic and standardized collection of
231 precise individual data ensure good representation of patients and medical practices.

232 However, this analysis has some limitations. Indeed, 596 eligible children (7.1%) were not
233 included in the EPIPAGE 2 cohort because of parental refusal. Among these, 109 singletons
234 (19.6% [15.2-24.9]) were breech presentations, with no significant difference from children
235 included in our analysis (data not shown). The comparison of caesarean delivery rates was not
236 possible between these two groups because the cause of delivery was unknown with refusal of
237 participation. However, non-participation is not likely linked to fetal presentation or mode of
238 delivery, which limits this potential bias.

239 The missing data for the variables "presentation" and "cause of prematurity" led us to exclude
240 173 then 75 subjects from the analysis (i.e., 6.8% of the initial sample). Infants whose
241 presentation was unknown were more often delivered by caesarean section (86.5% [79.0-
242 94.0]) and less often because of SPL or PPROM (46.0% [34.4-57.5]) than was our study
243 population. Thus, most of these participants were not eligible for our analysis. Among the 75
244 infants for whom the cause of prematurity was missing, 66.2% (53.6-78.8) were delivered by
245 caesarean section, so the distribution of delivery route did not differ from that for our analysis
246 population.

247 A final limitation was the lack of precise data on the type of breech presentation, frank or
248 complete. This clinically relevant information may affect the choice of delivery route, with a
249 complete breech considered to have a poorer obstetric prognosis. However, in the context of
250 preterm births, the type of breech is not as important in the decision as gestational age or the
251 speed of labor.

252 *Interpretation*

253 Our results show a high rate of caesarean section deliveries in preterm breech singletons in
254 France. Several factors can explain this result. First, situations of induced preterm birth
255 (because of vascular pathology, IUGR...), which have increased in frequency in recent years
256 (24), strongly affect the overall incidence of caesarean deliveries. In cases of SPL and
257 PPRM, clinical guidelines do not guide the practitioner's choice (20,22). The lack of
258 consensus in the literature (1–5) and the fear of potential severe complications of labor and
259 delivery can also explain the preponderant use of caesarean delivery. Its use may also be a
260 reflection of the medico-legal considerations in the management of obstetric situations
261 considered at risk (16,25).

262 Performing a caesarean section is a marker of active antenatal care of the unborn child, as are
263 antenatal steroids or magnesium sulfate for neuroprotection (26). Therefore, gestational age
264 logically plays a preponderant role in this decision (26). Thus, in our study, no caesarean
265 section was performed before the resuscitation threshold considered in France in 2011 (24
266 weeks). Thereafter, caesarean sections are more easily offered to patients with fetal vital
267 prognosis considered "acceptable" (27), which corresponds to increasingly low gestational
268 age as a result of advances in neonatology.

269 We showed significant regional variations in the frequency of caesarean deliveries for preterm
270 breech presentations with SPL or PPRM. This heterogeneity may reflect regional disparities
271 in the active antenatal care proposed in the context of extreme prematurity. Regional
272 variations may also be related to variations in patient characteristics but also to a different
273 distribution of maternity unit types and status. This contrast can reflect the leadership of the
274 regional university hospital, where practitioners of peripheral maternity clinics have often
275 been trained.

276 This variability in delivery practices is often reported between countries, maternity units and
277 even obstetricians (25,28–30). In a French survey of management for breech presentations in
278 university hospitals, Michel et al. found mean of 73.8% (range 50.3% to 98.3%) declared
279 rates of caesarean section deliveries (28). The authors reported that obstetric practices were
280 little affected by gestational age and that only 3 of 18 hospitals included gestational age in
281 their decision protocol for delivery route.

282 Clinical chorioamnionitis was associated with an increase in caesarean deliveries. This
283 finding is consistent in the literature: caesarean delivery allows for shortening the fetal
284 exposure to infection, especially when women are not in labor (31).

285 Unexpected delivery is common in situations of spontaneous prematurity, with a large number
286 of patients in labor admitted to hospital. Therefore, the breech presentation is often diagnosed
287 shortly before delivery (32). The delivery route must be chosen quickly, unless the imminence
288 of birth leaves no other choice than vaginal delivery. Our results are consistent with findings
289 from a retrospective study of term breeches showing that the probability of a vaginal birth
290 increases with cervical dilation at admission ≥ 5 cm (33). This finding raises the question of
291 the technical skills required for vaginal delivery in preterm breech presentations, especially in
292 a sudden obstetric context, that is, when vaginal delivery is accepted by the obstetric team
293 only because performing a caesarean section is impossible. This situation, often marked by
294 emergency, requires precise and adapted gestures by all professionals, including younger ones
295 (34).

296 **Conclusion**

297 Breech presentation is frequent for infants born at 22 to 34 weeks' gestation. In this clinical
298 situation, the rate of caesarean deliveries in France is high, with significant regional

299 disparities that could reflect the lack of consensus and recommendations on the preferential
300 mode of delivery. Other factors associated with caesarean delivery are the status of the
301 maternity unit, clinical chorioamniotitis, admission after labor onset and gestational age. The
302 impact of the delivery mode on neonatal outcomes needs to be addressed.

303

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429 **Tables and figures**

430 Figure 1: Flow of participants in the study.

431 Figure 2: Incidence of breech presentation and rate of caesarean section by week of
432 gestational age.

433 Figure 3: Incidence of breech presentation and mode of delivery by region of birth.*

434 Legend: * The Poitou-Charentes region did not participate.

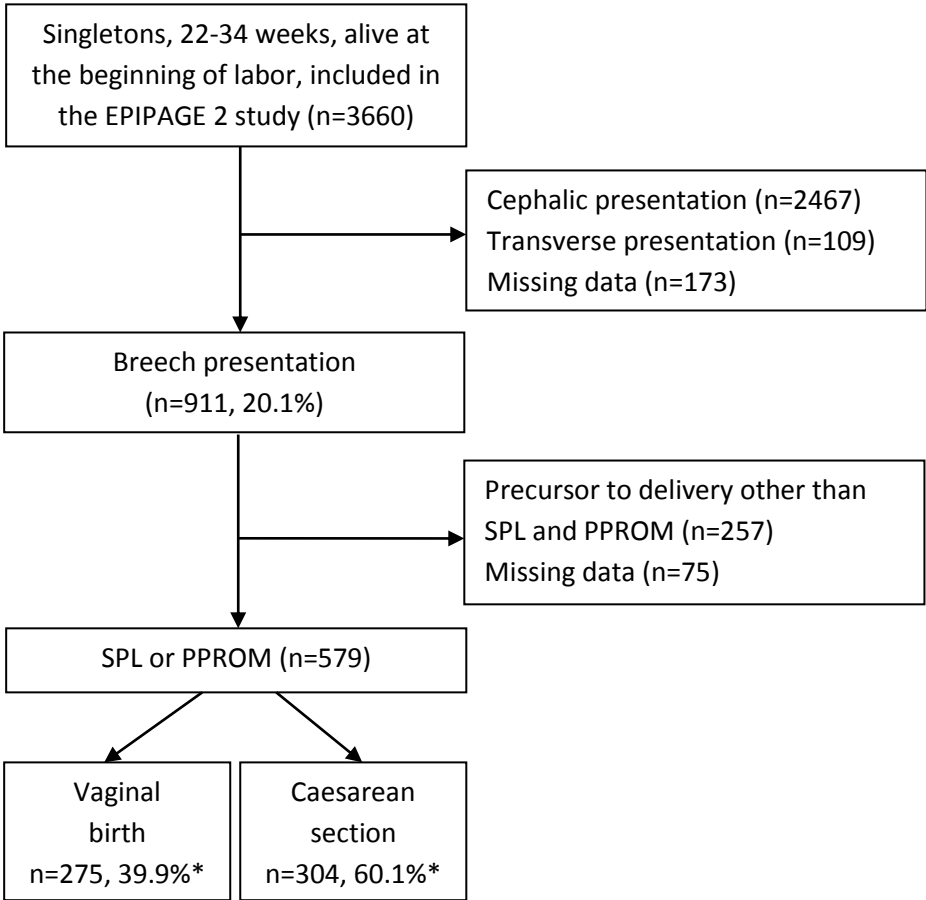
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436 Table 1: Association between the region of birth and caesarean section with breech
437 presentation and spontaneous preterm labor (SPL) or preterm premature rupture of
438 membranes (PPROM).

439 Table 2: Association between institutional and individual characteristics and caesarean section
440 with breech presentation and SPL or PPRM.

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Figure 1: Flow of infants in the study.

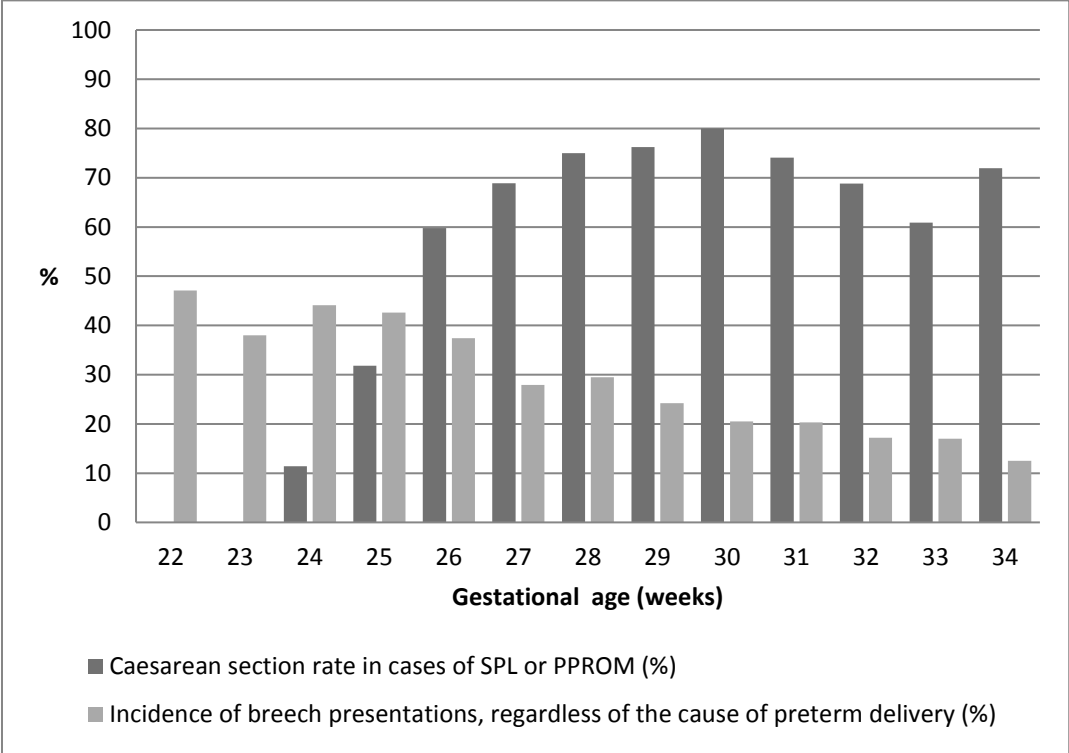


SPL: spontaneous preterm labor

PPROM: preterm premature rupture of membranes

* Percentages are weighted according to gestational age.

Figure 2: Incidence of breech presentation* and rate of caesarean section by week of gestational age.



* The incidence of breech presentation is assessed among the 3487 singletons, born at 22 to 34 weeks, alive at the beginning of labor with information about fetal presentation.

Table 1: Association between the region of birth and caesarean section with breech presentation and spontaneous preterm labor (SPL) or preterm premature rupture of membranes (PPROM).

	Vaginal birth (n=275)	Caesarean section (n=304)	Bivariate analysis	Multivariate analysis
	n (%)*	n (%)*	OR* (95%CI)	aOR** (95%CI)
Region of birth				
Alsace	7 (28.7)	10 (71.3)	1.8 (0.5-6.4)	2.1 (0.5-8.3)
Aquitaine	6 (25.0)	16 (75.0)	2.2 (0.5-9.4)	2.3 (0.7-8.4)
Auvergne	2 (12.7)	6 (87.3)	5.1 (0.8-31.7)	2.9 (0.4-22.3)
Basse Normandie	9 (47.6)	5 (52.4)	0.8 (0.2-3.7)	0.4 (0.1-1.7)
Bourgogne	8 (48.3)	8 (51.7)	0.8 (0.2-3.4)	1.0 (0.2-3.8)
Bretagne	14 (58.4)	9 (41.6)	0.5 (0.2-1.4)	0.6 (0.2-2.2)
Centre	7 (68.3)	5 (31.7)	0.3 (0.1-1.6)	2.5 (0.5-13.4)
Champagne-Ardenne	5 (48.0)	6 (52.0)	0.8 (0.1-4.5)	0.4 (0.1-2.1)
Franche-Comté	3 (33.8)	6 (66.2)	1.5 (0.2-10.0)	5.6 (0.7-44.8)
Guadeloupe	5 (61.5)	3 (38.5)	0.5 (0.1-2.1)	1.2 (0.1-10.8)
Guyane	5 (77.5)	4 (22.5)	0.2 (0.1-1.1)	0.3 (0.1-2.1)
Haute Normandie	10 (67.5)	7 (32.5)	0.4 (0.1-1.2)	0.7 (0.2-2.7)
Ile de France	71 (42.6)	67 (57.4)	1	1
Languedoc Roussillon	7 (36.0)	22 (64.0)	1.3 (0.4-4.5)	11.5 (3.2-41.8)
Limousin	0 (0.0)	2 (100.0)	-	-
Lorraine	13 (59.5)	5 (40.5)	0.5 (0.1-2.2)	0.6 (0.2-2.4)
Martinique	1 (12.9)	5 (87.1)	5.0 (0.5-45.2)	23.7 (0.6-949.5)
Midi-Pyrénées	13 (59.5)	12 (40.5)	0.5 (0.2-1.6)	0.7 (0.2-2.3)
Nord Pas de Calais	26 (43.7)	16 (56.3)	1.0 (0.4-2.4)	0.5 (0.2-1.4)
Provence Alpes Côte d'Azur	21 (37.5)	21 (62.5)	1.2 (0.5-3.0)	2.4 (0.9-6.6)
Pays de Loire	15 (27.3)	19 (72.7)	2.0 (0.8-5.0)	3.2 (1.1-9.5)
Picardie	5 (70.3)	2 (29.7)	0.3 (0.1-1.7)	0.3 (0.1-2.2)
Réunion	8 (48.2)	3 (51.8)	0.8 (0.1-4.5)	1.5 (0.3-8.1)
Rhône-Alpes	14 (11.3)	45 (88.7)	5.8 (2.6-13.2)	6.7 (2.3-19.1)

* Percentages and odds ratios (ORs) are weighted according to gestational age.

** aOR: OR adjusted for region, type and status of maternity unit, age, nationality, employment, marital status, parity, scarred uterus, cause of preterm birth, antenatal steroids use, *in utero* transfer, clinical chorioamnionitis, admission after labor onset, gestational age

95% CI, 95% confidence interval

Table 2: Association between institutional and individual characteristics and caesarean section with breech presentation and SPL or PPRM.

		Total (n=579)	Vaginal birth (n=275)	Caesarean section (n=304)	Bivariate analysis	Multivariate analysis
		n (%)*	n (%)*	n (%)*	OR* (95%CI)	aOR** (95%CI)
Maternity unit characteristics						
Unit type	I	27 (4.9)	19 (6.0)	8 (4.1)	0.7 (0.2-2.1)	0.6 (0.1-2.3)
	Ila	54 (11.9)	33 (13.2)	21 (11.1)	0.9 (0.4-1.9)	0.8 (0.3-2.4)
	Ilb	53 (15.6)	29 (12.5)	24 (17.7)	1.4 (0.7-3.1)	0.9 (0.3-2.3)
	III	445 (67.6)	194 (68.3)	251 (67.1)	1	1
Hospital status	Public teaching	315 (49.6)	146 (53.8)	169 (46.8)	1	1
	Public non-teaching	213 (41.5)	100 (39.4)	113 (42.9)	1.2 (0.8-2.0)	3.3 (1.7-6.2)
	Private	32 (8.9)	16 (6.8)	16 (10.3)	1.8 (0.6-4.8)	2.3 (0.6-8.8)
Maternal characteristics						
Age (years)	< 20	27 (2.9)	18 (4.6)	9 (1.7)	0.4 (0.2-0.9)	0.8 (0.2-2.5)
	20–34	440 (76.5)	215 (78.2)	225 (75.4)	1	1
	≥ 35	111 (20.6)	41 (17.2)	70 (22.9)	1.4 (0.7-2.6)	1.3 (0.7-2.4)
Nationality	French	446 (85.1)	206 (82.0)	240 (87.1)	1	1
	Other	85 (14.9)	46 (18.0)	39 (12.9)	0.7 (0.3-1.3)	1.0 (0.5-2.0)
Marital status	Marital life	482 (91.5)	223 (86.1)	259 (95.0)	1	1
	Single	61 (8.5)	34 (13.9)	27 (5.0)	0.3 (0.2-0.6)	0.8 (0.4-1.8)
Employment	Employed	333 (65.3)	139 (57.0)	194 (70.5)	1	1
	Unemployed	61 (9.7)	31 (9.8)	30 (9.7)	0.8 (0.4-1.7)	1.1 (0.5-2.5)
	Housewife	143 (25.0)	79 (33.2)	64 (19.8)	0.5 (0.3-0.8)	0.8 (0.4-1.5)
Obstetric characteristics						
Parity	0	298 (51.2)	154 (53.5)	144 (49.7)	1	1
	1	156 (26.0)	71 (26.0)	85 (25.9)	1.1 (0.6-1.9)	0.7 (0.4-1.3)
	2 or more	124 (22.8)	49 (20.5)	75 (24.4)	1.3 (0.7-2.4)	0.8 (0.4-1.7)
Scarred uterus	No	486 (89.6)	245 (93.4)	241 (86.9)	1	1
	1 previous scar	46 (7.1)	15 (5.4)	31 (8.3)	1.6 (0.7-3.9)	1.9 (0.8-4.8)
	≥ 2 previous scars	19 (3.3)	5 (1.2)	14 (4.8)	4.3 (1.3-13.8)	2.3 (0.5-11.4)
Cause of preterm birth	SPL	341 (59.1)	184 (62.0)	157 (57.2)	1	1
	PPROM	238 (40.9)	91 (38.0)	147 (42.8)	1.2 (0.8-2.0)	1.2 (0.7-2.0)
Clinical chorioamnionitis	No	387 (82.4)	188 (83.0)	199 (81.9)	1	1
	Yes	139 (17.6)	59 (17.0)	80 (18.1)	1.1 (0.7-1.8)	2.0 (1.1-3.7)
<i>In utero</i> transfer	No	326 (59.8)	186 (65.7)	140 (56.0)	1	1
	Yes	247 (40.2)	84 (34.3)	163 (44.0)	1.5 (0.9-2.5)	1.6 (0.9-2.7)
Antenatal steroids use	No	182 (33.0)	128 (39.7)	54 (28.5)	1	1
	Yes	384 (67.0)	139 (60.3)	245 (71.5)	1.7 (1.0-2.8)	1.5 (0.8-2.7)
Admission after labor onset	No	417 (74.8)	169 (63.2)	248 (82.7)	1	1
	Yes	148 (25.2)	102 (36.8)	46 (17.3)	0.4 (0.2-0.6)	0.3 (0.1-0.5)
Gestational age (weeks)	22-25	187 (17.2)	159 (36.7)	28 (4.3)	0.1 (0.0-0.2)	0.1 (0.0-0.2)
	26-27	127 (13.1)	47 (11.9)	80 (13.8)	0.8 (0.4-1.5)	0.8 (0.4-1.7)
	28-29	86 (10.6)	21 (6.5)	65 (13.4)	1.5 (0.7-3.0)	1.7 (0.7-4.1)
	30-31	108 (13.4)	25 (7.8)	83 (17.1)	1.6 (0.8-3.1)	1.8 (0.8-4.2)
	32-34	71 (45.7)	23 (37.1)	48 (51.4)	1	1

Hosmer-Lemeshow statistic= 0.08, area under the receiver operating characteristic curve (AUC)=0.88

SPL: spontaneous preterm labor, PPRM: preterm premature rupture of membranes

* Percentages and ORs are weighted according to gestational age.

** aOR: OR adjusted for region, type and status of maternity unit, age, nationality, employment, marital status, parity, scarred uterus, cause of preterm birth, antenatal steroids use, *in utero* transfer, clinical chorioamnionitis, admission after labor onset, gestational age