

## **Appendix 1. Assessment of Pelvic Floor Disorders at 6 Months Postpartum**

Information about pelvic floor disorders was obtained from a questionnaire sent 6 months after delivery. A second mailing was sent to the women from whom we had received no response. The questionnaire asked about postpartum pelvic floor exercises and pelvic floor symptoms during the preceding 4 weeks. The women who answered "yes" to the entry question "Do you have involuntary loss of urine?" were considered to have symptoms of UI and were then asked further questions from the French version of the Bristol Female Lower Urinary Tract Symptoms (BFLUTS) validated questionnaire<sup>1-3</sup> about the frequency, amount, and circumstances of leakage, and if and to what extent incontinence bothered women. Stress urinary incontinence (SUI) was assessed by responses to the question "Does urine leak when you are physically active, cough or sneeze?" Possible responses were as follows: never, occasionally, sometimes, often or all the time. "Occasionally" was defined as less than one-third of the time; "sometimes" as between one and two-thirds of the time; and "often" as more than two-thirds of the time but less than "all the time". Women who answered "often" or "all the time" were considered to have severe SUI.<sup>1-3</sup> Urge incontinence was assessed by any positive response to "Does urine leak before you go to the toilet?" and mixed incontinence by a positive response to both of the previous questions. Voiding difficulty was assessed by the response to the question "Do you have difficulties in emptying your bladder?"<sup>1,2</sup>

As previously reported,<sup>1</sup> perineal pain was evaluated with the question "Do you have chronic perineal pain (perineum designates the skin and muscle around the vaginal and anal outlets)?" This question was dichotomous (possible answers: "yes" and "no").<sup>1</sup> Episiotomy complications were evaluated with the question "Did you have any complications of your episiotomy (hematoma, abscess, scar disunion, surgery)?" They were defined by the existence of at least one of the following criteria: hematoma, abscess, scar disunion, or surgery required for episiotomy.

Anal incontinence was defined by a "yes" (versus "no") response to "Do you have involuntary loss of flatus or stool?"<sup>1</sup> The severity of AI symptoms was assessed with the French version of the American Society of Colon and Rectal Surgeon's Fecal Incontinence Severity Index (FISI).<sup>4,5</sup> The FISI is based on [(type of incontinence) × (frequency matrix)]. The matrix includes four types of leakage commonly

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found in the fecal-incontinent population (gas, mucus, and liquid and solid stool) and five frequencies classified as involuntary loss 2 or more times a day, once a day, 2 or more times a week, once a week, 1–3 times a month, or never. To create the FISI, responses for each of the four items were summed, with a higher FISI indicating greater perceived symptoms.

## Appendix 2. Propensity Score Matching Construction

To control for confounding factors that might influence both the choice of vacuum or forceps or spatulas for the attempted operative vaginal delivery and the occurrence of severe maternal and neonatal morbidity, we used a propensity score approach. A woman's propensity score was defined as her probability of undergoing attempted operative vaginal delivery by forceps or spatulas, based on her individual covariates measured before delivery. A propensity score was estimated for all women, by a logistic regression model with attempted operative vaginal delivery by forceps or spatulas as the dependent variable in relation to the following baseline maternal and obstetric characteristics: maternal age older than 30 years (binary variable), BMI before pregnancy over 30 kg/m<sup>2</sup> (binary variable), nulliparity (binary variable), previous cesarean delivery (binary variable), previous adverse event during delivery (binary variable), gestational diabetes mellitus (binary variable), gestational weight gain exceeding 20 kg (binary variable), prenatally suspected macrosomia (binary variable), gestational age at delivery (<39, 39-41 or ≥ 41 weeks), induced labor (binary variable), second stage of labor exceeding 3 hours (binary variable), active second phase of labor more than 30 minutes (binary variable), epidural analgesia (binary variable), persistent occiput position (binary variable: anterior or posterior/transverse), indications for operative vaginal delivery (nonreassuring FHR only, arrested progress only, or both), ACOG classification of the fetal head position (mid, low, outlet), and the obstetrician performing the delivery (binary variable). The choice of variables that were included in the propensity score model was made after analysis of the literature and careful thought.

Exposed (with attempted operative vaginal delivery by forceps or spatulas) and unexposed (with attempted operative vaginal delivery by vacuum) women were matched with a one-to-one nearest neighbor matching algorithm without replacement for the average propensity score,<sup>6,7</sup> within a caliper of 0.2 standard deviation of the logit of the propensity score.<sup>6,7</sup> Imbalances after matching were checked by propensity score distribution and calculation of standardized mean differences.<sup>8</sup>

Paired conditional statistical methods were used to assess the effect of exposure on the matched sample.

In the matched set, odds ratios (OR) and their 95% confidence intervals (95% CI) were estimated to quantify the association between the choice of vacuum or forcep or spatulas for the attempted operative

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vaginal delivery and the occurrence of severe maternal and neonatal morbidity by Generalized Estimating Equation logistic regression.

### Appendix 3. Univariate and Multivariable Analysis of Severe Maternal and Neonatal Morbidity After Attempted Operative Vaginal Delivery by Instrument (n=1942)

	Severe maternal morbidity *			Severe neonatal morbidity †		
	Crude OR (95% CI)	Adj. OR (95% CI)	P‡	Crude OR (95% CI)	Adj. OR (95% CI)	P‡
Instrument type						
Vacuum	Ref	Ref		Ref	Ref	
Forceps or Spatula	2.06 (1.41-3.01)	1.99 (1.27-3.10)	<.01	1.23 (0.89-1.71)	1.04 (0.69-1.56)	.9
Maternal age (years)						
> 30	1.00 (0.76-1.45)	1.00 (0.69 -1.44)	.9	0.85 (0.62-1.17)	0.73 (0.49-1.08)	.1
Prepregnancy BMI (kg/m²)						
<18.5	1.17 (0.71-1.95)	1.17 (0.68-2.03)	.6	1.15 (0.69-1.91)	1.09 (0.60-1.97)	.8
[18.5-25[	Ref	Ref		Ref	Ref	
[25-30[	1.03 (0.67-1.58)	0.94 (0.60-1.48)	.8	1.34 (0.90-1.98)	1.37 (0.89-2.13)	.2
≥ 30	1.37 (0.79-2.39)	1.25 (0.68-2.29)	.5	1.85 (1.12-3.04)	2.15 (1.22-3.80)	.01
Gestational weight gain > 20 kg	1.48 (0.95-2.30)	1.34 (0.84-2.14)	.2	0.91 (0.54-1.53)	0.81 (0.46-1.45)	.5
Nulliparous	1.15 (0.81-1.63)	1.76 (0.94-3.31)	.07	0.89 (0.65-1.23)	1.14 (0.64-2.03)	.6
Previous cesarean delivery	1.71 (1.12-2.60)	2.92 (1.47-5.79)	<.01	1.15 (0.73-1.80)	1.38 (0.71-2.70)	.3
Previous adverse events during delivery§	0.70 (0.56-1.36)	0.88 (0.40-1.91)	.7	1.18 (0.70-2.01)	1.24 (0.60-2.54)	.6
Gestational diabetes mellitus	0.68 (0.35-1.32)	-	-	0.91 (0.52-1.61)	-	-
Prenatally suspected macrosomia¶	1.65 (1.03-2.66)	1.37 (0.81-2.32)	.2	0.79 (0.44-1.42)	0.54 (0.25-1.14)	.1
Gestational age at delivery (weeks)						
< 39	0.83 (0.55-1.24)	0.87 (0.56-1.34)	.5	2.42 (1.74-3.37)	1.80 (1.21-2.67)	.01
[39-41[	Ref	Ref		Ref	Ref	
≥ 41	1.44 (1.02-2.03)	1.40 (0.96-2.05)	.08	1.27 (0.87-1.85)	1.10 (0.72-1.69)	.6
Induced labor	1.07 (0.73-1.57)	0.90 (0.59-1.38)	.6	1.45 (1.02-2.04)	1.58 (1.05-2.38)	.03
2 <sup>nd</sup> stage>3 hours	1.26 (0.84-1.89)	1.02 (0.64-1.62)	.9	0.46 (0.27-0.80)	0.42 (0.22-0.82)	.01
Active phase of 2 <sup>nd</sup> stage > 30 min	0.98 (0.71-1.35)	0.60 (0.39-0.93)	.02	0.79 (0.57-1.10)	0.95 (0.59-1.51)	.8
Epidural analgesia	0.76 (0.44-1.30)	0.42 (0.22-0.79)	<.01	0.98 (0.55-1.74)	1.55 (0.69-3.49)	.3
Manual rotation	1.29 (0.83-2.02)	-	-	1.14 (0.73-1.79)	-	-
Persistent occiput position						
Anterior	Ref	Ref		Ref	Ref	
Posterior	1.18 (0.71-1.94)	1.10 (0.64-1.87)	.7	1.47 (0.93-2.33)	1.19 (0.70-2.04)	.5
Transverse	0.96 (0.38-2.44)	0.76 (0.26-2.17)	.6	1.35 (0.60-3.01)	1.28 (0.53-3.09)	.6
ACOG classification						
Mid	1.80 (0.94-3.43)	1.08 (0.51-2.32)	.8	1.27 (0.70-2.31)	0.77 (0.37-1.60)	.5

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Low	1.31 (0.73-2.36)	1.05 (0.54-2.03)	.9	1.06 (0.63-1.80)	0.87 (0.47-1.59)	.6
Outlet	Ref	Ref		Ref	Ref	
Indications for OVD						
Nonreassuring FHR only	0.66 (0.47-0.92)	0.50 (0.32-0.79)	<.01	1.23 (0.87-1.74)	1.03 (0.62-1.70)	.9
Arrested progress only	Ref	Ref		Ref	Ref	
Nonreassuring FHR and arrested progress	0.91 (0.61-1.35)	0.74 (0.47-1.19)	.2	1.89 (1.29-2.76)	1.67 (1.02-2.72)	.04
Cesarean delivery after failed OVD	3.68 (1.76-7.67)	-	-	1.73 (0.71-4.17)	-	-
Obstetrician performing delivery						
Senior attending obstetrician	Ref	Ref		Ref	Ref	
Obstetric resident	0.68 (0.49-0.94)	0.84 (0.58-1.21)	.3	0.59 (0.43-0.80)	0.66 (0.45-0.97)	.04
Sequential use of two instruments	1.28 (0.63-2.60)	-	-	1.65 (0.88-3.09)	-	-
Episiotomy	0.83 (0.54-1.26)	-	-	0.68 (0.46-1.01)	-	-
Birth weight $\geq$ 4,000 g	1.56 (0.87-2.79)	-	-	1.07 (0.56-2.02)	-	-

OR, Odds Ratio; CI, confidence interval; BMI, body mass index; PPH, postpartum hemorrhage; ACOG, American College of Obstetricians and Gynecologists; IQR, interquartile range; OVD, operative vaginal delivery; FHR, fetal heart rate.

\* Severe maternal morbidity was defined by at least one of the following criteria: third or fourth-degree perineal lacerations, perineal hematomas, cervical laceration, extension of uterine incision in cesarean delivery, PPH>1,500 mL, surgical hemostatic procedure, uterine artery embolization, blood transfusion, infections (endometritis, episiotomy infection, wound infection requiring surgery), thromboembolic event (deep vein thrombophlebitis or pulmonary embolism), admission to intensive care unit, and maternal death.

† Severe neonatal morbidity was defined by at least one of the following criteria: 5-minute Apgar score<7, umbilical artery pH < 7.00, need for resuscitation or intubation, neonatal trauma, intraventricular hemorrhage > grade 2, admission to the NICU (neonatal intensive care unit) for >24 hours, convulsions, sepsis, and neonatal death.

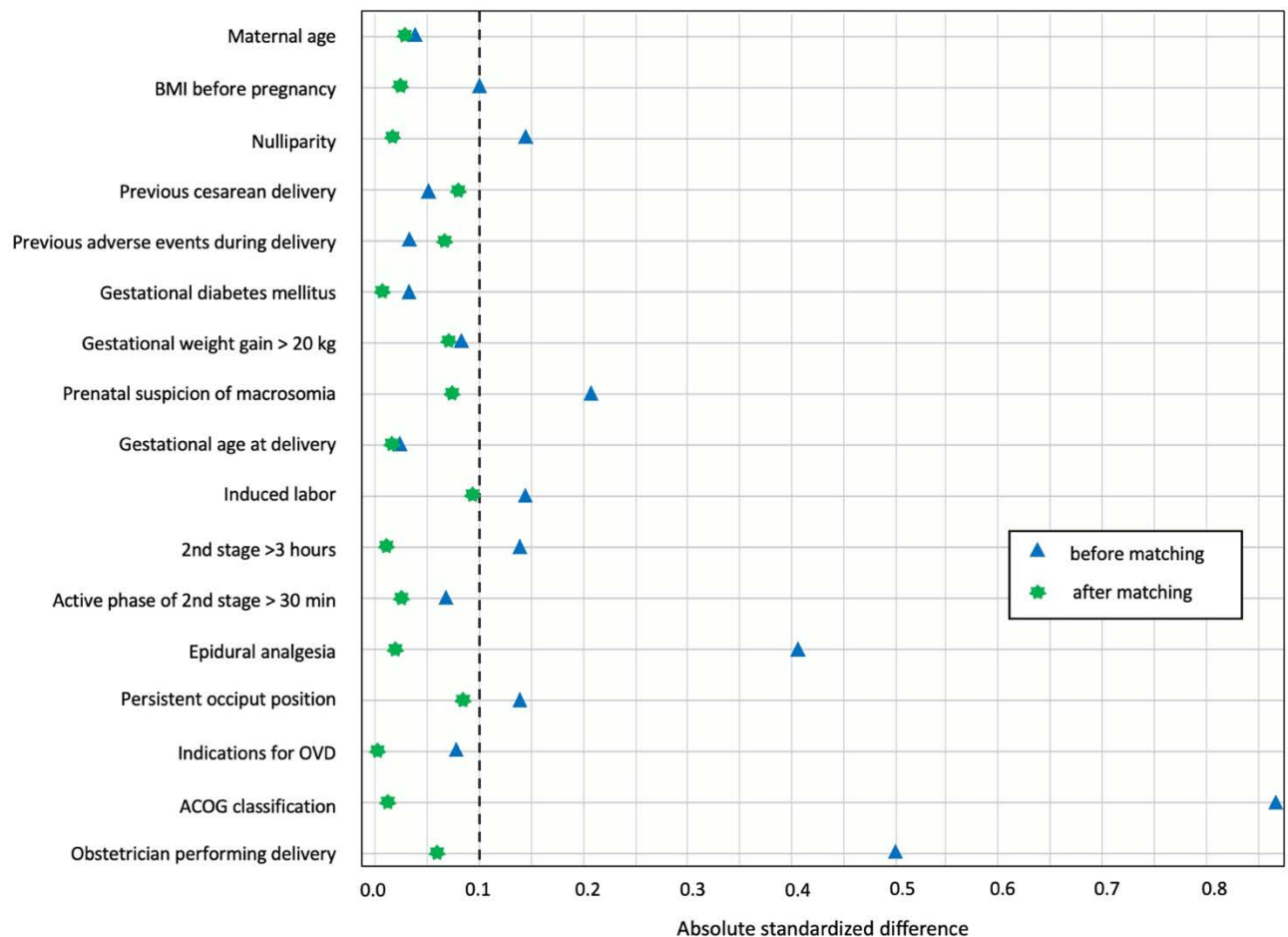
‡ Adjusted logistic regression analyses. Adjustment for maternal age, BMI, gestational weight gain, nulliparity, previous cesarean delivery, previous adverse event during delivery, prenatally suspected macrosomia, gestational age, induced labor, duration of second phase of labor, epidural analgesia, occiput presentation, ACOG classification, indication for OVD, and operator for OVD.

§ History of birth weight >4,000 g, shoulder dystocia, operative vaginal delivery or PPH.

|| Preexisting or gestational diabetes mellitus

¶ Prenatally suspected macrosomia: fundal height measurement at delivery > 37 cm and/or ultrasonographic fetal abdominal circumference > 90<sup>th</sup> p. for gestational age on Hadlock curves.

**Appendix 4. Absolute standardized differences between women with vacuum-assisted and forceps- or spatula-assisted deliveries, for the variables included in the propensity score, before (total population) and after matching (propensity score-matched population). Absolute standardized difference is a measure of effect size between two groups that is independent of sample size. It is the absolute value of the mean difference divided by the pooled standard deviation. BMI, body mass index; OVD, operative vaginal delivery; ACOG, American College of Obstetricians and Gynecologists.**



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**Appendix 5. Maternal and Labor Characteristics and Maternal and Neonatal Outcomes for Operative Vaginal Deliveries of Respondents and Nonrespondents to the Questionnaires at 6 Months (n=2,128)**

	<b>Respondents (n=934)</b>	<b>Non-respondents (n=1,194)</b>	<b>P</b>
<b>Maternal and labor characteristics</b>			
Maternal age (years)	29.0 ± 4.8	27.5 ± 5.2	<.001
> 30	325 (34.8)	318 (26.6)	<.001
Prepregnancy BMI (kg/m <sup>2</sup> )	22.7 ± 3.9	22.9 ± 4.5	.1
<18.5	68 (7.3)	123 (10.3)	.01
[18.5-25[	676 (72.7)	798 (66.8)	
[25-30[	136 (14.6)	180 (15.1)	
≥ 30	50 (5.4)	93 (7.8)	
Gestational weight gain > 20kg	78 (8.6)	142 (11.9)	.02
Nulliparous	701 (75.1)	872 (73.0)	.3
Previous cesarean delivery	87 (9.3)	135 (11.3)	.1
Previous operative vaginal delivery	50 (5.4)	72 (6.0)	.5
Previous birth>4,000 g	9 (1.0)	16 (1.3)	.5
Previous shoulder dystocia	2 (0.2)	6 (0.5)	.3
Previous PPH	7 (0.8)	17 (1.4)	.2
Gestational diabetes mellitus			.8
Preexisting	4 (0.4)	4 (0.3)	
Treated by diet	54 (5.8)	60 (5.0)	
Treated by insulin	16 (1.7)	21 (1.8)	
Prenatally suspected macrosomia *	66 (7.1)	98 (8.2)	.4
Gestational age at delivery (w)	39.8 ± 1.4	39.7 ± 1.6	.1
Gestational age at delivery ≥ 41 weeks	213 (22.8)	284 (23.8)	.6
Induced labor	154 (16.5)	227 (19.0)	.1
2 <sup>nd</sup> stage>3 hours	151 (16.2)	134 (11.7)	.003
Active phase of 2 <sup>nd</sup> stage > 30 min	322 (34.9)	350 (29.3)	.01
Dose of oxytocin (mIU) median [IQR]	920 [200-2220]	900 [200-2380]	.8
Epidural analgesia	882 (94.5)	1101 (92.2)	.03
Manual rotation	110 (11.8)	120.6 (10.1)	.2
Persistent occiput position			.01
Anterior	831 (89.3)	1043 (87.4)	
Posterior	75 (8.1)	115 (9.6)	

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	Respondents (n=934)	Non-respondents (n=1,194)	P
Transverse	25 (2.7)	36 (3.0)	
ACOG classification			.2
Mid	152 (16.4)	232 (19.4)	
Low	690 (74.6)	851 (71.3)	
Outlet	83 (9.0)	111 (9.3)	
Indications for OVD			.01
Nonreassuring FHR only	394 (42.2)	517 (43.3)	
Arrested progress only	382 (40.9)	406 (34.0)	
Nonreassuring FHR and arrested progress	158 (16.9)	265 (22.2)	
Obstetrician performing delivery			.3
Senior attending obstetrician	243 (26.4)	293 (24.5)	
Obstetric resident	677 (73.6)	901 (75.5)	
Sequential use of two instruments	26 (2.8)	57 (4.8)	.02
Rotational forceps delivery	0 (0)	2 (0.2)	.3
<b>Maternal outcome</b>			
Cesarean delivery after failed OVD	16 (1.7)	24 (2.0)	.6
Episiotomy	824 (88.2)	1028 (86.1)	.2
3 <sup>rd</sup> or 4 <sup>th</sup> -degree perineal lacerations	27 (2.9)	30 (2.5)	.6
PPH (blood loss >500 mL)	164 (17.6)	179 (15.0)	.1
Severe PPH (blood loss >1,500 mL)	17 (1.9)	13 (1.1)	.2
<b>Severe maternal morbidity</b> †	81 (8.7)	111 (9.3)	.6
<b>Neonatal outcome</b>			
Birth weight ≥4,000 g	52 (5.6)	60 (5.0)	.5
<b>Severe neonatal morbidity</b> ‡	70 (7.5)	137 (11.5)	.002

BMI, body mass index; PPH, postpartum hemorrhage; ACOG, American College of Obstetricians and Gynecologists; IQR, interquartile range; OVD, operative vaginal delivery; FHR, fetal heart rate.

Continuous data are expressed as means ± standard deviations or medians [IQR] when specified; discrete data are expressed as n (%). Student t,  $\chi^2$ , Kruskal-Wallis, and Fisher's exact tests were used as appropriate. A P value of .05 was considered significant.

\* Prenatally suspected macrosomia: fundal height measurement at delivery > 37 cm and/or ultrasonographic fetal abdominal circumference > 90<sup>th</sup> p. for gestational age on Hadlock curves.

† Severe maternal morbidity was defined by at least one of the following criteria: third or fourth-degree perineal lacerations, perineal hematomas, cervical laceration, extension of uterine incision in cesarean delivery, PPH>1,500 mL, surgical hemostatic procedure, uterine artery embolization, blood transfusion, infections (endometritis, episiotomy infection, wound infection requiring surgery), thromboembolic event (deep vein thrombophlebitis or pulmonary embolism), admission to intensive care unit, and maternal death.

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‡ Severe neonatal morbidity was defined by at least one of the following criteria: 5-minute Apgar score <7, umbilical artery pH < 7.00, need for resuscitation or intubation, neonatal trauma, intraventricular hemorrhage > grade 2, admission to the NICU (neonatal intensive care unit) for >24 hours, convulsions, sepsis, and neonatal death.

# **Appendix 6. Univariate Analysis of Urinary and Anal Incontinence at 6 Months After Attempted Operative Vaginal Delivery by Instrument (n=934)**

	Urinary incontinence			Anal incontinence		
	No	Yes	P	No	Yes	P
	(n=721)	(n=212)		(n=716)	(n=202)	
<b>Maternal and labor characteristics</b>						
Maternal age (years)	28.7 ± 4.7	30.0 ± 5.0	<.001	28.7 ± 4.7	30.4 ± 4.6	<.001
> 30	233 (32.3)	91 (42.9)	<.001	225 (31.4)	97 (48.0)	<.001
Prepregnancy BMI (kg/m <sup>2</sup> )	22.6 ± 3.8	23.0 ± 4.2	.1	22.5 ± 3.7	23.0 ± 4.1	.1
<18.5	57 (8.0)	11 (5.2)	.4	51 (7.1)	14 (7.0)	.2
[18.5-25[	521 (72.7)	154 (72.6)		530 (74.2)	137 (68.5)	
[25-30[	103 (14.4)	33 (15.6)		102 (14.3)	33 (16.5)	
≥ 30	36 (5.0)	14 (6.6)		31 (4.3)	16 (8.0)	
Gestational weight gain > 20kg	56 (8.1)	21 (10.2)	.3	60 (8.7)	16 (8.3)	.9
Nulliparous	542 (75.2)	158 (74.5)	.8	553 (77.2)	137 (67.8)	.01
Previous cesarean delivery	62 (8.6)	25 (11.8)	.2	63 (8.8)	23 (11.4)	.3
Previous operative vaginal delivery	43 (6.0)	7 (3.3)	.1	31 (4.3)	15 (7.4)	.08
Previous birth > 4,000 g	8 (1.1)	1 (0.5)	.4	3 (0.4)	6 (3.0)	.001
Previous shoulder dystocia	2 (1.1)	0 (0)	.4	2 (1.2)	0 (0)	.4
Gestational diabetes mellitus			.4			.01
Preexisting	4 (0.6)	0 (0)		3 (0.4)	1 (0.5)	
Treated by diet	38 (5.3)	15 (7.1)		33 (4.6)	20 (10.0)	
Treated by insulin	11 (1.5)	5 (2.4)		10 (1.4)	6 (3.0)	
Prenatally suspected macrosomia *	55 (7.6)	11 (5.2)	.2	42 (5.9)	20 (9.9)	.04
Gestational age at delivery (weeks)	39.8 ± 1.4	39.9 ± 1.3	.8	39.8 ± 1.4	40.0 ± 1.3	.2
Induced labor	116 (16.1)	38 (17.9)	.5	108 (15.1)	44 (21.8)	.02
2 <sup>nd</sup> stage > 3 hours	118 (16.4)	33 (15.6)	.8	112 (15.7)	38 (18.8)	.3
Active phase of 2 <sup>nd</sup> stage > 30 min	244 (34.2)	78 (37.5)	.4	243 (34.3)	76 (38.2)	.3
Epidural analgesia	686 (95.3)	195 (92.0)	.06	676 (94.6)	192 (95.1)	.8
Manual rotation	91 (12.7)	19 (9.0)	.1	84 (11.8)	24 (11.9)	.9
Persistent occiput position			.2			.3
Anterior	639 (88.8)	191 (91.0)		634 (88.9)	183 (90.6)	
Posterior	58 (8.1)	17 (8.1)		62 (8.7)	12 (5.9)	
Transverse	23 (3.2)	2 (1.0)		17 (2.4)	7 (3.5)	
ACOG classification			.1			.7
Mid	111 (15.5)	41 (19.6)		120 (16.9)	29 (14.5)	
Low	534 (74.7)	155 (74.2)		525 (74.1)	153 (76.5)	

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Outlet	70 (9.8)	13 (6.2)		64 (9.0)	18 (9.0)	
Indications for OVD			.8			.3
Nonreassuring FHR only	308 (42.7)	86 (40.6)		310 (43.3)	76 (37.6)	
Arrested progress only	292 (40.5)	90 (42.5)		292 (40.8)	86 (42.6)	
Nonreassuring FHR and arrested progress	121 (16.8)	36 (17.0)		114 (15.9)	40 (19.8)	
Obstetrician performing delivery			.5			.4
Senior attending obstetrician	190 (26.9)	52 (24.5)		180 (25.6)	58 (28.9)	
Obstetric resident	517 (73.1)	160 (75.5)		523 (74.4)	143 (71.1)	
Instrument type			.1			.2
Vacuum	222 (30.8)	54 (25.5)		219 (30.6)	52 (25.7)	
Forceps/Spatulas	499 (69.2)	158 (74.5)		497 (69.4)	150 (74.3)	
Sequential use of two instruments	18 (2.5)	8 (3.8)	.3	18 (2.5)	7 (3.5)	.5
Rotational forceps delivery	0 (0)	0 (0)	-	0 (0)	0 (0)	-
<b>Maternal outcome</b>						
Cesarean delivery after failed OVD	14 (2.0)	2 (1.0)	.3	13 (1.8)	3 (1.5)	.8
Episiotomy	639 (88.6)	184 (86.8)	.5	628 (87.7)	183 (90.6)	.3
3 <sup>rd</sup> or 4 <sup>th</sup> -degree perineal lacerations	16 (2.2)	11 (5.2)	.02	14 (2.0)	12 (5.9)	.003
PPH (blood loss >500 mL)	124 (17.2)	40 (18.9)	.6	116 (16.2)	44 (21.8)	.07
Severe PPH (blood loss>1,500 mL)	13 (1.8)	4 (1.9)	.9	10 (1.4)	7 (3.5)	.06
Severe maternal morbidity <sup>†</sup>	61 (8.5)	20 (9.4)	.7	55 (7.7)	25 (12.4)	.04
<b>Neonatal outcome</b>						
Birth weight (g)	3320.8	3299.3	.5	3296.4	3398.7	.01
	± 430.6	± 409.4		± 426.9	± 419.1	
Birth weight ≥ 4,000 g	41 (5.7)	10 (4.7)	.6	37 (5.2)	14 (6.9)	.3
Cephalic perimeter (cm)	34.4 ± 1.4	34.5 ± 1.3	.8	34.4 ± 1.4	34.7 ± 1.4	.01
Severe neonatal morbidity <sup>‡</sup>	58 (8.0)	12 (5.7)	.2	57 (8.0)	13 (6.4)	.5
<b>Variables recorded at 6 months postpartum</b>						
Breastfeeding	434 (60.2)	151 (71.2)	.004	434 (60.6)	142 (70.3)	.01
Pelvic floor muscle training	153 (21.4)	37 (17.5)	.2	553 (77.9)	172 (86.0)	.01
Urinary incontinence <sup>§</sup>	-	212 (100)	-	135 (18.9)	72 (35.6)	<.001
Stress urinary incontinence	-	21 (10.2)	-	18 (13.4)	5 (6.9)	.2
Urge urinary incontinence	-	68 (32.5)	-	51 (37.5)	19 (26.0)	.09
Mixed urinary incontinence	-	87 (41.0)	-	71 (9.9)	52 (25.7)	<.001
Severe urinary incontinence	-	1 (0.5)	-	1 (0.7)	1 (1.4)	.7
Difficulty voiding	-	141 (68.5)	-	105 (75.5)	41 (56.2)	.004
Anal incontinence <sup>  </sup>	130 (18.3)	72 (34.8)	<.001	-	202 (100)	-
FISI score	11 [7-15]	12 [7-18]	.2	-	11 [7-15]	-

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Perineal pain ¶	625 (87.4)	171 (82.2)	.06	91 (12.8)	34 (17.0)	.1
Episiotomy complications #	451 (67.5)	126 (64.3)	.4	216 (32.6)	69 (36.5)	.3
Sexually active	638 (95.1)	172 (94.0)	.5	627 (95.4)	170 (92.4)	.1
Dyspareunia	428 (67.1)	103 (59.9)	.08	218 (34.8)	56 (32.9)	.7

*BMI, body mass index; PPH, postpartum hemorrhage; ACOG, American College of Obstetricians and Gynecologists; IQR, interquartile range; OVD, operative vaginal delivery; FHR, fetal heart rate; FISI, Fecal Incontinence Severity Index.*

Continuous data are expressed as means  $\pm$  standard deviations or medians [IQR] when specified; discrete data are expressed as n (%). Student t,  $\chi^2$ , Kruskal-Wallis, and Fisher's exact tests were used as appropriate. A *P* value of .05 was considered significant.

\* Prenatally suspected macrosomia: fundal height measurement at delivery  $>37$  cm and/or ultrasonographic fetal abdominal circumference  $> 90^{\text{th}}$  p. for gestational age on Hadlock curves.

† Severe maternal morbidity was defined by at least one of the following criteria: third or fourth-degree perineal lacerations, perineal hematomas, cervical laceration, extension of uterine incision in cesarean delivery, PPH  $>1,500$  mL, surgical hemostatic procedure, uterine artery embolization, blood transfusion, infections (endometritis, episiotomy infection, or wound infection requiring surgery), thromboembolic event (deep vein thrombophlebitis or pulmonary embolism), admission to intensive care unit, and maternal death.

‡ Severe neonatal morbidity was defined by at least one of the following criteria: 5-minute Apgar score  $<7$ , umbilical artery pH  $< 7.00$ , need for resuscitation or intubation, neonatal trauma, intraventricular hemorrhage  $> \text{grade } 2$ , admission to the NICU (neonatal intensive care unit) for  $>24$  hours, convulsions, sepsis and neonatal death.

§ Symptoms of urinary incontinence defined as the answer "yes" to the question "Do you have involuntary loss of urine?"; stress urinary incontinence (SUI) was assessed by responses to the question "Does urine leak when you are physically active, cough or sneeze?". Women who answered "often" or "all the time" were considered to have severe SUI; urge incontinence by any positive response to "Does urine leak before you go to the toilet?"; mixed incontinence by a positive response to both of the previous questions; voiding difficulty by response to the question "Do you have difficulties in emptying your bladder?"

|| Symptoms of anal incontinence were defined as the answer "yes" to the question "Do you have involuntary loss of flatus or stool?"

¶ Perineal pain was assessed by the question: "Do you have chronic perineal pain (perineum designates the skin and muscle around the vaginal and anal outlets)?"

# Episiotomy complications were defined by the existence of at least one of the following criteria: hematoma, abscess, scar disunion, or surgery required for episiotomy.

**Appendix 7. Univariate and Multivariable Analysis of Urinary and Anal Incontinence at 6 Months After Attempted Operative Vaginal Delivery by Instrument (n=934)**

	Urinary incontinence * (n=861)			Anal incontinence † (n=778)		
	Crude OR (95% CI)	Adj. OR (95% CI)	P <sup>‡</sup>	Crude OR (95% CI)	Adj. OR (95% CI)	P <sup>‡</sup>
Instrument type						
Vacuum	Ref	Ref		Ref	Ref	
Forceps/Spatulas	1.30 (0.92-1.84)	1.44 (0.90-2.30)	.1	1.27 (0.89-1.81)	1.72 (1.07-2.75)	.02
Maternal age > 30 (years)	1.58 (1.15-2.76)	1.56 (1.08-2.45)	.02	2.02 (1.47-2.77)	1.58 (1.08-2.31)	.02
BMI ≥ 30 before pregnancy (kg/m <sup>2</sup> )	1.34 (0.71-2.53)	1.55 (0.75-3.18)	.2	1.92 (1.03-3.58)	2.29 (1.11-4.75)	.03
Gestational weight gain > 20 kg	1.30 (0.77-2.20)	1.48 (0.81-2.70)	.2	0.95 (0.53-1.69)	0.87 (0.45-1.67)	.7
Nulliparous	0.97 (0.68-1.37)	1.14 (0.75-1.72)	.5	0.62 (0.44-0.88)	0.64 (0.42-0.98)	.04
Prenatally suspected macrosomia §	0.66 (0.34-1.29)	-	-	1.76 (1.01-3.08)	-	-
Gestational diabetes mellitus	1.31 (0.77-2.25)	1.29 (0.71-2.34)	.4	2.25 (1.36-3.72)	1.92 (1.09-3.40)	.03
Induced labor	1.14 (0.76-1.70)	1.20 (0.76-1.91)	.4	1.57 (1.06-2.32)	1.33 (0.84-2.11)	.2
2 <sup>nd</sup> stage >3 hours	0.94 (0.62-1.43)	0.82 (0.49-1.36)	.4	1.25 (0.83-1.87)	1.26 (0.76-2.07)	.4
Active phase of 2 <sup>nd</sup> stage > 30 min	1.16 (0.84-1.59)	1.31 (0.79-2.18)	.3	1.18 (0.86-1.64)	1.19 (0.71-1.98)	.5
Epidural analgesia	0.57 (0.31-1.04)	0.44 (0.21-0.93)	.03	1.11 (0.54-2.26)	0.52 (0.23-1.17)	.1
Manual rotation	0.68 (0.40-1.14)	-	-	1.02 (0.63-1.65)	-	-
Persistent occiput position			.3			.6
Anterior	Ref	Ref		Ref	Ref	
Posterior	0.98 (0.56-1.72)	1.09 (0.60-1.99)		0.67 (0.35-1.27)	0.70 (0.39-1.56)	
Transverse	0.29 (0.07-1.25)	0.34 (0.08-1.53)		1.43 (0.58-3.49)	1.20 (0.40-3.60)	
ACOG classification			.1			.3
Mid	1.99 (1.00-3.97)	2.08 (0.99-4.94)		0.86 (0.44-1.67)	0.54 (0.23-1.28)	
Low	1.56 (0.84-2.90)	1.44 (0.69-2.99)		1.04 (0.60-1.80)	0.78 (0.39-1.56)	
Outlet	Ref	Ref		Ref	Ref	
Indications for OVD			.9			.5
Nonreassuring FHR only	0.91 (0.65-1.27)	0.97 (0.57-1.65)		0.83 (0.59-1.18)	0.95 (0.55-1.65)	
Arrested progress only	Ref	Ref		Ref	Ref	
Nonreassuring FHR and arrested progress	0.97 (0.62-1.50)	1.22 (0.69-2.15)		1.19 (0.77-1.84)	1.29 (0.72-2.29)	
Obstetrician performing delivery						
Senior attending obstetrician	Ref	Ref		Ref	Ref	
Obstetric resident	1.13 (0.79-1.61)	1.21 (0.80-1.84)	.4	0.85 (0.60-1.20)	0.88 (0.58-1.34)	.6
Sequential use of two instruments	1.53 (0.66-3.57)	-	-	1.39 (0.57-3.38)	-	-
Episiotomy	0.84 (0.53-1.33)	0.83 (0.47-1.46)	.4	1.35 (0.80-2.28)	1.30 (0.69-2.47)	.4

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3 <sup>rd</sup> - 4 <sup>th</sup> degree perineal lacerations	2.41 (1.10-5.26)	-	-	3.16 (1.44-6.94)	-	-
Birth weight $\geq$ 4,000 g	0.82 (0.40-1.67)	0.71 (0.33-1.54)	.4	1.36 (0.72-2.58)	0.84 (0.38-1.86)	.7
Cephalic perimeter > 36 cm	0.56 (0.30-1.06)	-	-	1.73 (1.04-2.86)	1.64 (0.91-2.94)	.09
Breastfeeding	1.64 (1.17-2.28)	1.85 (1.27-2.69)	.001	1.54 (1.10-2.15)	1.64 (1.12-2.42)	.01

*OR, Odds Ratio; CI, confidence interval; BMI, body mass index; PPH, postpartum hemorrhage; ACOG, American College of Obstetricians and Gynecologists; IQR, interquartile range; OVD, operative vaginal delivery; FHR, fetal heart rate.*

\* Symptoms of urinary incontinence defined as the answer “yes” to the question “Do you have involuntary loss of urine?”

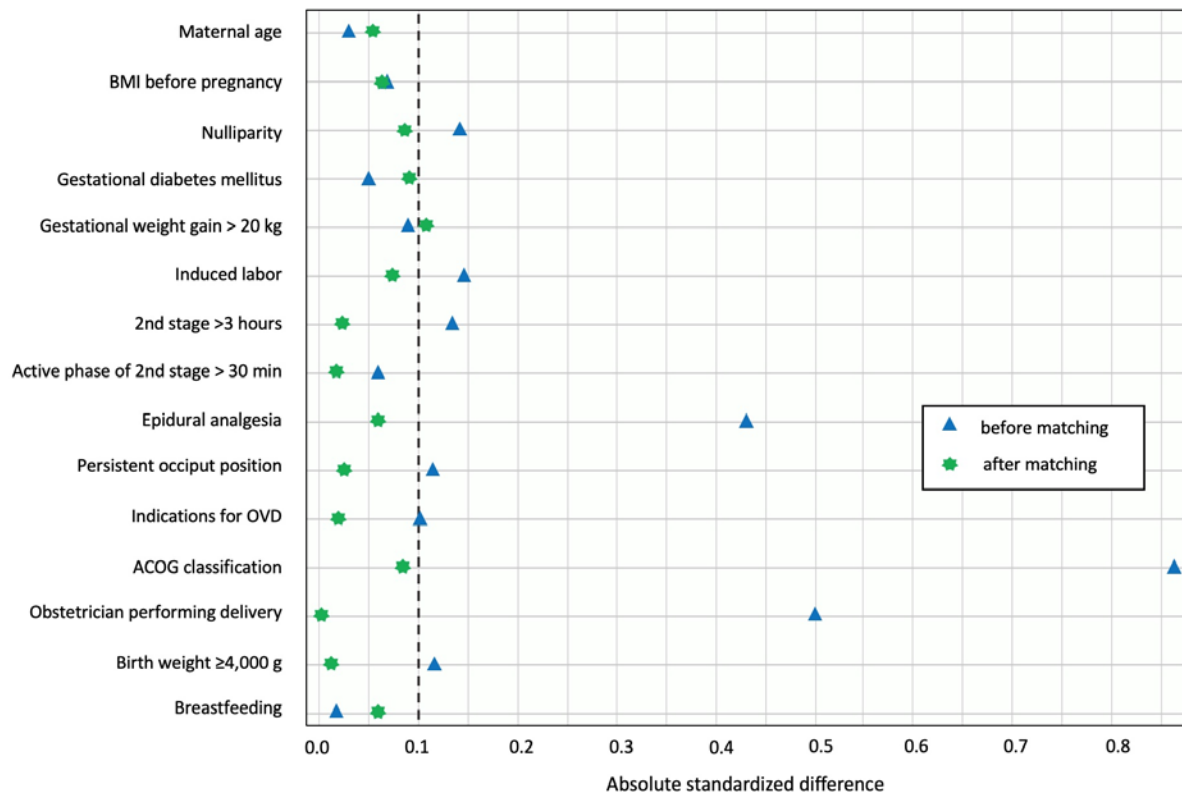
† Symptoms of anal incontinence defined as the answer “yes” to the question “Do you have involuntary loss of flatus or stool?”

‡ Adjusted logistic regression analyses. Adjustment for maternal age, BMI, gestational weight gain, nulliparity, prenatally suspected macrosomia, gestational diabetes mellitus, induced labor, duration of active second phase of labor, epidural analgesia, occiput presentation, ACOG classification, 3<sup>rd</sup>- 4<sup>th</sup> degree perineal lacerations, birth weight, breastfeeding, and cephalic perimeter of the newborn for anal incontinence.

§ Prenatally suspected macrosomia: fundal height measurement at delivery > 37cm and/or ultrasonographic fetal abdominal circumference > 90<sup>th</sup> p. for gestational age on Hadlock curves.

|| Preexisting or gestational diabetes mellitus

**Appendix 8. Absolute standardized differences between women with vacuum and forceps or spatula deliveries, for the variables included in the propensity score, before (total population) and after matching (propensity score-matched population). Absolute standardized difference is a measure of effect size between two groups that is independent of sample size. It is the absolute value of the mean difference divided by the pooled standard deviation. BMI, body mass index; OVD, operative vaginal delivery; ACOG, American College of Obstetricians and Gynecologists.**



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## References

1. Fritel X, Schaal J, Fauconnier A, Bertrand V, Levet C, Pigné A. Pelvic floor disorders 4 years after first delivery: a comparative study of restrictive versus systematic episiotomy. *BJOG Int J Obstet Gynaecol.* 2007;115(2):247-52.
2. Jackson S, Donovan J, Brookes S, Eckford S, Swithinbank L, Abrams P. The Bristol Female Lower Urinary Tract Symptoms questionnaire: development and psychometric testing. *BJU Int.* 1996;77(6):805-12.
3. Brookes ST, Donovan JL, Wright M, Jackson S, Abrams P. A scored form of the Bristol Female Lower Urinary Tract Symptoms questionnaire: Data from a randomized controlled trial of surgery for women with stress incontinence. *Am J Obstet Gynecol.* 2004;191(1):73-82.
4. Rockwood TH, Church JM, Fleshman JW, Kane RL, Mavrantonis C, Thorson AG, et al. Patient and surgeon ranking of the severity of symptoms associated with fecal incontinence: The fecal incontinence severity index. *Dis Colon Rectum.* 1999;42(12):1525-31.
5. Rockwood TH. Incontinence severity and QOL scales for fecal incontinence. *Gastroenterology.* 2004;126:S106-13.
6. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika.* 1983;70:41-55.
7. Austin PC. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. *Multivar Behav Res.* 2011;46(3):399-424.
8. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. *Stat Med.* 2009;28(25):3083-107.