Title page

Title: Sexual violence and mode of delivery: a population-based cohort study

Running title: Sexual violence and mode of delivery

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Abstract

Objective This study aimed to explore the association between sexual violence and mode of delivery.

Design National cohort study.

Setting Women presenting for routine ultrasound examinations were recruited to the Norwegian Mother and Child Cohort Study (MoBa) between 1999-2008.

Population 74 059 pregnant women.

Methods Sexual violence was self-reported during pregnancy using postal questionnaires. Mode of delivery, other maternal birth outcomes and covariates were retrieved from the Medical Birth Registry of Norway. Risk estimations were performed using multivariable logistic regression analysis.

Main Outcome Measures Mode of delivery and selected maternal birth outcomes.

Results Of 74 059 women, 18.4% reported a history of sexual violence. A total of 10% had an operative vaginal birth, 4.9% elective caesarean section (CS), and 8.6% had an emergency CS. Severe sexual violence (rape) was associated with elective CS, AOR 1.56 (95% CI 1.18-2.05) for nulliparous women and 1.37 (1.06-1.76) for multiparous women. Those exposed to moderate sexual violence had a higher risk of emergency CS, AOR 1.31 (1.07-1.60) and 1.41 (1.08-1.84) for nulli- and multiparous women, respectively. No association was found between sexual violence and operative vaginal birth, except for a lower risk among multiparous women reporting mild sexual violence, AOR 0.73 (0.60-0.89). Analysis of other maternal outcomes showed a reduced risk of episiotomy for women reporting rape and a higher frequency of induced labour.

Conclusions Women with a history of rape had higher odds of elective CS and induction and significantly fewer episiotomies.

Keywords Sexual violence, rape, mode of delivery, maternal birth outcome, MoBa.

Introduction

Sexual violence against women is a recognised public health problem. Studies suggest that one in five women is exposed to sexual violence during her lifetime[1-3], and those exposed are at greater risk of developing health problems, both at the time of violence and later in life.[2,3] Previous studies investigating whether women with a history of sexual violence experience worse birth outcomes have been inconclusive.[4-8] A recent Norwegian study that examined women with various psychosocial burdens, including fear of childbirth, attending a specialised clinic found that women who were raped as adults had a greatly increased risk of caesarean section (CS), vaginal operative delivery and prolonged labour.[5] In agreement with other studies,[6,9] the authors did not find an increased risk of operative deliveries or a longer duration of labour for women exposed to childhood sexual abuse.[5] However, an association between both childhood sexual abuse and intimate partner violence (IPV) and a higher risk of CS has been reported.[4,10,11] The association between sexual violence and outcomes as induction, use of pain relief, episiotomies and anal sphincter tears has been investigated, but in few studies with no conclusive findings.[4,5,8]

The increasing rate of interventions during childbirth, especially CS and induction, are a cause for concern.[12,13] Although advanced maternal age, twin gestation and other medical factors can increase pregnancy complications, they do not fully explain the increased rate of interventions.[14] Some literature has suggested that the increased CS rate is due in part to increased maternal request for CS, which may be in part because of fear of childbirth.[12,15] Previous studies have found an association between sexual violence and fear of childbirth.[16,17] Women with a history of sexual violence may thus wish to have a CS or induction because of their negative experience. The bodily experience of childbirth may trigger memories of sexual abuse and affect a woman's ability to cooperate with staff in the second

stage and thus be associated with vaginal operative deliveries and perineal trauma.[18] As there have been few, inconclusive studies addressing the mode of delivery and maternal birth outcome for women exposed to sexual violence, further investigation is warranted. Our study examined this question in the large Norwegian Mother and Child cohort population. The primary aim was to investigate whether a history of sexual violence was associated with the mode of delivery, and we also examined the association between sexual violence and selected maternal outcomes.

Methods

The Norwegian Mother and Child Cohort Study (MoBa) is a prospective population-based pregnancy cohort study conducted by the Norwegian Institute of Public Health.[19] Participants were recruited from Norway between 1999-2008, and 38.7% of the invited women consented to participate. This study is based on version VI of the quality-assured data files released for research in 2011. The MoBa study is described in detail elsewhere.[19]

The participants in this study received a postal invitation with their routine ultrasound appointment. The women answered extensive questionnaires regarding demographic factors, general health, reproductive history and maternal health during pregnancy. We used questionnaire 1 (Q1), completed at approximately gestational week 17 (mean 17.2 weeks; SD 2.2), and questionnaire 3 (Q3), completed at week 30 (mean 30.5 weeks; SD 1.4). Data from the MoBa study were linked with data from the Medical Birth Registry of Norway (MBRN), a registry that keeps record of all deliveries in Norway,[20] and with data based on a standardised form completed by midwives shortly after delivery. Only term births were included in this study. While a pregnancy is the observation unit in the MoBa study, women are the observation unit in our study, hence the exclusion of 13 475 pregnancies of women who

participated more than once. Figure 1 describes the inclusion and exclusion criteria and process for this study. The study sample comprised 74 059 women.

Variables

The exposure variable was collected from Q1, as described in our previous study.[21] The women were asked if they had been 1) pressured to perform sexual acts, 2) forced with violence or 3) raped. A positive answer was defined as having experienced sexual violence. Women with more than one positive answer were classified according to the most severe level reported. The answer options were recoded into mild, moderate and severe sexual violence. By excluding pregnancies of women participating several times, the exposure was counted only once for each woman. In addition, the women were asked about the timing of the violence with the answer options: 1) during this pregnancy, 2) during the six months prior to this pregnancy or 3) earlier. Approximately 1700 women who had responded to the first version of Q1 had the option to answer 'earlier' and 'during the last 12 months'. The timing of the violence was therefore recoded into previous sexual violence and recent sexual violence, which was defined as sexual violence during the pregnancy or during the previous 6 or 12 months.

Outcome variables were obtained from the MBRN. The mode of delivery was classified as spontaneous birth, instrument vaginal delivery (vacuum- or forceps-assisted births) elective caesarean section (CS) and emergency CS. Elective CS included those planned >8 hours prior to delivery; emergency CS included all other caesarean deliveries. Other maternal outcomes included the presence of induction, epidural, dystocia, episiotomy and anal sphincter tear. Complications such as dystocia, foetopelvic disproportion, abnormal labour and augmentation were recorded in the MBRN as the variable dystocia.

The following socio-demographic characteristics and behavioural risks were derived from Q1: age, categorised as younger (<20 years) and older (≥35); civil status as single (yes/no); higher education (>12 years of school) and pre-gestational body mass index (BMI) ≥30. Age was dichotomized and not used as a continuous variable because younger and older maternal age are considered to be associated with mode of delivery and other birth outcomes.[13,22.] Parity was obtained from the MBRN. Mental distress is considered to be associated with both sexual violence [23] and pregnancy complications [24] and therefore included in the multivariable statistical modelling. The Hopkins Symptom Checklist, which accounted for five items (SCL-5) from Q3, with a cut-off at ≥2.0 points as suggested by Strand,[25] was used to define symptoms of mental distress.

Due to the co-occurrence of different types of violence,[3] we examined the effect of other types of violence in the multivariable statistical models. Information on adult physical violence was obtained from Q1 and was counted as positive if a woman reported that, as an adult, she had experienced being slapped, hit, kicked or otherwise bothered in a physical way. Childhood physical violence was obtained from Q3, from the response to the question "Have you experienced physical violence before the age of 18?". Emotional abuse as a child (<18) or as an adult (≥18) was counted as positive if the woman reported that anyone had ever attempted to repress, degrade or humiliate her systematically or if anyone had threatened to hurt her or someone close to her.

In the multivariable statistical models, we additionally included factors considered to be associated with mode of delivery and the different maternal outcomes.[13,14] Information about these variables was obtained from MBRN, and we included pre-eclampsia, maternal diabetes (all types), macrosomia (birth weight over 4.5 kg) and previous CS for multiparous women.

Induction, dystocia and epidural were considered as covariates associated with the mode of delivery when they were not the outcome of interest.

Statistical analysis

Statistical analyses were performed using the statistical package SPSS 18.0 for WINDOWS (SPSS Inc., Chicago, IL, USA) version 18. Cross-tabulations, Pearson's chi-square tests and linear-by-linear associations were used to calculate percentages and assess differences in demographic and obstetric factors for women with a history of mild, moderate and severe sexual violence. Multinomial logistic regression analysis was used to examine the association between sexual violence and mode of delivery. Univariable models were performed first, with the mode of delivery as the dependent variable and mild, moderate and severe sexual violence as the independent variables. All adjusting variables were added in sequence to the preliminary univariable models and were included in a multivariable model if associated with either of the birth outcomes with a p-value of 0.1 or less. Variables that retained a significant association with either of the birth outcomes were included in the final models. A p-value <0.05 was the level of inclusion for the adjusting variables in the final multivariable models. Separate models were performed for nulli- and multiparous women. Binary logistics models were similarly performed, with the dependent variables comprised of binary variables. When examining the association between sexual violence and induction, dystocia and epidural rates, the women who underwent an elective CS were excluded. Women who underwent a CS were also excluded when examining the association between exposure and episiotomies or anal sphincter tears. The association between sexual violence and maternal birth outcomes were reported using crude (OR) and adjusted odds ratios (AOR) with 95% confidence intervals (CI).

Results

Among the 74 059 women enrolled, 8935 (12.1%) reported a history of mild sexual violence, 2072 (2.8%) moderate and 2613 (3.5%) severe. Table 1 displays the characteristics and outcomes for women, categorised by the severity of the sexual violence reported. Women with a history of sexual violence were significantly younger, more likely to be unemployed and less likely to be living with a partner. In addition, they more frequently reported smoking and alcohol consumption during early pregnancy, a BMI ≥30 and mental distress.

A total of 56 027 (75.7%) women had a spontaneous birth; 7987 (10%) had an operative vaginal birth, 3645 (4.9%) women were delivered by an elective CS, and 6399 (8.6%) had an emergency CS (data not presented in tables). The proportion of vaginal operative deliveries was not higher among women who reported sexual violence compared to those who did not. For elective CS, the rate increased with an increasing severity of sexual violence (Linear-by-linear association: p-value<0.001). The proportion of women who underwent emergency CS was highest in the moderate sexual violence group. There were significant differences among the women reporting sexual violence compared to those reporting no sexual violence for all other outcomes, with the exception of dystocia (Table 1).

Table 2 shows the crude and adjusted ORs for the mode of delivery stratified by parity. We found that multiparous women reporting mild sexual violence had a reduced risk of vaginal operative delivery compared to women reporting no sexual violence, with an AOR of 0.73 (95% CI 0.60-0.89). Nulliparous women who reported severe sexual violence had a higher risk of elective CS, with an AOR of 1.56 (95% CI 1.18-2.05), whereas multiparous women who reported severe sexual violence had an AOR of 1.37 (95% CI 1.06-1.76). A higher risk for elective CS was also found among multiparous women with a history of moderate sexual

violence, with an AOR of 1.33 (95% CI 1.01-1.74). All the women exposed to moderate sexual violence had a higher risk of emergency CS.

Table 3 presents the crude and adjusted ORs for the other outcomes stratified by parity. All the women reporting severe sexual violence had a higher risk of induction, with an AOR of 1.22 (95% CI 1.04-1.42) and 1.37 (95% CI 1.15-1.63) for nulli- and multiparous women, respectively. There was an association between the use of an epidural and moderate or severe sexual violence for the nulliparous women. All the women reporting severe sexual violence had a lower risk of episiotomy. Although the nulliparous women exposed to sexual violence had a reduced risk of an anal sphincter tear, this association was not found for multiparous women.

There were no differences between the women exposed to recent sexual violence (sexual violence during pregnancy or the last 6 and 12 months) when compared to women exposed to previous sexual violence. In our study, 570 (0.8%), 19 (<0.0%) and 63 (0.1%) women reported recent mild, moderate and severe sexual violence, respectively (data not presented in tables).

Discussion

Main findings

Women reporting severe sexual violence (rape) had an increased risk of an elective CS, whereas those exposed to moderate sexual violence had an increased risk of emergency CS. An association between sexual violence and vaginal operative birth was only significant for multiparous women with a history of mild sexual violence, with a decreased risk. Women

reporting rape had a higher risk of induction and a lower risk of episiotomy. Nulliparous women with a history of sexual violence had fewer anal sphincter tears.

Strengths

The population-based design and large study sample are strengths of this study. These strengths allowed us to control for potential confounding factors and several covariates associated with the outcome, suggesting that the findings would be applicable to the Norwegian population. Selection bias in relation to the exposure is unlikely, as the women who consented to participate were not expecting questions on sexual violence. In our sample, only 703 women declined to answer the questions on sexual violence. Additionally, all outcomes were gathered from the quality-assessed medical birth registry of Norway and were registered immediately after birth.[20]

Limitations

The limitations of this study include the relatively low response rate of 37.8%. A study addressing potential bias due to self-selection in MoBa found that women younger than 25 years, smokers, women living alone and women with two or more previous births were under-represented.[26] However, despite the under-representation of some groups, it was concluded that estimates of exposure-outcome associations were not biased due to self-selection.[26] Another limitation to this study is the lack of a validated instrument for measuring the exposure. The gold standard for valid data on violence against women is currently stand-alone specialized surveys and violence modules as in MoBa may achieve a lower disclosure rate.[23] However, the prevalence of 18.5% of any sexual violence found in our study is comparable to findings from previous literature.[1,2]

Interpretation

Some studies have shown an increased risk for CS, similar to our findings.[4,11,27] Nerum et al. reported a 9-fold increase in the risk of CS among women raped as adults.[5] The strength of the association is likely due to selection bias toward CS, as the exposed population was identified among women already contacting the health service to request a CS.[5] The study did not differentiate between elective and emergency CS. Indeed, our study is the first to report an increased risk for women exposed to sexual violence for both elective and emergency CS. We found a smaller likelihood of a vaginal operative birth for multiparous women with a history of mild sexual violence. Lukasse et al.[4] have shown a decreased risk of vaginal operative birth for nullliparous women exposed to any type of childhood abuse, not only sexual abuse. In contrast, Nerum et al. found a 12-fold increase in the risk of operative vaginal birth for women raped as adults.[5]

Several mechanisms may explain the association between sexual violence and mode of delivery. For example, birth may trigger memories of sexual violence, causing physiological mechanisms that can interfere with contractions and lead to a prolonged second stage.[28] This may lead to emergency CS but does not explain the decreased risk of vaginal operative births we found for multiparous women. A study by Simkin [29] describes birth behaviours among women with a history of abuse, including anxiety over body boundaries and fear of invasive procedures, which may explain this finding. If birth attendants are aware of a history of sexual violence, they may try to avoid invasive procedures, such as vaginal operative birth or performing an episiotomy. MoBa does not give information about birth attendant's knowledge of sexual violence history so we were unable to control for this. Other studies have emphasised the meaning of control and the importance for abused women to remain in

control,[30] for example, choosing an elective CS. When obstetricians are aware of abuse, they may also be more willing to grant a maternal request for a CS.

In our study, we found that rape was associated with an increased risk of induced labour for both nulli- and multiparous women, in accordance with Nerum et al., who reported similar findings among first-time mothers raped as adults.[5] The induction of labour may also be a method for women to retain control, as the initiation of labour is planned. We found a small increase in the use of epidurals for nulliparous women exposed to moderate and severe sexual violence, in accordance with the findings by Nerum at al.[5] but in contrast to the findings by Van Hulst et al.[8] The triggering of abuse memories may cause a 'fight' reaction, which may explain the further complications experienced by sexually abused women giving birth.[18] An increase in stress hormones caused by such a reaction may interfere with both progress in labour and the pain experienced, leading to the need for an epidural.

One unexpected finding was the lower risk of an episiotomy for all the women exposed to severe sexual violence, previously reported among nulliparous women by Lukasse et al.[4] and by Van Hulst et al.[8] in a study population comprised of approximately 60% nulliparous women. This finding can be explained by a fear of invasive procedures. Similarly to Lukasse et al.,[4] we found an association between nulliparous women reporting sexual violence and a decreased risk of having an anal sphincter tear. The need for sexually abused women to remain in control [30] may explain this finding. Maintaining control during the last stage of labour is suggested as a preventive mechanism for vaginal tears.[31]

Nerum et al. reported a large effect of rape on caesarean section rates, in contrast to our finding, which was more moderate. This difference is most likely due to differences in the

study populations, but nevertheless, the findings shows consistency of the observed association, one of the suggested criteria used to discuss if associations are likely to be causal.[32] The temporal relationship of the association is assured in this study as women were exposed to sexual violence before the outcome. Some of our findings lack a dose response relationship and caution is therefore needed in the interpretation of causality for these findings. Hill's criteria also emphasis the strength of the association and the significant effects found in our study were small, with the majority of AORs less than 1.5. However, having adjusted for relevant covariates and potential confounders, the effects indicates a truly increased risk among pregnant women with a history of sexual violence attending routine antenatal care.

Conclusion

Sexual violence is highly prevalent in this population-based cohort, and women exposed to severe sexual violence have a higher risk of elective caesarean section and labour induction, interventions that are increasing and may constitute a health risk for women. This study emphasizes the importance of birth attendant's knowledge of a sexual violence history among women since this may influence a woman's preference for birth. Clinicians should consider examining a patient's history of sexual violence and use this knowledge to provide individually adjusted care for abused women. Future research should focus on enquiry methods to disclose violence and acceptable interventions to help women that have been exposed to violence.

Competing interests

None.

Contributions to authorship

LH participated in the conception and design of the study, performed the analysis and drafted the manuscript. BS participated in the conception of the study and advised on the statistical analyses and drafting of the manuscript. SV advised on the statistical analyses and the drafting of the manuscript. ML participated in the conception and design of the study, advised on the statistical analyses and participated in the drafting of the manuscript. All authors read and approved the final version.

Details of ethics approval

The study was approved by The Regional Committee for Medical Research Ethics 28.03.1996 (Ref.SAFH 95/313 RTL), and the Norwegian Data Inspectorate approved the study.

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Table 1. Characteristics and outcomes for women with a history of mild, moderate and severe sexual violence in the Mother and Child Cohort study, N = 74 059

	No violence	*Mild*	*Moderate*	*Severe*	Pearson X^2
	N= 60 438 (81.6%)	N= 8935 (12.1%)	N=2072 (2.8%)	N= 2613 (3.5%)	p-value
Nulliparous	32 107 (53.1)	4557 (51.0)	1026 (49.5)	1383 (52.9)	*
Multiparous	28 331 (46.9)	4378 (49.0)	1046 (50.5)	1230 (47.1)	*
Younger < 20	668 (1.1)	158 (1.8)	51 (2.5)	158 (6.0)	*
Older ≥35	8444 (14.0)	1479 (16.6)	364 (17.6)	376 (14.4)	*
Single	1635 (2.7)	508 (5.7)	157 (7.6)	281 (10.8)	*
Higher Education	37 262 (63.8)	4843 (56.7)	940 (48.1)	899 (36.5)	*
Unemployed	4544 (7.6)	963 (11.0)	305 (15.0)	534 (21.0)	*
BMI ≥30	5232 (8.9)	852 (9.7)	235 (11.8)	340 (13.5)	*
Smoking	4227 (7.0)	1040 (11.7)	343 (16.8)	571 (22.1)	*
Alcohol	6880 (13.1)	1328 (16.9)	305 (16.7)	327 (14.6)	*
Mental distress	3071 (5.1)	1086 (12.2)	303 (14.6)	535 (20.5)	*
Previous CS (multiparous)	3837 (13.5)	567 (13.0)	159 (15.2)	188 (15.3)	0.075
Diabetes	750 (1.2)	143 (1.6)	33 (1.6)	45 (1.7)	*
Pre-eclampsia	2026 (3.4)	301 (3.4)	67 (3.2)	93 (3.6)	0.933
Induced labour	8035 (13.3)	1278 (14.3)	288 (13.9)	423 (16.2)	*
Epidural	17 584 (29.1)	2629 (29.4)	658 (31.9)	885 (33.9)	*
Dystocia	21 214 (35.1)	3047 (34.1)	742 (35.8)	912 (34.9)	0.257
Anal sphincter tear	2505 (4.1)	297 (3.3)	60 (2.9)	75 (2.9)	*
Episiotomy	12 173 (20.1)	1618 (18.1)	347 (16.7)	392(15.0)	*
Macrosomia	2712 (4.5)	407 (4.6)	103 (5.0)	118 (4.5)	0.768
Mode of delivery					
Spontaneous	45 778 (75.7)	6853 (76.7)	1492 (72.0)	1904 (72.9)	*
Operative vaginal	6639 (11.0)	867 (9.7)	220 (10.6)	261 (10.0)	*
Elective CS	2888 (4.8)	447 (5.0)	127 (6.1)	183 (7.0)	*
Emergency CS	5133 (8.5)	768 (8.6)	233 (11.2)	265 (10.1)	*

*=p value<0.001, Df=3

Table 2. Odds ratios (and 95% confidence intervals) for different mode of delivery for women with a history of mild, moderate and severe sexual violence, stratified by parity. Women with a spontaneous birth are in the comparison group.

	Vaginal operative		Elective CS		Emergency CS	
	n = 6689		n = 1333		n = 4571	
Nulliparous[a]	OR	AOR	OR	AOR	OR	AOR
Mild sexual violence	0.93 (0.85-1.01)	0.93 (0.85-1.03)	1.07 (0.90-1.26)	1.03 (0.86-1.23)	1.01 (0.92-1.16)	0.97 (0.87-1.08)
Moderate sexual violence	1.03 (0.87-1.23)	1.02 (0.84-1.24)	1.12 (0.80-1.58)	1.08 (0.75-1.56)	1.41 (1.17-1.67)	1.31 (1.07-1.60)
Severe sexual violence	0.91 (0.78-1.05)	0.96 (0.81-1.14)	1.64 (1.28-2.10)	1.56 (1.18-2.05)	1.21 (1.03-1.42)	1.15 (0.97-1.39)
Multiparous[b]	n = 1298		n = 2312		n = 1828	
Mild sexual violence	0.77 (0.64-0.92)	0.73 (0.60-0.89)	1.00 (0.88-1.14)	0.96 (0.82-1.12)	1.04 (0.91-1.20)	0.98 (0.84-1.14)
Moderate sexual violence	1.23 (0.91-1.67)	1.15 (0.82-1.60)	1.44 (1.15-1.49)	1.33 (1.01-1.74)	1.51 (1.19-1.93)	1.41 (1.08-1.84)
Severe sexual violence	1.12 (0.84-1.51)	1.06 (0.76-1.48)	1.46 (1.19-1.78)	1.37 (1.06-1.76)	1.31 (1.03-1.66)	1.11 (0.85-1.45)

a= AOR controlled for: younger (age <20) and older (age ≥35), education, BMI, smoking, diabetes, pre-eclampsia, induced birth, dystocia, epidural, macrosomia and mental distress

b=AOR controlled for: older (age ≥35), education, BMI, smoking, mental distress, previous CS, diabetes, pre-eclampsia, induced birth, dystocia, epidural and macrosomia

Table 3. Odds ratios (and 95 % confidence intervals) for selected maternal birth outcomes and sexual violence stratified by parity

	No violence	Mild		Moderate		Severe	
	n = 32 107	n = 4557 (11.7%)		n = 1026 (2.6%)		n = 1383 (3.5%)	
Nulliparous		OR	AOR	OR	AOR	OR	AOR
Induction[a]	15.4%	16.9%		15.8%		18.9%	
		1.12 (1.03-1.22)	1.10 (1.01-1.21)	1.03 (0.87-1.23)	0.97 (0.80-1.17)	1.21 (1.05-1.40)	1.22 (1.04-1.42)
Epidural[b]	40.8%	42.1%		45.5%		47.9%	
		1.05 (0.98-1.12)	1.02 (0.95-1.10)	1.21 (1.06-1.37)	1.19 (1.03-1.37)	1.33 (1.20-1.49)	1.27 (1.12-1.45)
Episiotomy[c]	34.2%	32.2%		31.1%		28.0%	
		0.91 (0.85-0.98)	0.94 (0.87-1.02)	0.87 (0.75-1.01)	0.88 (0.74-1.04)	0.75 (0.66-0.86)	0.80 (0.69-0.92)
Anal sphincter tear[d]	6.9%	5.7%		5.0%		4.5%	
		0.81 (0.70-0.94)	0.85 (0.73-0.98)	0.71 (0.52-0.98)	0.73 (0.53-1.00)	0.64 (0.48-0.85)	0.70 (0.53-0.94)
Multiparous	n = 28 331	n = 4378 (12.5%)		n = 1046 (3.0%)		n = 1230 (3.5%)	
Induction[e]	12.3%	13.0%		13.8%		16.7%	
		1.07 (0.97-1.19)	1.07 (0.96-1.18)	1.15 (0.95-1.39)	1.07 (0.87-1.31)	1.44 (1.22-1.70)	1.37 (1.15-1.63)
Epidural[f]	17.7%	18.2%		20.3%		21.5%	
		1.04 (0.95-1.13)	1.02 (0.93-1.12)	1.19 (1.01-1.40)	1.07 (0.90-1.28)	1.28 (1.10-1.48)	1.12 (0.95-1.32)
Episiotomy[g]	10.9%	9.5%		9.6%		7.2%	
		0.86 (0.76-0.96)	0.88 (0.79-1.00)	0.86 (0.68-1.08)	0.81 (0.63-1.03)	0.63 (0.50-0.80)	0.64 (0.50-0.83)
Anal sphincter tear[h]	2.4%	2.0%		2.0%		2.3%	
		0.82 (0.64-1.04)	0.84 (0.66-1.07)	0.84 (0.52-1.35)	0.82 (0.51-1.32)	0.95 (0.62-1.43)	0.95 (0.62-1.45)

a= elective CS excluded. AOR controlled for: younger (age <20), older (age ≥35), BMI, pre-eclampsia, diabetes and macrosomia
b= elective CS excluded. AOR controlled for: younger (age <20), BMI, smoking, mental distress, pre-eclampsia, induction, dystocia, macrosomia and civil status
c= all CS excluded. AOR controlled for: BMI, education, civil status, mental distress, induction, dystocia, vaginal operative birth and macrosomia
d= all CS excluded. AOR controlled for: younger (age <20), mental distress, dystocia, episiotomy, vaginal operative birth, macrosomia and epidural
e= elective CS excluded. AOR controlled for: older (age ≥35), BMI, pre-eclampsia, diabetes and macrosomia
f= elective CS excluded. AOR controlled for: older (≥35), mental distress, smoking, previous CS, pre-eclampsia, induction and dystocia,
g= all CS excluded. AOR controlled for: education, mental distress, previous CS, induction, dystocia, epidural, vaginal operative birth and macrosomia
h= all CS excluded. AOR controlled for: older (≥35), macrosomia, vaginal operative birth, previous CS, induction, dystocia and epidural