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Pelvic Floor Disorders 5-10 Years After Vaginal or Cesarean Childbirth

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Abstract

Objective—To estimate differences in pelvic floor disorders by mode of delivery.

Methods—We recruited 1,011 women for a longitudinal cohort study, 5-10 years after first delivery. Using hospital records, we classified each birth as: cesarean without labor, cesarean during active labor, cesarean after complete cervical dilation, spontaneous vaginal birth, or operative vaginal birth. At enrollment, stress incontinence, overactive bladder, anal incontinence, and prolapse symptoms were assessed with a validated questionnaire. Pelvic organ support was assessed using the Pelvic Organ Prolapse Quantification system. Logistic regression analysis was used to estimate the relative odds of each pelvic floor disorder by obstetric history, adjusting for relevant confounders.

Results—Compared to cesarean without labor, spontaneous vaginal birth was associated with a significantly greater odds of stress incontinence (odds ratio (OR) 2.9; 95% confidence interval (CI) 1.5, 5.5) and prolapse to or beyond the hymen (OR 5.6; 95% CI 2.2, 14.7). Operative vaginal birth significantly increased the odds for all pelvic floor disorders, especially prolapse (OR 7.5; 95% CI 2.7, 20.9). These results suggest that 6.8 additional operative births or 8.9 spontaneous vaginal births, relative to cesarean births, would lead to one additional case of prolapse. Among women delivering exclusively by cesarean, neither active labor nor complete cervical dilation increased the odds for any pelvic floor disorder considered, although the study had less than 80% power to detect a doubling of the odds with these exposures.

Conclusion—Although spontaneous vaginal delivery was significantly associated with stress incontinence and prolapse, the most dramatic risk was associated with operative vaginal birth.

INTRODUCTION

Pelvic floor disorders, including urinary and fecal incontinence and pelvic organ prolapse, are more prevalent among women who have delivered at least one child (1-3). Determining which aspects of childbirth contribute most to the risk of pelvic floor disorders and investigating how obstetric care can be modified to reduce their incidence is an area of intense investigation. Cesarean delivery has been suggested as a possible prevention strategy.

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Research on the relationship between childbirth and pelvic floor disorders is challenging because of the long latency for these disorders. In the first year after childbirth, some studies have suggested that cesarean birth reduces the prevalence of bothersome incontinence symptoms (4-7). However, cross-sectional studies of parous women later in life (2,8) suggest that women who have delivered vaginally have a higher prevalence of pelvic floor symptoms than women who report only cesarean deliveries. This association has been most convincingly demonstrated for stress incontinence (2,8), with much less evidence for other pelvic floor disorders.

Epidemiologic studies of prolapse are particularly challenging because of the expense and logistical complexity of performing gynecologic examinations across large populations. As a result, studies of the relationship between childbirth and prolapse have typically relied on surrogate measures of prolapse, such as symptoms (8-9) or surgical treatment (3,10,11). However, symptoms are weakly correlated with objective measures of prolapse (12,13). Also, given that thresholds for surgical intervention may vary considerably, the incidence of surgical treatment might be an unreliable indicator of the true incidence of prolapse. Therefore, the relative incidence of prolapse after vaginal and cesarean delivery remains unknown.

To address the question of whether delivery mode influences the later development of pelvic floor disorders, we are conducting a longitudinal cohort study of pelvic floor disorders after childbirth. Because of the long latency for these disorders, women are recruited to participate 5 to 10 years after their first delivery. This analysis, based on enrollment data, addresses the specific question of whether delivery mode is associated with pelvic floor disorders, including pelvic organ prolapse, 5-10 years after delivery.

METHODS

Study Design

The Mothers' Outcomes After Delivery study is a prospective cohort study of pelvic floor outcomes in women recruited 5-10 years after delivery of their first child. This study has been designed and conducted by investigators from the Johns Hopkins Medical Institutions and the Greater Baltimore Medical Center in Baltimore, Maryland. Institutional review board approval was obtained at both institutions. All participants provided written informed consent.

Study Population

Recruitment for this longitudinal cohort study began in 2008 and is ongoing. To be eligible, women must have given birth to their first child (index birth) at Greater Baltimore Medical Center 5 to 10 years prior to enrollment. Participants were identified from obstetric hospital discharge records using discharge diagnoses. Hospital charts were reviewed by trained personnel to verify eligibility and to confirm delivery type. Potential participants were also screened for eligibility via telephone interview. Exclusion criteria (applied to the index birth) included: maternal age <15 or >50 years, delivery at < 37 weeks gestation, placenta previa, multiple gestation, known fetal congenital anomaly, stillbirth, prior myomectomy, and abruption. Women who developed these events during subsequent pregnancies were not excluded.

Based on chart review, 8,285 eligible women were identified. Each eligible delivery was classified as either a vaginal birth or cesarean birth. Cesarean births were further classified as either unlabored cesarean deliveries or labored cesarean deliveries. Unlabored cesarean delivery was defined as cesarean performed prior to the onset of active labor, defined as regular contractions with cervical dilation of 3 cm or greater. Each delivery was also

classified by the woman's age at delivery (organized into 5-year strata) and the number of years from first delivery (in 1/4-year strata).

Based on the objectives of the study, the recruitment goal was 1,000 women, including 200 unlabored cesareans, 400 labored cesareans, and 400 vaginal births (classified by index birth). Our recruitment strategy was designed to insure that age at first delivery and years since first delivery were similar across these three birth groups. To ensure a sufficient sample of unlabored cesareans, we recruited all eligible women in this group. For the other groups, women within each stratum were randomly assigned a "rank" and recruitment proceeded according to rank until the number of women recruited in the labored cesarean and vaginal birth groups was twice the number of women in the unlabored cesarean group. As a result of these matching criteria, 5,215 of the 8,285 eligible births were approached for recruitment

We were able to contact 2,510 of 5,215 women (48.1%). Fifty-seven women were excluded because they were ineligible, were currently pregnant, had delivered a child or reported pelvic surgery within the past 6 months, or were unable complete written questionnaires in English. Of the 2,453 who were contacted and eligible, 1,271 (51.8%) declined to participate. This analysis is based on enrollment data from 1,011 women who had completed the baseline assessment at the time of this analysis.

Exposures

Obstetric exposures were derived from abstraction of all delivery records for each participant. Of 1,951 deliveries reported by the 1,011 participants, multiparous women reported 70 deliveries which occurred at other hospitals (e.g., after the index birth). For these deliveries we substituted maternal recall of delivery events for a formal review of the obstetric records.

Based on obstetric history, women were classified into five groups to more fully characterize their obstetric exposures, over all deliveries. The reference group (i.e., unexposed) comprised women who had delivered all their children by unlabored cesarean. The four "exposed" groups were: (1) cesarean delivery after the onset of active labor but before complete cervical dilation; (2) cesarean delivery after complete cervical dilation; (3) spontaneous vaginal birth; and (4) operative vaginal birth. It was hypothesized that the harm to the pelvic floor increased across these groups, with the least harm in the reference group (group 0) and the greatest harm in group 4. A woman's group was determined by considering all of her deliveries; women were placed in the group corresponding to the delivery that was likely to cause the most harm to the pelvic floor. For instance, any woman with an operative delivery was placed in that group regardless of her other delivery types. In 96%, the first birth was the birth most likely to cause the most harm to the pelvic floor.

In addition to obstetric exposures, we considered the following confounders: race, maternal age at the time of first delivery, interval (in years) between delivery and study enrollment, obesity, and cigarette smoking. Race was self-reported. Obesity was determined at study enrollment. Specifically, each participant's weight and height were measured and body mass index was calculated (kg/m^2). Obesity was defined as a body mass index of 30 kg/m^2 or greater. Cigarette smoking was classified as "never" or "ever", based on whether a woman had smoked at least 100 cigarettes in her life.

Outcomes

The presence or absence of pelvic floor disorders was evaluated at the enrollment visit. Symptoms of pelvic floor disorders were assessed using the Epidemiology of Prolapse and Incontinence Questionnaire, a validated self-administered questionnaire (14). This

questionnaire generates scores for four pelvic floor disorders: stress urinary incontinence (SUI), overactive bladder (OAB), anal incontinence and pelvic organ prolapse (POP). In each case, a validated threshold is used to define women who meet criteria for the disorder. Scores greater than these threshold values have been shown to correspond to significant bother from pelvic floor symptoms (14). In this research, we used the published thresholds (14) to distinguish women with and without each pelvic floor disorder.

In addition to the research questionnaire, a gynecological examination was performed to assess pelvic organ support, using the Pelvic Organ Prolapse Quantification examination system (15). The examination was performed by physicians and a research nurse, each of whom demonstrated competency in performing the research examination prior to the study; competency was reconfirmed throughout the study. Women were classified as having objective evidence of prolapse if the most dependent point of the vaginal wall or the cervix came to or beyond the hymen (13,16,17).

At enrollment into our cohort study, participants were asked about prior treatment for pelvic floor disorders, including surgery. Participants were also asked about current therapy, including medications for urinary incontinence or current pessary use for treatment of prolapse. We also considered current or prior pelvic muscle exercises, but only if the program was supervised by a therapist. For the purposes of this analysis, women who reported prior surgery, prior supervised pelvic muscle exercises, or any current therapy for a specific pelvic floor disorder were considered to have that condition, regardless of current symptoms.

Statistical Methods

This cross-sectional analysis is based on enrollment data. Contingency tables were used to estimate the univariable associations between each pelvic floor disorder and each exposure. In these analyses, each of the five pelvic floor disorders of interest (SUI, OAB,anal incontinence, POP symptoms, and POP by exam) was considered separately. P-values were obtained using a Fisher's exact test.

Logistic regression was used to provide measures of association between obstetric exposures and prevalent pelvic floor disorders. Group 0 (women who had delivered exclusively by cesarean before labor) was the reference group. Univariable (i.e., unadjusted) and multivariable (i.e., adjusted) analyses were performed. The multivariable model was adjusted for black race, maternal age > 35 at first delivery, multiparity, and obesity (body mass index>30kg/m^2). Relative odds were used to summarize the strength of the associations and Wald-based 95% confidence intervals (18) were used to determine statistical significance.

In planning this research, we estimated that at least 10% of women would demonstrate pelvic floor disorders at the time of enrollment. We selected our sample size to detect a doubling of the relative odds, which we considered a clinically important difference. With that assumption, we calculated that a sample size of 200 women in the reference group (unlabored cesarean) and 400 women in each comparison group would provide 80% power to reject the null hypothesis (assuming a type I error of 0.05).

RESULTS

At enrollment, the median age was 39.5 years, 82% were Caucasian, and 28% were older than 35 years at the time of their first delivery. Also, 72% were multiparous and 26% were classified as obese. The median interval between first delivery and enrollment was 7.4 years (interquartile range 6.3, 9.0); because of delays in recruiting, 4% were more than 10 years

from first delivery at enrollment. The cohort included 205 women whose index birth was an unlabored cesarean, 388 whose index birth was a labored cesarean, and 418 women whose index birth was a vaginal delivery. Participation was similar across these three birth groups (p=0.63).

The characteristics of participants, by obstetric exposure, are shown in Table 1. Of 1,011 participants, 192 women had delivered exclusively by cesarean before active labor (group 0). Of the 368 women who had no prior vaginal births and at least one cesarean birth after the onset of active labor, 228 had experienced at least one cesarean in the first stage of labor (group 1) and 140 had experienced at least one cesarean in the second stage of labor (group 2). Of the 451 women who had at least one vaginal birth, 325 women had no operative vaginal births (group 3) and 126 women had experienced at least one operative vaginal birth (group 4). Among those who delivered by operative vaginal birth, 50 had delivered by vacuum extraction, 71 by forceps, and 5 had experienced both vacuum and forceps deliveries. As expected by study design, the obstetric exposure groups were similar with respect to age at first delivery and the interval from first delivery; the groups were also similar with respect to parity and smoking. Differences across groups were noted for age at enrollment, race and obesity.

The most common pelvic floor disorders were SUI (11%), OAB (8%), andanal incontinence (11%). Bothersome symptoms of prolapse were reported by 3%, compared to the 7% who demonstrated prolapse to or beyond the hymen based on physical examination. As shown in Table 2, women who had experienced at least one vaginal birth were significantly more likely to report stress incontinence ($p< 0.001$) and were significantly more likely to demonstrate prolapse to or beyond the hymen ($p< 0.001$). Symptoms of prolapse were uncommon across all groups but were significantly associated with operative delivery ($p= 0.012$). Symptoms of anal incontinence did not differ significantly across obstetric exposure groups ($p= 0.195$).

As noted, symptoms of prolapse were less prevalent than anatomic evidence of prolapse. Specifically, of 75 women with prolapse to or beyond the hymen, only 14 (19%) reported bothersome symptoms. Thus, the majority of women with prolapse on examination were asymptomatic or minimally symptomatic. Among the 75 women who had prolapse on examination, women who delivered their first baby after age 35 were more likely to report bothersome prolapse symptoms (p=0.045). Moreover, among the 26 women reporting symptoms of prolapse, obese women were significantly less likely to demonstrate prolapse on examination ($p<0.001$). Thus, the symptoms of prolapse were expressed differently by obese women and by women who delivered a first child at an older age.

The relative odds for each pelvic floor disorder by delivery group are presented in Table 3. After adjusting for black race, maternal age at first delivery, multiparity, smoking history, and obesity, we found that stress incontinence and prolapse to or beyond the hymen were significantly more common among women who had delivered by vaginal birth (either spontaneous or operative) than among women who delivered exclusively by cesarean (groups 0 to 2). The other pelvic floor disorders were significantly associated with operative vaginal birth but not with spontaneous vaginal birth. For women with a history of at least one operative delivery, the adjusted odds of stress incontinence and overactive bladder were more than quadrupled (SUI: relative odds 4.45, 95% confidence interval 2.14, 9.27; OAB: relative odds 4.89, 95% confidence interval 2.23, 10.74). The odds of prolapse to or beyond the hymen were increased almost 8-fold among women who had a history of at least one operative birth (relative odds 7.50, 95% confidence interval 2.70, 20.87). To put this into perspective, we calculated the number needed to harm, a measure of the magnitude of risk associated with an exposure. Assuming a causal relationship between delivery type and

prolapse, our results suggest that, relative to cesarean deliveries, 8.9 spontaneous vaginal births would lead to one additional case of prolapse. Similarly, 6.8 operative births would lead to one additional case of prolapse.

In contrast, we did not see a clinical or statistical difference in the odds of any pelvic floor disorder between the three cesarean groups. Specifically, among women who delivered all their children by cesarean, there was no significant difference in pelvic floor disorders between women who entered active labor prior to at least one cesarean birth and women who had never been exposed to active labor. However, given the relatively low prevalence for each pelvic floor disorder in the reference group (<10%), the study had limited power (<80%) to detect less than a doubling of the odds of pelvic floor disorders among the three subgroups of women with only cesarean deliveries.

Discussion

The most important finding from this study is that, 5-10 years after a first birth, pelvic floor disorders were dramatically increased among women with a history of at least one operative vaginal birth. Our results are consistent with published studies indicating that operative delivery is associated with subsequent fecal incontinence (9, 19). Our findings also demonstrate an increase in urinary incontinence after operative delivery, a finding which has been inconsistently observed in prior research (5,9, 20,21). We are unaware of any prior studies investigating the association between operative vaginal birth and prolapse. We found a very strong association in this regard and we speculate that this association may be mediated by undetected injury to the levator ani. It has been suggested that operative delivery is a risk factor for levator ani muscle injury (22) and that levator injuries may contribute to prolapse (23). Further research is needed to identify whether levator ani injuries are the mechanism responsible for the association we observed between operative birth and prolapse.

Another important finding from this research is the absence of any association between active labor and pelvic floor disorders among women delivering by cesarean. Prior studies had suggested that labored cesarean is a risk factor for pelvic floor disorders, compared to unlabored cesarean (8,24-26). We specifically designed our recruitment to include a sufficient number of women to test for differences between these groups. Our findings are similar to those of Boyles (4), who found no difference in urinary incontinence one year after either elective cesarean, cesarean in labor, or cesarean in the second stage of labor. Our results build upon these findings with a longer duration of follow up and an assessment of other pelvic floor disorders.

An important observation is that 75% of women with prolapse to or beyond the hymen were asymptomatic or minimally symptomatic. This finding is consistent with observations made by Bradley, who found that 84% of postmenopausal women with this degree of prolapse did not see or feel a vaginal bulge (13). The prognosis for women with asymptomatic prolapse is unclear. The conventional wisdom is that these women develop worsening prolapse and increasing bother over time. However, the natural history of prolapse is poorly understood (27,28). We do not know whether asymptomatic prolapse is more or less likely to progress (or regress). Longitudinal observation of this cohort will allow us to characterize prolapse progression or remission, and to investigate the incidence of bothersome symptoms as the population ages.

One limitation of this study is that the prevalence of all pelvic floor disorders in this population was low, limiting our power to investigate some associations and contributing to wide confidence intervals for relative odds of the least common outcomes. However, we

intentionally recruited women 5-10 years from first childbirth, in the hopes of capturing the onset of pelvic floor disorders with longitudinal observation (e.g., as the population ages). Thus, the relative difference between these groups is expected to grow with time and will be a major focus of the ongoing longitudinal study. In addition, this is an observational study and we therefore cannot with certainty ascribe the incidence of pelvic floor disorders to obstetric events. We cannot exclude the possibility that unmeasured characteristics of the population or other exposures were relevant to the development of pelvic floor disorders. Finally, participation in this research was only 50%. However, this participation rate is similar to other studies investigating pelvic floor disorders after childbirth (4,8,9).

A strength of this study is that obstetric exposures were defined by obstetric hospital records, rather than maternal recall, for 96.5% of all deliveries. Another strength of the study is the assessment of pelvic floor disorders with a validated symptom questionnaire and a structured examination to assess pelvic organ support. The examination for pelvic organ support is a relatively unique aspect of this study. Prior studies defined prolapse either by symptoms (8) or the incidence of surgical intervention (3,10,11). In one of the few prior cohort studies that included an anatomic assessment of pelvic organ support after childbirth (16), prolapse to or beyond the hymen was noted in 2 of 39 (5%) women after unlabored cesarean versus 15 of 105 (14%) after vaginal birth. The present study expands on those results by including a more adequate sample size, as well as a longer duration of follow up.

In summary, these results provide important evidence of a strong association between vaginal childbirth and pelvic floor disorders. In particular, our results suggest that operative vaginal delivery is associated with a large increase in the relative odds of pelvic floor disorders 5-10 years after delivery. Longitudinal data to be collected as this study proceeds will establish whether vaginal birth and operative delivery have a different impact than cesarean birth on the long-term progression of pelvic floor disorders over time. Our future research will establish to what extent obstetric exposures affect changes over time in symptom burden and anatomic support. These data will be useful to women and their obstetric providers as they weigh childbirth options.

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Table 1

Characteristics (median (interquartile range) or n (%)) of 1,011 women, by history of obstetric exposures

		At least one cesarean in active labor (n= 368)		At least one vaginal birth (n= 451)		P value
	(0)	(1)	(2)	(3)	(4)	
	All births cesarean prior to active labor (n= 192)	Never reached complete cervical dilation (n= 228)	At least one cesarean after complete cervical dilation (n= 140)	No operative vaginal births (n= 325)	At least one operative vaginal birth (n= 126)	
Age at enrollment, years	40.0 (36.1, 43.6)	38.3 (34.6, 42.1)	40.3 (36.9, 43.6)	39.3 (35.7, 42.8)	40.8 (36.6, 43.4)	0.001
Years from 1st delivery to enrollment	7.0 (6.2, 8.6)	7.4 (6.3, 8.8)	7.4 (6.2, 9.0)	7.5 (6.3, 9.2)	7.5 (6.6, 9.2)	0.040
Primary Race						
Caucasian	154 (80%)	164 (72%)	129 (92%)	275 (85%)	108 (86%)	
Black	32 (17%)	48 (21%)	5 (4%)	40 (12%)	12 (10%)	[lt]0.001
Other	6 (3%)	16 (7%)	6 (4%)	10 (3%)	6 (5%)	
Maternal age[mt]35 yrs at 1st delivery	64 (33%)	52 (23%)	45 (32%)	86 (26%)	36 (29%)	0.116
Multiparous at enrollment	131 (68%)	157 (69%)	99 (71%)	249 (77%)	90 (71%)	0.188
BMI† ≥ 30kg/m^2 at enrollment	65 (34%)	85 (37%)	35 (25%)	59 (18%)	15 (12%)	[lt]0.001
Smoking ever¥	78 (41%)	68 (30%)	46 (33%)	94 (29%)	38 (30%)	0.075

†BMI = Body mass index = weight (kg)/ (height(m))^2

¥Smoking ever = smoked at least 100 cigarettes in entire life

Table 2

Pelvic floor disorders 5-10 years from first delivery, according to characteristics of 1,011 women

	Pelvic floor disorder									
	SUI*		OAB*		AI*		POP symptoms*		POP exam*	
	112 (11%)		79 (8%)		107 (11%)		26 (3%)		75 (7%)	
	N (%)	P†	N (%)	P†	N (%)	P†	N (%)	P†	N (%)	P†
Obstetric exposure group¥		[lt]0.001		0.002		0.195		0.012		[lt]0.001
Group 0 (n=192)	14 (7%)		13 (7%)		15 (8%)		3 (2%)		5 (3%)	
>Group 1 (n=228)	14 (6%)		11 (5%)		19 (8%)		2 (1%)		3 (1%)	
Group 2 (n=140)	12 (9%)		9 (6%)		17 (12%)		2 (1%) 10(3%)		3 (2%)	
Group 3 (n=325)	47(14%)		24 (7%)		37 (11%)		9 (7%)		43(13%)	
Group 4 (n=126)	25(20%)		22(17%)		19 (15%)				21(17%)	
Primary Race		0.491		0.586		[lt]0.001		0.345		0.003
Caucasian(n=830)	96(12%)		62 (7%)		101(12%)		24(3%)		68 (8%)	
Black (n=137)	11 (8%)		13 (9%)		2 (1%)		1 (1%)		2 (1%)	
Other (n=44)	5 (11%)		4 (9%)		4 (9%)		1 (2%)		5 (11%)	
Maternal age [mt]35 yrs at 1st delivery		0.095		0.089		0.820		0.006		0.081
Yes (n=283)	39(14%)		29(10%)		31 (11%)		14(5%)		28(10%)	
No (n=728)	73(10%)		50 (7%)		76 (10%)		12(2%)		47 (6%)	
Multiparous at enrollment		0.074		0.002		0.211		0.508		0.06
Yes (n=726)	72(10%)		44 (6%)		71 (10%)		17(2%)		61 (8%)	
No (n=285)	40(14%)		35(12%)		36 (13%)		9 (3%)		14 (5%)	
BMI††[mt]30kg/m^2 at enrollment		0.004		[lt]0.001		0.413		0.823		0.170
Yes (n=259)	42(16%)		34(13%)		31 (12%)		7 (3%)		14 (5%)	
No (n=752)	70 (9%)		45 (6%)		76 (10%)		19(3%)		61 (8%)	
Smoking ever		0.198		0.033		0.584		0.020		0.898
Yes (n= 324)	42(13%)		34(10%)		37(11%)		14(4%)		23(7%)	
No (n= 687)	70(10%)		45(7%)		70(10%)		12(2%)		52(8%)	

*SUI=stress urinary incontinence; OAB=overactive bladder; AI=anal incontinence; POP symptoms=prolapse symptoms; POP exam=prolapse to or beyond the hymen on physical examination

†P values reflects comparison across groups for each exposure category

¥Obstetric exposure groups: 0=all births by cesarean prior to labor; 1= All births by cesarean with at least one cesarean in active labor (but prior to complete cervical dilation); 2=all births by cesarean but at least one after complete cervical dilation; 3=at least one spontaneous vaginal birth; 4=at least one operative vaginal birth

††BMI = Body mass index = weight (kg)/ (height(m))^2

Table 3

Relative odds for each pelvic floor disorder 5 to 10 years from first delivery, by obstetric exposure. (Bold font is used to highlight those ratios that are significantly different from 1.)

Pelvic Floor Disorders		(0) All births cesarean prior to active labor (n= 192)	(1) All cesarean births prior to complete cervical dilation (n= 228)	(2) At least one cesarean after complete cervical dilation (n= 140)	(3) No operative vaginal births (n= 325)	(4) At least one operative vaginal birth (n= 126)
Stress urinary incontinence	Unadjusted	1 (ref)	0.83 (0.39, 1.79)	1.19 (0.53, 2.66)	**2.15 (1.15, 4.02)**	**3.15 (1.57, 6.33)**
	Adjusted*	1 (ref)	0.88 (0.40, 1.91)	1.30 (0.57, 2.95)	**2.87 (1.49, 5.52)**	**4.45 (2.14, 9.27)**
Overactive bladder	Unadjusted	1 (ref)	0.70 (0.31, 1.60)	0.95 (0.39, 2.28)	1.10 (0.55, 2.21)	**2.91 (1.41, 6.03)**
	Adjusted*	1 (ref)	0.74 (0.32, 1.73)	1.17 (0.47, 2.91)	1.66 (0.80, 3.48)	**4.89 (2.23, 10.74)**
Anal incontinence	Unadjusted	1 (ref)	1.07 (0.53, 2.17)	1.63 (0.79, 3.39)	1.52 (0.81, 2.84)	**2.10 (1.02, 4.30)**
	Adjusted*	1 (ref)	1.12 (0.55, 2.29)	1.48 (0.70, 3.11)	1.62 (0.85, 3.10)	**2.22 (1.06, 4.64)**
Prolapse symptoms	Unadjusted	1 (ref)	0.56 (0.09, 3.37)	0.91 (0.15, 5.54)	2.00 (0.54, 7.36)	**4.85 (1.29,18.27)**
	Adjusted*	1 (ref)	0.72 (0.12, 4.42)	0.99 (0.16, 6.13)	2.80 (0.73, 10.81)	**6.83 (1.68, 27.80)**
Prolapse to or beyond the hymen on examination	Unadjusted	1 (ref)	0.50 (0.12, 2.12)	0.82 (0.19, 3.49)	**5.70 (2.22,14.66)**	**7.48 (2.74, 20.42)**
	Adjusted*	1 (ref)	0.53 (0.13, 2.27)	0.73 (0.17, 3.13)	**5.64 (2.16, 14.70)**	**7.50 (2.70, 20.87)**

Data are presented as odds ratio (5% confidence interval).

*Adjusted for black race, maternal age [mt] 35 at 1st delivery, multiparity, smoking, and obesity.