

Perineal Injury in Nulliparous Women Giving Birth at a Community Hospital: Reduced Risk in Births Attended by Certified Nurse-Midwives

Maureen Browne, RM (UK), RN, MPH, Mark Jacobs, MD, Maureen Lahiff, PhD, and Suellen Miller, CNM, RN, MHA, PhD

Introduction: Our objective was to determine if there is a difference in rates of perineal injury sustained by nulliparous women attended by obstetricians compared with certified nurse-midwives (CNMs) at a US community hospital.

Methods: We analyzed retrospective data for 2819 women who spontaneously gave birth to singleton, vertex, term, live infants between 2000 and 2005. The independent variable was attendant type (obstetrician or CNM). The main outcome variables were intact perineum, episiotomy, and spontaneous perineal lacerations. Multivariate logistic regression was used to adjust for six potential confounders: macrosomia, maternal age, epidural anesthesia, oxytocin administration, medical insurance status, and ethnicity.

Results: The odds ratios (ORs) for obstetrician-attended births versus CNM-attended births were significant for a spontaneous minor perineal laceration versus intact perineum (OR = 1.82; 95% confidence interval [CI], 1.33–2.48), spontaneous major laceration versus intact perineum (OR = 2.29; 95% CI, 1.13–4.66), and episiotomy use versus no perineal injury, with or without extension (OR = 2.94; 95% CI, 2.01–4.29).

Discussion: We found that the prevalence and severity of perineal injury, both spontaneous and from episiotomy use, were significantly lower in CNM-attended births.

J Midwifery Womens Health 2010;55:243–249 © 2010 by the American College of Nurse-Midwives.

keywords: episiotomy, midwifery, nulliparity, perineal injury

INTRODUCTION

Perineal injury at birth is associated with both short- and long-term maternal morbidities, including postpartum perineal pain,^{1,2} sexual dysfunction,³ and delayed time to resume sexual intercourse.³ A retrospective study by Williams et al.¹ found that 33% of women who had a perineal laceration or episiotomy still experienced some degree of perineal pain at 1 year postpartum. Another retrospective study conducted by Signorello et al.³ found that the degree of lacerations sustained at birth was significantly associated with the degree of dyspareunia and the experience of pain on resuming intercourse, at both 3 and 6 months postpartum.

Perineal pain and sexual problems are also associated with postpartum depression (PPD).⁴ In a survey of women 6 to 9 months after birth, Brown and Lumley⁴ found that women who experienced both perineal pain and sexual difficulties had significantly increased odds of developing PPD. The odds ratio (OR) for developing PPD in women who reported perineal pain was 1.42 (95% confidence interval [CI], 1.0–2.1), and for women who reported sexual difficulties it was 2.16 (95% CI, 1.6–3.0).⁴ In a US population-based study using the National Hospital Discharge

Survey for 1979 to 2004, 3.5% of all women who had a spontaneous vaginal birth had severe perineal lacerations; this rate has not decreased overall since 1979.⁵ From the same study, the US rate of episiotomy with vaginal births decreased from 60.9% in 1979 to 24.5% in 2004.⁵ However, perineal pain and its consequences still affect large numbers of women. The aim of this study is to examine the relationships between the prevalence and severity of perineal injuries and type of birth attendant in spontaneous vaginal births of nulliparous women in a community hospital setting in the United States. Both spontaneous lacerations and episiotomies were investigated.

LITERATURE REVIEW

There is evidence that obstetrician-attended births have a higher prevalence of perineal injuries than midwife-attended births. In a 2004 retrospective study, Bodner-Adler et al.⁶ reported a significantly lower rate of both episiotomies and perineal lacerations of all degrees in women with low-risk pregnancies attended by midwives, compared with those attended by physicians ($P < .001$).⁶ In 2008, Hatem et al.⁷ conducted a Cochrane review of 11 randomized trials in which 12,276 women with low- to mixed-risk for obstetric complications were randomly assigned to midwife-led or other models of care. They found that midwives and obstetricians had markedly different birth practices; women assigned to the midwife model of care had a lower risk of having an episiotomy compared with women in the other models of care (relative risk

Address correspondence to Maureen Browne, RM (UK), RN, MPH, Department of Genetics, Kaiser Permanente Northern California, 280 West MacArthur Blvd., Oakland, CA 94611. E-mail: maureenbb@gmail.com

[RR] = 0.82; 95% CI, 0.77–0.88).⁷ They also found that women assigned to the midwife model of care had a lower prevalence of spontaneous perineal injury than women assigned to other models of care, although this finding was not significant (RR = 0.99; 95% CI, 0.94–1.03).⁷

Several studies have found that compared with multiparous women, nulliparous women have a higher risk for sustaining spontaneous and iatrogenic perineal lacerations at birth.^{8–12} In addition, women who have a perineal laceration or an episiotomy at their first birth are at higher risk for having a perineal laceration at subsequent births compared with women who did not experience a laceration or episiotomy during the first birth.^{13,14} In a review and logistic regression analysis of the birth outcomes of 6052 women, Alperin et al.¹³ reported that episiotomy performed at a woman's first birth significantly increased the risk of second-degree perineal lacerations (OR = 4.47; 95% CI, 3.78–5.30) and major perineal lacerations (OR = 5.25; 95% CI, 2.96–9.32) at the next birth. These findings were replicated in a retrospective analysis by Martin et al.¹⁴ (N = 1895) wherein women with perineal injuries at their first birth had more than three times the odds of sustaining spontaneous perineal lacerations at the second birth (OR = 3.3; 95% CI, 2.6–4.2) when compared with women who did not have a perineal laceration at their first birth.¹⁴

Other factors besides attendant type and parity are associated with perineal injury. While there is strong evidence that macrosomia (birth weight > 4000 g) is significantly associated with perineal injury,^{8–12,16–18} evidence for other factors, such as maternal age,^{11,15,18} epidural anesthesia,^{8,10,12,19,20} oxytocin administration,^{9–10,12} medical insurance status,^{18,21} and ethnicity is mixed.^{8,22,23}

Given the variability and confounding factors that affect risk for perineal injury, we sought to examine the prevalence and severity of perineal injury, both spontaneous and from episiotomy, in births attended by CNMs compared with those attended by obstetricians, while adjusting for six potential confounding factors. There were four

main research questions: 1) Is there a relationship between type of birth attendant and spontaneous perineal injury for minor lacerations (first and second degree) versus no injury (intact perineum)? 2) Is there a relationship between type of birth attendant and spontaneous perineal injury for major lacerations (third and fourth degree) versus no injury (intact perineum)? 3) Is there a relationship between type of birth attendant and episiotomy use versus none (that includes all episiotomies with or without extension to a third- or fourth-degree laceration)? 4) Is there a relationship between type of birth attendant and any type of perineal injury versus intact perineum?

METHODS

We conducted a retrospective cohort analysis of the birth outcomes of 2819 nulliparous women from the perinatal database PONDERS (Site of Care Systems, CA) of Marin General Hospital, in northern California. The PONDERS database contains perinatal information for births at selected health care facilities in California. The Institutional Review Board at Marin General Hospital and the Committee for the Protection of Human Subjects at the University of California, Berkeley granted ethical approval for the study.

The birth attendant recorded perineal outcomes in the medical record. Experienced data entry clerks entered information from the medical record into PONDERS. The data entry clerk's responsibilities included checking PONDERS' entries for completeness and consistency. From PONDERS, maternal discharge summaries were generated for birth attendant signatures and birth registration data.

The final study population consisted of 2819 nulliparous women who had a spontaneous vaginal birth of a live infant in cephalic presentation with a gestational age of at least 37 completed weeks between January 1, 2000 and December 31, 2005. Only women who were attended by an obstetrician or by a CNM were included in the study. A diagram of the selection process, with exclusions, is presented in [Figure 1](#).

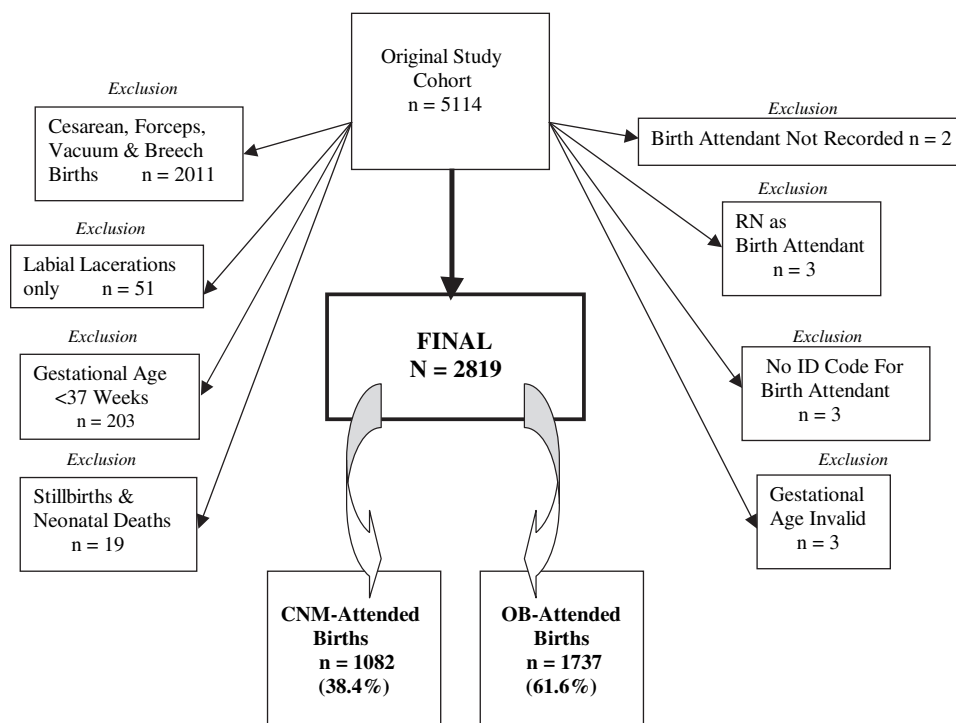
The main exposure was attendant type: obstetrician or CNM. The main outcome variables included intact perineum, episiotomy, and spontaneous perineal lacerations. Spontaneous lacerations were classified by degree of severity, depending on tissue layers involved, using standard criteria of first-, second-, third-, or fourth-degree laceration.²² The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes first- and second-degree vaginal lacerations and episiotomies as conditions managed adequately without a considerable effect on the woman's health; they are not classified by ICD-9-CM as instances of maternal morbidity.²⁴ However, third- and fourth-degree spontaneous perineal lacerations are considered maternal morbidities by ICD-9-CM.²⁴ Based on ICD-9-CM, we dichotomized spontaneous lacerations into minor (first and second degree) and major (third and fourth degree).

Maureen Browne, RM (UK), RN, MPH, conducted this research as part of a master's in Public Health in Maternal and Child Health at the University of California, Berkeley, Berkeley, CA. Currently employed as Lead Coordinator for the CA State Newborn Screening Program at Kaiser Permanente Northern California, she is also a Registered Midwife in the United Kingdom and Australia.

Mark Jacobs, MD, FACOG, is the Medical Director of Women's Health Services, Marin County Department of Health and Social Services, as well as Perinatologist at Marin General Hospital, Greenbrae, CA. He is a Clinical Professor in the Department of Obstetrics, Gynecology and Reproductive Sciences, at the University of California, San Francisco, San Francisco, CA.

Maureen Lahiff, PhD, is Lecturer in Biostatistics in the School of Public Health, University of California, Berkeley, Berkeley, CA.

Suellen Miller, CNM, RN, MHA, PhD, is Associate Professor, Department of Obstetrics, Gynecology and Reproductive Sciences at the University of California, San Francisco, where she is also the Director of Safe Motherhood Programs. She is Associate Professor in the Maternal and Child Health Program, School of Public Health, at the University of California, Berkeley, Berkeley, CA.



CNM = Certified Nurse-Midwife, OB = Obstetrician

Figure 1. Diagram of original study cohort with exclusions.

Spontaneous perineal injury was classified as injury exclusive of episiotomy. Women whose medical records indicated they sustained both a second-degree perineal laceration and an episiotomy were classified as having had an episiotomy. Extension of an episiotomy refers to episiotomy wherein a third- or fourth-degree laceration was also sustained.

In addition to the four primary questions, three additional analyses were carried out:

1) the relationship between type of birth attendant and episiotomy versus second-degree laceration, 2) the relationship between type of birth attendant and episiotomy with extension to third- or fourth-degree laceration versus no injury, and 3) the relationship between type of birth attendant and episiotomy without an extension to a third- or fourth-degree laceration versus no injury.

Because 1) maternal age, 2) epidural anesthesia, 3) oxytocin administration, 4) medical insurance status, 5) ethnicity, and 6) macrosomia are potential independent risk factors for perineal laceration and/or episiotomy, we adjusted for these six potential confounders in our analyses. We refer to these factors as “the six potential confounders.” All statistical analyses were carried out in STATA (version 9; STATA Corp., College Station, TX). The outcome variables for each of the research questions were dichotomous; therefore, multivariate logistic regression models were used to estimate ORs to compare obstetricians with CNMs, adjusting for the six potential confounders.

RESULTS

The sociodemographic and clinical characteristics of women attended by CNMs and obstetricians are presented in [Table 1](#). There are statistically significant differences in the characteristics of women between attendant types. Women attended by CNMs were younger, more likely to have public health insurance, be Hispanic, and less frequently receive oxytocin or epidural anesthesia compared with women attended by obstetricians. Therefore, all multivariate logistic regression models included these variables as covariates, so that the ORs comparing attendant types are adjusted for these variables.

The prevalence and severity of perineal injury, both from spontaneous lacerations and episiotomy use, were significantly higher in obstetrician-attended births. With regard to spontaneous perineal lacerations, women attended by obstetricians had 1.82 times greater odds of having a spontaneous minor laceration versus no injury compared with women attended by CNMs (95% CI, 1.33–2.48; [Table 2](#)). Women attended by obstetricians had 2.29 times greater odds of a spontaneous major laceration versus no injury, compared with women attended by CNMs (95% CI, 1.13–4.66; [Table 3](#)).

For episiotomy, women attended by obstetricians had 2.94 greater odds of having an episiotomy with or without extension versus no injury, compared with women attended by CNMs (95% CI, 2.01–4.29). Women attended by obstetricians had 2.87 times greater odds of having

Table 1. Demographic and Clinical Characteristics in Relation to Birth Attendant Type (N = 2819)

Demographic and Clinical Characteristics	CNM n=1082	Obstetrician n=1737	P ^a
Birth attendant, n (%)	1082 (38.4)	1737 (61.6)	
Maternal age, mean (SD), y	24.4 (5.7)	31.5 (5.4)	≤.001
Maternal age, n (%)			
16–20	312 (28.8)	69 (3.9)	
21–25	405 (37.4)	169 (9.7)	
26–30	195 (18.0)	447 (25.8)	
31–35	98 (9.1)	668 (38.5)	
≥36	72 (6.7)	383 (22.1)	
Birth weight, mean (SD), g	3360 (436.0)	3418 (447.6)	≤.05
Birth weight, n (%)			
<4000 g	1007 (93.1)	1581 (91.0)	
≥4000 g	75 (6.9)	156 (9.0)	
Race/ethnicity, n (%)			≤.001
White	250 (23.1)	1396 (80.4)	
Hispanic	734 (67.8)	114 (6.5)	
Asian	44 (4.1)	135 (7.8)	
African American	20 (1.9)	31 (1.8)	
Other	34 (3.1)	61 (3.5)	
Medical insurance, n (%)			≤.001
Private	323 (29.8)	1437 (82.7)	
Medicaid/Medi-Cal	759 (70.2)	300 (17.3)	
Epidural anesthesia, n (%)			≤.001
Epidural anesthesia	217 (20.1)	1165 (67.1)	
No epidural	865 (79.9)	570 (32.9)	
Oxytocin administration, n (%)			≤.001
Induced/augmented	437 (40.4)	1005 (57.9)	
None	645 (59.6)	731 (42.1)	

CNM = certified nurse-midwife; SD = standard deviation.

^aP values for age and birth weight are for t test; all other P values are for chi-square test of association.

an episiotomy versus a spontaneous second-degree laceration, compared with women attended by CNMs (95% CI, 1.86–4.43; the results are not shown).

Among all women with episiotomy, 12% had a third- or fourth-degree extension. For women who had episiotomies, the probability of experiencing a third- or fourth-degree extension was the same for both obstetricians and CNMs (OR = 0.82; 95% CI, 0.27–2.53); the results are not shown. Women attended by obstetricians had 4.92 greater odds of having an episiotomy without extension versus no injury, compared with women attended by CNMs (95% CI, 3.05–7.96; Table 4).

DISCUSSION AND CLINICAL IMPLICATIONS

After controlling for six known confounding variables from demographic characteristics and labor management, women whose births were attended by obstetricians had higher odds of sustaining spontaneous perineal lacerations and episiotomies compared with women whose births were attended by CNMs. Given that nulliparity has been shown to be significantly associated with perineal injury,^{8–12} we restricted our study to nulliparous women to present clearer analyses of the association between attendant types and

Table 2. Spontaneous Minor Perineal Lacerations Versus No Injury: Odds Ratios for Selected Covariates From Multivariate Logistic Regression (N = 2318)

Variable	Odds Ratio (95% Confidence Interval)
Attendant ^a	1.82 (1.33–2.48)
Race/ethnicity ^b	
Hispanic	1.44 (1.04–1.99)
Asian	1.45 (0.85–2.48)
African American	0.37 (0.19–0.71)
Other	1.18 (0.64–2.17)
Birth weight ^c ≥4000 g	1.21 (0.78–1.87)
Age, y ^d	
21–25	0.98 (0.72–1.35)
26–30	1.53 (1.06–2.21)
31–35	1.76 (1.18–2.63)
≥36	1.59 (1.02–2.45)
Private insurance ^e	1.37 (1.07–1.76)
Oxytocin administered	1.03 (0.82–1.30)
Epidural anesthesia	1.30 (1.00–1.69)

^aCertified nurse-midwife reference group for attendant type.

^bWhite reference group for race/ethnic group.

^cLess than 4000 g was the reference for birth weight.

^d16–20 years reference group for maternal age.

^eMedi-Cal (Medicaid) reference group for medical insurance.

perineal lacerations, because there was no need to adjust statistically for the outcomes of previous births.

To fully understand the association between attendant type and perineal outcomes, it is important to control for confounders. The women attended by CNMs and

Table 3. Spontaneous Major Perineal Lacerations Versus No Injury: Odds Ratios for Selected Covariates From Multivariate Logistic Regression (N = 2,358)

Variable	Odds Ratio (95% Confidence Interval)
Attendant ^a	2.29 (1.13–4.66)
Race/ethnicity ^b	
Hispanic	3.96 (1.98–7.93)
Asian	3.40 (1.65–7.01)
Other	2.55 (0.87–7.47)
Birth weight ^c ≥4000 g	3.50 (1.91–6.41)
Age, y ^d	
21–25	2.39 (0.87–6.57)
26–30	3.97 (1.43–11.01)
31–35	3.10 (1.03–9.31)
≥36	3.40 (1.09–10.59)
Private insurance ^e	1.13 (0.64–1.99)
Oxytocin administered	1.33 (0.83–2.12)
Epidural anesthesia	0.67 (0.40–1.12)

Note: No African American women had spontaneous major perineal lacerations; thus, African Americans cannot be included in this analysis.

^aCertified nurse-midwife reference group for attendant type.

^bWhite reference group for race/ethnic group.

^cLess than 4000 g was the reference for birth weight.

^d16–20 years reference group for maternal age.

^eMedi-Cal (Medicaid) reference group for medical insurance.

Table 4. Episiotomy Without Extension Versus No Perineal Injury: Odds Ratios for Selected Covariates From Multivariate Logistic Regression (N = 805)

Variable	Odds Ratio (95% Confidence Interval)
Attendant ^a	4.92 (3.05–7.96)
Race/ethnicity ^b	
Hispanic	1.44 (0.86–2.42)
Asian	1.85 (0.92–3.71)
African American	0.35 (0.13–0.99)
Other	1.09 (0.46–2.63)
Birth weight ^c ≥4000 g	1.97 (1.13–3.43)
Age, y ^d	
21–25	0.84 (0.49–1.45)
26–30	1.06 (0.59–1.92)
31–35	1.49 (0.81–2.72)
≥36	0.91 (0.47–1.76)
Private insurance ^e	1.15 (0.79–1.76)
Oxytocin administered	1.13 (0.80–1.58)
Epidural anesthesia	1.90 (1.33–2.72)

^aCertified nurse-midwife reference group for attendant type.

^bWhite reference group for race/ethnic group.

^cLess than 4000 g was the reference for birth weight.

^d16–20 years reference group for maternal age.

^eMedi-Cal (Medicaid) reference group for medical insurance.

obstetricians differed in insurance status and ethnicity groups. Because insurance status is significantly associated with both attendant type and perineal outcomes, it is a confounder; this was verified by using chi-square tests. Including insurance status in the multivariate logistic regression analyses allowed us to estimate the association between attendant type and perineal outcomes while adjusting for insurance status. In the same way, ethnicity was found to be a confounder and so was also adjusted for in the multivariate regression analyses. The significant chi-square tests of association between attendant type and perineal outcomes were $P < .001$ for minor perineal lacerations and episiotomy and $P < .05$ for major perineal lacerations.

As presented in the literature review, few studies have examined the association between attendant type and perineal outcomes for women who had spontaneous births. The retrospective study by Bodner-Adler et al.⁶ and the Cochrane review by Hatem et al.⁷ reported results similar to ours—compared with obstetrician-attended births, midwife-attended births had lower rates of spontaneous perineal injury and/or episiotomy use. However, our study population included nulliparous women only, while these two studies included both nulliparous and multiparous women.

Our study controlled for six potential confounders: maternal age, epidural anesthesia, oxytocin administration, medical insurance status, ethnicity, and macrosomia. Of these potential confounders, maternal age only was controlled for in the Bodner-Adler et al.⁶ study. Controlling for potential confounders varied considerably in the 11

randomized, controlled trials summarized in the Cochrane review.⁷ Some of the most recently conducted trials in this review controlled for one or two potential confounders such as maternal age, ethnicity, or health insurance; however, no single study controlled for all six potential confounders included in our study.

We classified perineal injury into spontaneous/minor and spontaneous/major perineal lacerations and episiotomy, focusing on perineal integrity. The Bodner-Adler et al.⁶ study classified perineal injury similar to ours with each degree of spontaneous laceration and episiotomy use. In the randomized trials of the Cochrane review,⁷ the definitions of types of perineal injury varied; in some older trials, perineal outcomes were described broadly as genital tract trauma, which included episiotomy and spontaneous major lacerations only in the analyses, but excluded minor lacerations.

Our research participants gave birth in a community hospital-based setting; Bodner-Adler et al.'s⁶ study was conducted at a teaching hospital,⁶ and the Cochrane review was conducted from a range of maternity care settings.⁷ The findings of our study from a community practice environment provide a balance for much of the research previously published, which is often from tertiary medical center settings. Second, we adjusted for several variables that are known to be associated with perineal injury. The strengths of this study are its large sample of women and data retrieval from one health care facility over a 6-year period. A limitation of the study was the absence of information on the birth attendant's years of practice, because there is evidence that less perineal injury is associated with more experienced attendants, regardless of profession.²⁵ Information about specific birth management practices thought to be related to perineal injury are not recorded in PONDERS.

Differences in birth practices vary between CNMs and obstetricians, and these differences may partially explain our findings. Examples of practices of the midwifery model of care associated with fewer adverse perineal outcomes include encouraging the mother to be in nonsupine positions for the second stage of labor and birth^{19,26,27} and promoting noncoached pushing.²⁷ These practices are not part of the traditional obstetric model of care.²⁶ However, when comparing CNMs and obstetricians, our study does not allow us to determine which specific aspects of the midwifery model are significant in helping reduce the incidence of perineal injury.

The increased risk of perineal injury in obstetrician-attended births shown in this study presents an important opportunity to improve obstetric practice. For example, to improve birth outcomes complicated by shoulder dystocia, obstetricians have employed a combined approach using best practice guidelines, didactic instruction, and practice with realistic simulators.^{28,29} It may be time to widely disseminate a similar educational approach to reducing perineal injury at spontaneous birth.

There are known significant associations between perineal injury and several postpartum morbidities, including perineal pain,^{1,2} sexual dysfunction,³ and subsequent postpartum depression.⁴ These conditions have serious health implications in that they adversely affect maternal recovery and are associated with postpartum depression, which in turn is significantly associated with negative maternal–infant interactions³⁰ and delayed infant cognitive, behavioral, and emotional development during the first year after birth.^{31–34} It is therefore paramount that all birth attendants learn and perform evidence-based clinical practices to decrease perineal injury.

CONCLUSIONS

This study has two major implications. Informing women about the variation in perineal injury by attendant type and providing women with opportunities for dialogue with prospective birth attendants will together help women make informed choices. In turn, this could lead to more empowered and positive birth experiences for women. Our study also highlights the potential benefits to women if clinicians exchange knowledge and expertise about research-based practices. Ultimately, it is hoped that a collaborative exchange will influence birth attendants to adopt labor practices that decrease the prevalence and especially the severity of perineal injury during childbirth and its related comorbidities for women and their families.

We would like to acknowledge Carrine Meyer, MPH, MA, for her generous input with regard to manuscript revisions and Frank Blanco, PONDERS data entry clerk at the study institution, for his invaluable assistance with data retrieval.

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