

Pregnancy Outcomes of Women With Physical Disabilities: A Matched Cohort Study

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Objective: To document pregnancy outcomes of women with moderate-to-severe physical disabilities and to evaluate maternal and fetal outcomes compared with those of nondisabled 1:1 matched controls within the same hospital system.

Design: A retrospective matched cohort.

Setting: A multidisciplinary outpatient reproductive health care clinic for women with physical disabilities, situated in an urban rehabilitation hospital and affiliated with a large tertiary medical care center.

Population: Women with physical disabilities.

Methods: A chart review of 755 women with physical disabilities who were seen at a multidisciplinary specialty reproductive health care clinic, in which 48 total pregnancies of 34 women with physical disabilities were found. Thirty-four of these pregnancies were carried to delivery in 25 of these women with physical disabilities.

Main Outcome Measures: Obstetric and disability-related pregnancy and delivery complications.

Results: Twenty-nine of the 34 pregnancies (85%) occurred in women with moderate-to-severe neurologic disabilities who were wheelchair users, with 33 resultant infants (1 twin pregnancy), and 2 instances of intrauterine fetal demise. Forty percent of the women delivered prematurely, although only 3 of 34 delivered before 32 weeks (9%). Thirty-four percent of the infants (12) were of low birthweight, all of whom were preterm. Although there was a higher rate of pregnancy-related complications ($P = .003$) in the disabled cohort, there were no maternal deaths, and few of the complications were severe or life threatening. Rates of urinary tract infections and other maternal infections were significantly higher in the disabled cohort and were correlated with both increased preterm delivery and lower birthweight infants ($P = .009$ and 0.023 , respectively). Thirty-eight percent of the infants were delivered by cesarean section. The disabled cohort had lower rates of augmentation of labor ($P = .03$) and breastfeeding ($P = .02$) compared with nondisabled controls. Although bladder and functional status changes were noted during the pregnancies of women with physical disabilities, these women reverted to their prepregnancy functional status by 6 weeks postpartum.

Conclusion: Our study describes a cohort of women who had moderate-to-severe physical disabilities who historically have been discouraged from pregnancy. Women with physical disabilities experienced higher rates of preterm deliveries, low birthweight infants, and pregnancy complications. The pregnancy complications in most cases were not severe and were readily managed. Although it was common to experience functional changes during pregnancy, these changes had largely resolved by 6 weeks postpartum. Larger observational studies are needed to better understand the etiology and prevention of preterm labor and low-birthweight infants in this population, and, in particular, the role of maternal infections.

PM R 2013;5:90-98

INTRODUCTION

Due to advances in medical technology, women with moderate-to-severe physical disabilities are surviving in increasing numbers to adulthood, and many of these women desire to become wives and mothers. The global estimate of disability prevalence in adults is between 16% and 19%, with a lower prevalence in younger age groups (9% in 18-49 year olds) [1].

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Disclosure: nothing to disclose

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Disclosure: nothing to disclose

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Disclosure: nothing to disclose

Peer reviewers and all others who control content have no relevant financial relationships to disclose.

Submitted for publication June 20, 2011; accepted October 18, 2012.

Historically, many of these women have been discouraged by their health care practitioners and family members from pursuing biologic motherhood based upon the beliefs that (1) pregnancy could pose a threat to life, (2) pregnancy could worsen the disability and result in further loss of function, and/or (3) disability status is incompatible with motherhood [2]. Unfortunately, little information exists about the pregnancy experiences and outcomes of women with moderate-to-severe physical disabilities to guide both patients and practitioners in making informed decisions about pregnancy. Those studies that report outcomes describe an increased incidence of infant low birthweight and preterm birth, although these studies are limited by small numbers and are usually specific to 1 diagnostic group only [3-13]. None of these previous studies report detailed infant outcomes or aggregate data of pregnancy outcomes of women with physical disabilities, including various physical disability diagnoses (both congenital and acquired). The objective of this study was to document pregnancy outcomes of women with moderate-to-severe physical disabilities who were seen by an integrated-care team and to evaluate their outcomes compared with those in a cohort group of women without disabilities and within the same hospital system, as well as historical controls for women with specific physical disabilities, and the general U.S. population.

METHODS

Cases were obtained from the review of 755 charts of women with physical disabilities seen at a unique women's clinic within a free-standing urban rehabilitation hospital in the United States from January 1, 1992, through December 31, 2006. The study was approved by the Northwestern University Institutional Review Board. This women's clinic was started in 1992 in response to a dearth of accessible reproductive health care services for women with extensive physical disabilities. The integrated care team included physicians from obstetrics and gynecology, physical medicine and rehabilitation, anesthesiology, urology; specialists in rehabilitation engineering and wheelchair seating and positioning; and physical and occupational therapists. Women whose physical disabilities involved impairments of muscle tone, strength, or coordination, and who consequently experienced substantial limitations in 1 or more basic physical activities (ie, walking, climbing stairs, reaching, lifting, carrying) were included in the study [1]. Congenital and acquired disability diagnoses were included. Pregnancies were confirmed by urine and/or serum human chorionic gonadotropin or by ultrasound. Births to mothers whose disease onset occurred after delivery were excluded. Available inpatient, outpatient, and allied health charts were reviewed from the rehabilitation hospital and corresponding labor/delivery charts at an affiliated women's hospital for each woman, and the inpatient medical record of each newborn were reviewed.

Information collected included demographic data, medical and surgical history, medication and contraceptive use, obstetric history, and prenatal care, as well as obstetric and physiologic complications within the prenatal, postpartum, and perinatal periods. A 1-to-1 matched control group was generated from Northwestern Prentice Women's Hospital medical records database through the use of hospital discharge codes and patient demographics. The same information was collected for women without disabilities matched for race and/or ethnicity, singleton or twin birth, maternal age, and month and year of delivery (limited to within 1 month from the delivery date of the woman with a disability; the appropriate match closest to the date of birth, with adequate obstetric and delivery information available, was chosen). Charts were reviewed from pregnancy diagnosis to final outcome, which was defined as pregnancy termination, 6 weeks postpartum, or infant hospital discharge.

To describe pregnancy and delivery complications, reported complications were considered to be in 1 of 2 categories: serious and/or life threatening, or nonserious and/or non-life threatening. If a serious or life-threatening pregnancy or delivery complication occurred, then this patient was also included in the statistical analysis as a pregnancy or delivery with significant complications. Serious, life-threatening pregnancy complications included the following: autonomic dysreflexia during pregnancy; urosepsis; sepsis due to endometritis, pyelonephritis, intrauterine infection; placental abruption; uterine hemorrhage; preeclampsia; kidney stones with ureteral stent placement during pregnancy; thromboembolic disease; and initiation of maternal ventilatory assistance. Serious, life-threatening delivery complications included the following: autonomic dysreflexia during delivery or postpartum, placental abruption, uterine hemorrhage, preeclampsia, failed forceps delivery, and complicated cesarean delivery (see definitions, Table 1).

Non-life-threatening complications included the following: repeated urinary tract infections (UTI), dependent edema, back pain, spasticity, gastroenteritis, upper respiratory infections, preterm labor, treated postpartum endometritis, treated chorioamnionitis, vaginal tear, third- or fourth-degree perineal laceration or episiotomy, change in bladder or bowel management, change in mobility status (eg, a person who typically would walk with braces would transition to manual wheelchair), assisted vaginal delivery, or uncomplicated cesarean delivery (Table 1). Of note, 44 of 54 UTIs (greater than 81%) were verified by culture; those that were not verified were from older paper charts with missing microbial reports. Two documented UTIs had between 50,000 and 100,000 colonies of growth, with treatment based on symptoms. Confirmation by culture of other infections, such as upper respiratory, ear, or fungal, was the exception rather than the rule.

Descriptive statistics were provided for all the measures under study, including median and range for continuous data, and frequency tables for categorical data. Bivariate

Table 1. Definitions

Assisted vaginal delivery	Vaginal delivery with vacuum or forceps assist.*
Autonomic dysreflexia	Blood pressure elevation in patients with T6 and higher spinal cord injury; higher than 30 mm Hg systolic or 15 mm Hg diastolic above baseline, accompanied by symptoms such as headache or diaphoresis in response to noxious stimuli.†
Augmentation of labor	Use of active rupture of membranes or oxytocin administration to stimulate spontaneous labor.*
Induction of labor	Use of oxytocin and/or prostaglandins before delivery of infant to induce labor contractions.*
Intrauterine fetal demise	Intrauterine death of the fetus with documentation of absent intrauterine fetal heart tones.*
Intrauterine growth retardation	Infants with birthweight and birth length below the 10th percentile for gestational age.‡
Lie	Intrauterine longitudinal axis being transverse, longitudinal, or oblique.*
Low birthweight	Birthweight of less than 2500 g.*
Malpresentation	Refers to any presentation that was not cephalic with the occiput leading.*
Maternal infections during pregnancy	A physician-documented symptomatic yeast, bacterial, or viral infection, and/or the occurrence of more than 2 urinary tract infections during pregnancy.
Prelabor rupture of membranes	Rupture of membranes after 37 weeks' gestation but before spontaneous labor.*
Presentation	Fetal part directly overlying the pelvic inlet, being cephalic (vertex), breech, or shoulder.*
Preterm delivery	Birth before 37 weeks' gestation.*
Preterm labor	Documented persistent contractions accompanied by dilatation or effacement of the cervix before 37 weeks' gestation.*
Pyelonephritis	Presence of fever and pyuria, with confirmed urine culture.*
SGA or LGA	Birthweight less than the 10th centile (SGA) or greater than the 90th centile (LGA).‡
Urinary tract infection	Symptomatic bacteruria with more than 50,000 colonies/mL; symptoms included but were not limited to malaise, increase in spasticity, leakage of urine between catheterization or leakage around indwelling catheter, subject-reported urine cloudiness and/or abnormal smell, and/or symptoms of discomfort in women with incomplete spinal cord injury lesions or intact sensation; clinic protocol was for urine testing to be completed when symptomatic, or at least monthly if asymptomatic.

SGA = small for gestational age; LGA = large for gestational age.

*From Ref. 25.

†From Ref. 26.

‡From Ref. 27.

analysis was conducted to compare characteristics of the women with physical disabilities and the nondisabled controls. Odds ratios with 95% confidence intervals (CIs) were reported by using the Fisher exact probability and Mann-Whitney *U* tests with corresponding 95% CIs. Associations between disability (and related clinical variables) and both gestational age and birthweight were examined by using linear regression, with regression coefficients and corresponding 95% CIs presented. Associations between disability (and related clinical variables) and binary outcomes were examined by using logistic regression, with results expressed as the Wald χ^2 and 95% CIs. Statistical significance within regression models was assessed by using F tests for linear regression and likelihood ratio tests for logistic regression. Reported *P* values were 2 sided, and a *P* value of .05 was used to determine statistical significance. Data were analyzed by using SPSS 17.0 (SPSS Inc, Chicago, IL) and Stata 11.0 (StataCorp, College Station, TX).

RESULTS

Thirty-four women were identified, with a total of 48 pregnancies, which resulted in 33 live infants, 2 intrauterine fetal demise (IUFD), 11 therapeutic abortions, and 3 spontaneous

abortions. One IUFD occurred at 38 4/7 weeks' gestation in a woman with T4 paraplegia who had pyelonephritis and developed urosepsis; the other occurred at 23 6/7 weeks' gestation in a woman with T9 American Spinal Injury Association A woman with complete spinal cord injury (SCI) who had a history of premature deliveries and also had a positive drug screen for cocaine and amphetamines at the time of delivery. Twenty-five women carried 34 pregnancies (1 twin gestation) to at least 23 6/7 weeks' gestation (Table 2). Fourteen of 35 infants (40%) were delivered preterm, the majority of whom (11) were between 32 and 37 weeks' gestation. Three were delivered before 32 weeks. Twelve of 35 infants (34%) were of low birthweight (9 were between 2000 and 2500 g, and 3 were less than 2000 g). All low birthweight infants were born preterm. Six of 35 infants (17%) were small for gestational age, 3 were intrauterine growth restricted, and 3 were large for gestational age. All previously reported bladder management or functional status changes had resolved by 6 weeks postpartum (100%) (additional results are reported in Tables 3 and 4). Nine of the 25 women who continued their pregnancies beyond 23 weeks (36%) were documented to have undergone postpartum tubal ligation during the course of this study.

Table 2. Clinical characteristics of the women with physical disabilities cohort

Total no. pregnancies	48
Total no. terminations	14
Spontaneous	3
Therapeutic	11
Diagnosis of pregnant women, no.	
SCI (T6 and above)	19
SCI (below T6)	7
Cerebral palsy	13
Stroke	3
Brain injury	1
Spinal muscle atrophy (type 1)	2
Marfan syndrome	1
Multiple sclerosis	1
Total no. deliveries	34
Diagnoses of mothers who delivered, no.	
SCI (T6 and above)	17
SCI (below T6)	5
Cerebral palsy	8
Stroke	1
Brain injury	1
Spinal muscle atrophy (type 1)	2
Disability onset before pregnancy, y	
Congenital	13
Acquired	21
Mean duration of disability (acquired only)	7
Planned pregnancies, no.	
Yes	16
No	18
Fertility treatment, no.	
Yes	3
No	31
Mobility, no.	
Ambulatory	5
Nonambulatory	29
Bladder management before pregnancy (baseline), no.	
IC	19
IDC	3
Spontaneous continent (no IC or IDC)	9
Incontinent (use of adult sanitary napkins)	3
Bladder management change during course of pregnancy, no.	
No. known	34
From IC to IDC	2
Reported increased frequency of IC or leakage	11
No	21
Bladder management return to baseline postpartum, no.	
No. known	34
Yes	34
No	0
Alternative anesthesia administration or delivery due to scoliosis, contractures, spinal fusion, or other severe musculoskeletal aberrancies, no.	
No. known	34
Yes	6
No	28

Table 2. Continued

Autonomic dysreflexia (only SCI T6 and above), no.	
No. known	17
Yes	10
No	7
Increased spasticity, no.	
No. known	32
Yes	8
No	24
Functional status decline, requiring increased physical assistance, no.	
No. known	20
Yes	8
No	12
Respiratory compromise that requires oxygen supplementation or ventilator support, no.	
No. known	34
Yes	3
No	31
Muscle fatigue impairing swallow function, no.	
No. known	34
Yes	1 woman, 2 pregnancies
No	32
Hospitalization for pain management, no.	
No. known	34
Yes	1 woman, 2 pregnancies
No	32
Wheelchair seating and positioning adjustments, no.	
No. known	20
Yes	3
No	17
Functional status changes return to baseline postpartum, no.	
No. known	20
Yes	20
No	0

SCI = spinal cord injury; IC = intermittent catheterization; IDC = indwelling catheter.

Our results showed statistically significant higher rates of maternal infections during pregnancy ($P = .003$), and specifically of multiple UTIs ($P < .0001$), pregnancy complications ($P = .003$), and low birthweight infants ($P = .04$). The disabled cohort had lower rates of augmentation of labor ($P = .03$) and breastfeeding ($P = .02$) than the nondisabled controls. Notably, we found a statistically significant correlation between the presence of maternal infection during pregnancy with both preterm delivery (95% CI, -5.192 to -0.748 ; $P = .009$; OR = 6.83) and low birthweight (95% CI, -4.780 to -0.350 ; $P = .023$; OR = 5.923) for women with a disability. We found a positive trend toward a correlation between the presence of maternal infection during pregnancy and preterm labor when taking into account both case patients and controls, although it did not achieve statis-

Table 3. Characteristics of pregnancies in women with physical disabilities versus nondisabled controls in a midwestern urban health center, 1992-2006

Characteristic	Women with Physical Disabilities	Comparison Group	P Value
No. carried pregnancies	34	34	
Median (range) maternal age, y	27 (21-40)	28 (20-41)	
Maternal age, no.			
<25 y	13	13	
25-29 y	9	9	
30-34 y	6	6	
35-40 y	5	5	
>40 y	1	1	
Race and/or ethnicity, no.			
Black	13	15	.31
Black Hispanic	3	1	.61
Black Asian	0	1	
Hispanic	10	5	.24
Asian	2	2	
White	6	10	.39
Maternal prepregnancy weight			
No. patients known	13	NA	
Median (range), kg	66 (31-84)	NA	
Maternal weight gain during pregnancy			
No. patients known	11	15	
Median (range), kg	9 (2-24)	14 (5-23)	.05
Time period of delivery, no.			
1992-1996	4	4	
1997-2001	13	13	
2002-2006	17	17	
Sex of infant (35 total infants), no.			
Male	15	17	.81
Female	20	18	
Maternal smoking during pregnancy, no.			
Yes	4	3	
No	31	30	
Maternal alcohol use during pregnancy, no.			
Yes	1	2	
No	33	32	
Maternal drug use during pregnancy, no.			
Yes	1	2	
No	33	32	
Group B streptococcus positive, no.			
Known	34	31	
Yes	6	5	
No	28	26	
Reported domestic, sexual, or physical abuse during pregnancy, no.			
Yes	5	2	.43
No	29	32	
Mother's gravidity, no.			
Primigravida	7	9	.78
Multigravida	27	25	
Mother's parity, no.			
Nulliparous	13	16	.61
Multiparous	21	18	
Previous stillbirth, no.			
Known	34	29	
Yes	0	0	
No	34	29	
Previous preterm birth, no.			
Known	34	29	
Yes	4	3	
No	30	26	

Table 3. *Continued*

Characteristic	Women with Physical Disabilities	Comparison Group	P Value
Initiation of prenatal care			
No. known	24	30	
Median (range), mo	2 (1-3)	3 (1-8)	.01
Prenatal care visits			
No. known	30	30	
Median (range) visits	10 (6-16)	10 (1-15)	.36

NA = not available.

tical significance ($P = .154$). Bladder management with intermittent catheterization or an indwelling catheter was correlated with the occurrence of 2 or more UTIs during pregnancy (95% CI, -5.395 to -0.925 ; $P = .006$; OR = 7.65). Method of bladder management and/or ambulation status (ambulatory versus wheelchair mobile) was not found to have a statistically significant correlation with adverse outcomes (ie, preterm delivery, low birthweight, perinatal complications, pregnancy complications, or delivery complications) in this sample of women.

We also compared complications and outcomes between the 2 specific disability groups with the largest number of pregnancies: SCI and cerebral palsy. Outside of the 60% of women with SCI T6 and above who experience autonomic dysreflexia, no other statistically significant differences were noted between the overall number or type of pregnancy complications, delivery complications, or outcomes among women with these specific disability diagnoses.

DISCUSSION

Women with disabilities are not routinely expected, encouraged, or counseled about fertility and possible pregnancy outcomes. Too often, women with disabilities are recipients of messages that actively discourage healthy and responsible sexuality and reproduction [2]. Given the general importance of childbearing, parenting, and family life to the majority of women, women with disabilities too often are marginalized by misinformation, bias, and assumptions without supporting medical evidence. It is undoubtedly true that many women with disabilities have a "thinner margin of health" [14] and are at risk for medical complications due to the disability, as was seen in our cohort. However, in the interest of informed decision making, it is critical that women with disabilities and their physicians have access insofar as possible to the highest quality data about health risks, pregnancy experiences, and outcomes. This information is particularly helpful for preconceptional counseling when a woman and her partner are making an informed decision about biologic pregnancy. It can also help guide the care and anticipation of potential complications in these complex pregnancies.

Unfortunately, few such data exist. Although efforts are underway to prospectively collect such information through mul-

ticenter or national databases, these studies have not yet commenced. In the meantime, it is helpful to report the experiences and outcomes of programs that have had experience working with pregnant women with moderate-to-severe physical disabilities [15]. This study contributes to the limited data and, indeed, reinforces that these women are at heightened risk for preterm delivery and low birthweight infants compared with women without disabilities. The women with disabilities had a higher rate of maternal infections (often due to urinary sources), which significantly correlated with both lower birthweight infants and preterm delivery in this study. Of note, two-thirds of the women with disabilities had neurogenic bladders and used intermittent catheterization or indwelling catheters. Approximately three-fourths of the women with disabilities in the cohort who used intermittent catheterization or an indwelling catheter were maintained on a prophylactic antibiotic regimen, and, despite this, the majority experienced multiple breakthrough infections. We question whether there may be a more effective prophylactic antibiotic regimen to reduce UTIs in this population, as suggested by a recent small study that used alternation of prophylactic antibiotics [16]. No prophylaxis was noted for other types of infections beyond UTIs. Further work is clearly needed both to understand the relationship between the infections and complications, and to develop the best practices for treating infections.

Although there were no maternal deaths in our cohort of women with disabilities, there were 2 IUFDs, both of which occurred in women with active infections; 1 woman also had cocaine and amphetamine exposure, and with a history of preterm labor. These cases were complicated by poor patient compliance with treatment regimens and engagement with adverse health behaviors. The higher rate of pregnancy complications in the disabled cohort was likely associated with these women having both disability- and obstetric-related complications that occurred during their pregnancies versus controls not having these additional disability-related complications. One of the most complicated pregnancies was the first of 2 pregnancies of our subject with spinal muscular atrophy type I; further details of this pregnancy have been previously reported [17].

Despite the 2 IUFDs and other noted pregnancy-related complications, the majority of the antenatal medical and obstetric issues in the cohort were manageable (ie, problems that can be identified

and treated with appropriate prenatal and peripartum care as defined by current standards) and pregnancy outcomes overall favorable. It is heartening to observe that only 3 of 34 pregnancies (9%) delivered before 32 weeks' gestation. Ninety-one percent of pregnancies delivered at term or near term, and the rate of delivery complications and cesarean delivery did not appear to differ between case patients and controls.

Matched Cohort Comparisons

The incidence of cesarean section was not significantly higher in the disabled cohort, and approximately two-thirds of the women were able to deliver vaginally (both assisted and unassisted). A lower percentage required regional anesthesia than the nondisabled cohort. Most notably, all the women at risk for autonomic dysreflexia (eg, women with SCI T6 and higher) received epidural or other forms of regional anesthesia in accordance with the American College of Obstetrics and Gynecology's recommendations in 2002 [18].

It is important to note that a predominant percentage of women within our study was of minority race or ethnic descent. Ethnic and/or racial variations exist in neonatal mortality rates and within birthweight and gestational age categories. Black women have been reported to have higher proportions of preterm births, low birthweight infants, and very low birthweight infants compared with either non-Hispanic white or Hispanic women [19]. The rates of preterm birth and low birthweight in this study were more than 3 times as high as the highest rates reported for racial and/or ethnic minorities between 1992 and 2006 for the general U.S. population [19]. Within this small study, the rates of prematurity and low birthweight were near evenly distributed between black and white women, with a lower predominance of low birthweight among Hispanic women. We were unable to draw firm conclusions as to the contribution of race and/or ethnicity versus disability to the rates of low birthweight infants and preterm delivery in this small sample.

Historical Comparisons

In comparison with previously reported hospital or population-based retrospective studies of pregnancy outcomes in women with specific disability diagnoses [4-7,10,11], the current data are similar with respect to the rate of occurrence of recurrent UTIs during pregnancy, pyelonephritis, preterm labor, and autonomic dysreflexia during delivery or postpartum. However, our case group displays a higher rate of preterm deliveries, low birthweight infants, cesarean delivery, and regional anesthesia use during delivery compared with these previous studies. In addition, we report a lower rate of assisted vaginal delivery, prolonged labor, induction, and augmentation of delivery.

Specifically, several studies previously published about pregnancy experiences for women with SCI reported increased rates

of preterm delivery compared with the general U.S. population: a total of 6 studies charted data with a range of 8%-19% [4-7,10,11]. In 2004, Coppage et al [13] documented a 37.5% preterm delivery rate (6 of 16 live births) for women with residual physical deficits after stroke. U.S. rates of preterm births were reported as 10.9% in 1990 and 12.5% in 2004 per the U.S. National Center for Health Statistics [19], both comparatively lower than our preterm birth rate of 40% for our cohort of women with physical disabilities. In our study, 12 of 35 infant birthweights (34%) were less than 2500 g. The reported range of rates of low birthweight infants among 6 SCI studies was 4%-24% [4-7,10,11]. The U.S. National Center for Health Statistics reported rates of low birthweight infants in 1990 and 2004 that were 7% and 8.1%, respectively [19]. Thus, there seems to be agreement between our study and previous studies regarding higher rates of preterm and low birthweight infants among women with physical disabilities compared with those of the general U.S. population.

Analysis of results of previous studies have suggested that maternal weight gain may also influence infant outcomes [20]. Further research is required to determine appropriate maternal weight gain parameters for these women. An accurate body mass index calculation is necessary to determine parameters for appropriate maternal weight gain during pregnancy [21]. We believe that it may be incorrect to calculate body mass index in the same fashion for women who are wheelchair mobile as for nondisabled controls. Women in wheelchairs may have a lower overall muscle mass or bone density, and inexactly measured or calculated heights if significant scoliosis or kyphoscoliosis was present. The question of reduced maternal weight gain or suboptimal nutritional status during pregnancy may also be related to a higher incidence of low birthweight infants and/or preterm births for this population. This question also clearly warrants further study.

We also sought to collect data sparsely documented through prior studies, such as the incidence of increased spasticity, successful breastfeeding, and decreased functional mobility. Previous reports of these complications in the SCI literature include increased spasticity (12% as reported by Jackson and Wadley [11]) and decreased mobility (15.5% as reported by Jackson and Wadley [11], and 18% as reported by Baker, Cardenas, and Benedetti [6]), and higher breastfeeding rates (Robertson [2] reported that all mothers in this study successfully breastfed). The reasons for the lower rate of breastfeeding are unclear, although it is known that many women who are physically disabled resume some medications after delivery that could be problematic with breastfeeding (eg, antispasmodics). For women with higher levels of SCI, breastfeeding can also trigger autonomic dysreflexia [22]. Finally, it is also important to note that there was a suggestion of heightened physical and sexual abuse in the disabled cohort (although this finding did not reach statistical significance), which is consistent with the literature on abuse that involves women with disabilities [23,24]. Most studies of women with physical disabilities indi-

Table 4. *Pregnancy outcomes*

Outcome	Disabled Cases, no./total (%)	Nondisabled Controls, no./total (%)	P Value	Odds Ratio (95% Confidence Interval)
Multiple urinary tract infections	16/34 (47)	1/34 (3)	<.0001	29.3 (3.59-239.62)
Pregnancy complications	13/34 (38)	2/34 (6)	.003	9.9 (2.03-48.44)
Maternal infection(s) during pregnancy	20/34 (59)	7/34 (21)	.003	5.5 (1.88-16.16)
Low birthweight	12/35 (34)	4/35 (11)	.04	4 (1.15-14.16)
Breastfeeding [†]	17/32 (53)	27/35 (77)	.02	0.3 (0.08-0.78)
Augmentation of labor	11/34 (32)	21/34 (62)	.03	0.3 (0.11-0.80)
Regional anesthesia use	25/34 (74)	28/34 (82)	.6	0.6 (0.19-1.91)
Delivery complications	17/34 (50)	10/34 (29)	.1	2.4 (0.89-6.51)
Preterm delivery	14/35 (40)	8/35 (23)	.2	2.3 (0.80-6.36)
Cesarean delivery	13/35 (37)	9/35 (26)	.4	1.7 (0.61-4.81)
Preterm labor	7/34 (21)	5/34 (15)	.8	1.5 (0.43-5.31)
Malpresentation	7/35 (20)	5/35 (14)	.8	1.5 (0.43-5.28)
Pyelonephritis	5/34 (15)	1/34 (3)	.2	5.7 (0.63-51.57)
Induction of labor	5/34 (15)	8/34 (24)	.5	0.6 (0.16-1.93)
Postpartum endometritis	4/34 (12)	1/34 (3)	.4	4.4 (0.47-41.60)
Greater than first-degree perineal tear [‡]	4/34 (12)	8/34 (24)	.3	0.4 (0.12-1.61)
Chorioamnionitis	3/35 (9)	4/35 (12)		0.7 (0.15-3.52)
Uterine hemorrhage	3/34 (9)	3/34 (9)		
Prolonged labor	2/34	2/34		
Uterine atony	2/34	2/34		
Preeclampsia	1/34	1/34		
Urosepsis	1/34	0/34		
Retained placenta	1/34	0/34		
Nephrolithiasis	1/34	1/34		
Delivery requiring episiotomy	1/34	1/34		
Placental abruption	0/34	1/34		

[†]Two intrauterine fetal demise infants were not included in the calculation.

[‡]Second- or third-degree perineal tears; no fourth-degree tears were documented for case patients or controls.

cate that physical, sexual, and emotional abuse probably does occur at a higher rate, often involves a personal care assistant or intimate partner, and may go on for long periods of time. Any caregiver who works with a disabled woman during pregnancy needs to be vigilant and ask appropriate screening questions.

Study Limitations

There were a number of limitations to our study. As a retrospective study, we had to rely on the information available in the medical charts, which was not always complete. Although there are limited studies of women with severe disabilities, our series was still relatively small in number and had disparate diagnoses. We also had limitations in our ability to match controls, given our hospital's predominantly white demographic. Because of this issue, each pregnancy was matched as an independent pregnancy despite multiple pregnancies in 7 women with disabilities. We were also unable to match smoking, parity, or socioeconomic status. Our control group was not uniformly seen in a single outpatient prenatal care clinic, compared with our case group. We believe that our patient cohort represented the more severe end of the spectrum. A number of the women sought out the clinic for second opinions after being counseled to terminate their pregnancies, and it was also a known referral source for women with disabilities. It is also possible that our hospital may be considered a referral center for more com-

plex and challenging pregnancies or deliveries for women without physical disabilities. All data were collected within 1 hospital system. Medical caregivers may have been more likely to diagnose complications within our case group, given the additional attention that the mothers of these infants required during their pregnancies and/or deliveries due to their preexisting complex medical comorbidities.

CONCLUSION

Our results, despite a small sample size, showed that women with physical disabilities have a statistically significantly higher rate of pregnancy complications ($P = .003$), including infections during pregnancy ($P = .003$), 2 IUFDs, and low birthweight infants ($P = .04$) compared with nondisabled controls, with the presence of infection during pregnancy being correlated with both preterm delivery ($P = .009$) and low birthweight ($P = .023$) for women with disabilities. There were few severe or life-threatening complications experienced by the mothers, and no maternal deaths. Despite the increased incidence of complications, the majority of these women were successfully able to have children with the help of an integrated care team model. In support of patient autonomy, it is critical that women with disabilities and their physicians have access to the best available information when making decisions about childbearing to guide their decision

making. This study adds to the body of limited information. It will be important for prospective models to assess the effectiveness of an integrated model of care on pregnancy and neonatal outcomes for women with disabilities and for their infants. Larger multicenter observational studies are needed to further elucidate disability-related pregnancy and delivery complications, before future long-term prospective studies to investigate appropriate interventions or to define standards of care for these women and their infants.

ACKNOWLEDGMENTS

The authors thank Dr Mark Perlman, Vice Chair, and S. Jan Behrman, Professor, Department of Obstetrics and Gynecology, at University of Michigan Hospitals, for thorough and insightful review of this manuscript, and Mr Kenneth Guire, Department of Epidemiology and Biostatistics, School of Public Health, University of Michigan, for guidance in statistical methodology and interpretation of data.

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CME Question

In evaluating the outcomes of pregnancies, which of the following is significantly higher in women with physical disabilities (WWPD) compared to nondisabled women?

- a. preeclampsia
- b. induced labor
- c. cesarean delivery
- d. maternal infections

Answer online at me.aapmr.org