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Postpartum Hospital Utilization among Massachusetts Women with Intellectual and Developmental Disabilities: A Retrospective Cohort Study

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Abstract

Objectives—This study examined the risk of postpartum hospital admissions and emergency department (ED) visits among U.S. women with intellectual and developmental disabilities (IDD).

Methods—We used the 2002–2012 Pregnancy to Early Life Longitudinal Data System and identified deliveries to women with and without IDD. Women with IDD (n=1,104) or case subjects were identified from the International Classification of Diseases and Related Health Problems 9th Revision (ICD-9 CM) codes. The study primary outcome measures were any postpartum hospital admission and any ED visit during three critical postpartum periods (1–42 days, 43–90 days, and 1–365 days). We conducted unadjusted and adjusted survival analysis using Cox proportional hazard models to compare the occurrence of first hospital admission or ED visits between women with and without IDD.

Results—We found that women with IDD had markedly higher rates of postpartum hospital admissions and ED visits during the critical postpartum periods (within 1–42 days, 43–90 days and 91–365 days) after a childbirth.

Conclusion for Practice—Given the heightened risk of pregnancy complications and adverse birth outcomes and the findings of this study, there is an urgent need for clinical guidelines related to the frequency and timing of postpartum care among new mothers with IDD. Further, this study

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provides evidence of the need for evidence-based interventions for new mothers with IDD to provide preventive care and routine assessments that would identify and manage complications for both the mother and the infant outside of the traditional postpartum health care framework.

Keywords

Disability; Obstetrics/Gynecology

INTRODUCTION

Women with intellectual and developmental disabilities (IDD) face multiple social, economic, and health disparities (Brown, Cobigo, Lunskey, Dennis, & Vigod, 2016; Brown, Cobigo, Lunskey, & Vigod, 2016; Brown, Lunskey, Wilton, Cobigo, & Vigod, 2016; Mitra, Parish, Clements, Cui, & Diop, 2015; Parish et al., 2015). In addition to these disparities, women with IDD are often deprived of their sexual and reproductive rights and are also more likely to have risk factors associated with pregnancy complications and adverse birth outcomes (Brown, Cobigo, Lunskey, & Vigod, 2016; Brown, Kirkham, Cobigo, Lunskey, & Vigod, 2016; Mitra et al., 2015). Earlier studies have found that compared to women without IDD, those with IDD experience more medical complications during pregnancy and have higher rates of adverse birth outcomes (Mitra et al., 2015; Parish et al., 2015). One recent population-based study found that women with IDD were significantly more likely to have labor inductions and Cesarean sections compared to women without IDD, in addition to higher rates of pre-eclampsia/eclampsia, venous thromboembolism, and chorioamnionitis (Brown, Kirkham, et al., 2016). That same study also found higher antepartum hemorrhage rates for women with IDD, which has been found in other research as well (Clements, Mitra, Zhang, & Iezzoni, 2016; Verburg et al., 2016). Another study examining healthcare utilization found that women with IDD are more likely to experience high rates of prenatal hospital utilization and less likely to utilize adequate and timely prenatal care (Mitra et al., 2015).

Despite growing knowledge about the perinatal health of women with IDD (Clements et al., 2016; Verburg et al., 2016; Brown, Cobigo, Lunskey, Dennis, & Vigod, 2016; Brown, Cobigo, Lunskey, & Vigod, 2016; Brown, Lunskey, Wilton, Cobigo, & Vigod, 2016; Mitra, Parish, Clements, Cui, & Diop, 2015; Parish et al., 2015), little is known about the health and healthcare utilization of women with IDD during the postpartum period in the United States. A recent study on postpartum hospital admissions and emergency department visits among Canadian women with IDD (Brown, Cobigo, Lunskey, & Vigod, 2017) found that women with IDD were at an increased risk for postpartum hospital admission and emergency department visits within 42 days following delivery, especially for psychiatric indications. However, generalizability of these findings for the U. S. population of women with IDD remains a challenge due to marked differences in healthcare systems and other social welfare support schemes that are available to persons with IDD in Canada. Further, Brown et al. (2017) did not examine the risk of women with IDD for hospital admission and emergency department visits during the extended postpartum period. The health of mothers during the fourth trimester (defined as 1–90 days post childbirth) (Verbiest, Bonzon, & Handler, 2016) and the extended postpartum period (defined as one-year post childbirth)

(Walker, Murphey, & Nichols, 2015) has significant effects on the emotional and physical health of both mothers and their infants (Young, Madden, & Bryant, 2015). In light of the limitations of existing literature and the scarce existing population-based research about the postpartum experiences of U. S. women with IDD, the aim of this study is to assess the risk of postpartum hospital admission and emergency department visits during the first postpartum year among women with and without IDD in the United States.

METHODS

Study setting

We conducted a population-based retrospective cohort study in Massachusetts. Massachusetts has a population of approximately 6.6 million (U. S. Census Bureau, 2013) and an average of about 77,000 deliveries per year (Massachusetts Department of Public Health, 2014). Our study covered all hospital-based deliveries that occurred during the 2002–2012 period.

Data source

We analyzed data from the Massachusetts Pregnancy to Early Life Longitudinal Data System (PELL). The PELL data links all statewide birth certificates, fetal death reports, and delivery and non-delivery-related hospital discharge records (inpatient visits, observational stays, and emergency department visits) for all infants and their mothers using deterministic and probabilistic methodologies. The PELL data contain >100 clinical and nonclinical data elements for each delivery that occurred in Massachusetts and the subsequent hospitalizations since 1998, including primary and secondary diagnoses and procedures, admission and discharge status, patient demographic characteristics, expected payer, total charges, and length of stay. Detailed information on the PELL design is available elsewhere (Walker et al., 2015; Young et al., 2015). We analyzed PELL data from January 1, 2002, to December 31, 2012.

Study sample

The PELL data include unique decoded patient identifiers, thus the unit of analysis is any delivery to a Massachusetts woman who gave birth during the 2002–2012 study period. Deliveries to women with IDD ($n=1,104$) or case subjects were identified by analyzing the primary and secondary diagnoses of any hospital admissions before, during, or after the delivery, including emergency department (ED) visits, non-delivery hospitalizations, and observational stays (any hospital stay for which diagnosis and treatment are not expected to exceed 24 hours but may extend to 48 hours). If any of the IDD-related diagnoses from the International Classification of Diseases and Related Health Problems 9th Revision (ICD-9 CM) codes (see Table 1 for complete listing) was present on the hospital discharge record, the woman was considered to have IDD. For some women the IDD status could have been established based on hospital discharge records that date 10 years prior to or after delivery. For example, if a woman gave birth in 2002, her IDD status could be based only on a hospital admission in 2012. However, our assumption in this study is that any IDD-related diagnoses identified before, during, or after the delivery were childhood-onset conditions. IDD diagnoses after delivery would be rare, although it could be possible for some women.

Due to the relatively small number of deliveries among women with IDD, we combined data from 11 years (2002–2012) to increase the sample size, hence the statistical power. Our final analytical sample was 779,513 deliveries, including 1,104 deliveries to mothers with IDD and 778,409 deliveries to mothers without IDD.

Outcome measures

Our primary outcome measures were 1) hospital admissions (inpatient stays and/or observational stays) and 2) emergency department (ED) visits within 1–42 days, 43–90 days, and 91–365 days after childbirth. For our analysis, we captured the first encounter of any hospital admission and any first encounter of repeated (two or more) hospital admissions (World Health Organization, 2010). Additionally, we captured, any first encounter of an ED visit, any repeated (two or more) ED visits, and any frequent (four or more) ED visits. Of note, we aggregated the inpatient stays and observational stays due to their relatively low frequency among women with IDD. Additionally, ED visits that resulted in hospital admission were not double counted as both an ED visit and a hospital admission. Finally, hospital discharge date was calculated from the time at discharge, not time of admission.

Covariates

Covariates of interest included social and demographic characteristics (maternal age, race/ethnicity, education (less than high school, high school graduate, or some or more college)), marital status, type of health insurance (private or public), adequacy of prenatal care (characterized as inadequate, intermediate, adequate, or adequate plus using the Kotelchuck index) (Kotelchuck, 1994, 1997), and smoking during pregnancy. Previous research showed that pre-pregnancy health conditions and maternal complications are significantly associated with adverse delivery outcomes (Brown, Cobigo, Lunskey, Dennis, et al., 2016; Clements et al., 2016; Adams, Smith, & Ruffin, 2000) hence, they can potentially impact the risk of postpartum hospital utilization. For pre-pregnancy health conditions or pregnancy related complications, we included a binary variable as to whether women had none or one of the following: diabetes, gestational diabetes, hypertension, gestational hypertension, cardiac disease, hydramnios/oligohydramnios, hemoglobinopathy, renal disease, RH sensitization, rubella infection, seizure disorders, sickle cell anemia, uterine bleeding, weight gain/loss, and other risk factors for pregnancy. For delivery related complications, we added a binary variable as to whether women had none or one of the following: abruptio placentae, other excessive bleeding, placenta previa, precipitous labor, prolonged labor, rupture of membrane, seizures during labor, anesthetic complications, breech/malpresentation, cephalopelvic disproportion, cord prolapse, dysfunctional labor, fever, fetal distress, meconium moderate to heavy, and other labor and delivery complications. The variables for pregnancy risks and delivery related complications include indicators for ‘other risks for pregnancy’ and ‘other labor and delivery complications’, as defined by the developers of the PELL data. These two indicators include medical/clinical factors that have low prevalence and were therefore combined. The PELL codebook, however, does not provide any further information as to what specific diagnoses were included in these categories. Other clinical characteristics included were low birth weight (infant weight <2,500 g) and mode of delivery (vaginal vs. Cesarean). We also adjusted for the sex of the baby, because previous research found that carrying boy babies was associated with serious pregnancy

complications (Verburg et al., 2016). Since this analysis is based on the combined 2002–2012 PELL data across 11 years, we also included year of delivery.

This study was approved by the institutional review boards of the authors' respective institutions and the Massachusetts Department of Public Health.

Statistical Analyses

We summarized and compared sociodemographic, health, and clinical characteristics between women with and without IDD using chi-square tests (for categorical variables), t-tests (for continuous variables), and Wilcoxon rank-sum tests (for variables that were not normally distributed). We conducted unadjusted and adjusted survival analysis using Cox proportional hazard models to compare the occurrence of first hospital admission or emergency department visits between women with and without IDD within 1–42 days, 43–90 days, and 91–365 days after childbirth. Similarly, we estimated the occurrence of first repeated (≥ 2) hospital admission, repeated (≥ 2) ED visits, and frequent (≥ 4) ED visits. Women who were followed for more than 365 days after childbirth but whose first hospital admission or ED visit occurred after 365 days were right-censored at 365 days or were considered as having no hospitalization or ED visits. The time that was first counted was the hospital discharge date. We estimated the hazard ratios (HR) and 95% confidence intervals (CI) of the time to occurrence of the first event of interest (hospital admission or ED visit). Owing to inclusion of repeated deliveries to the same mother during the study period, we adjusted for individual-level clustering by using the robust clustered sandwich estimator method (Wooldridge, 2003). First, in line with methodological guidelines to avoid overadjustment bias, (Schisterman, Cole, & Platt, 2009) we used multivariable models (model 1) that adjusted for maternal age, race/ethnicity, maternal education, marital status, type of health insurance, adequacy of prenatal care, pre-pregnancy health conditions or pregnancy complications, and year of delivery. Variables that are likely on the causal pathway between maternal IDD status and postpartum hospital admissions or emergency department visits (i.e. delivery complications, low birth weight, cesarean delivery, and sex of the newborn child) were not included in these models. In the second step, we adjusted the multivariable models (model 2) for the pathway variables to assess how they influence the results from model 1. For covariates with missing values we conducted chained multiple imputations.

We performed all analyses using Stata, version 15 MP (StataCorp, 2015).

Results

Sample characteristics

Women with IDD were more likely to be younger, have a lower level of education, be non-Hispanic Black or Hispanic, have public health insurance, and were less likely to be married (see Table 2). Women with IDD were more likely to have 'adequate plus' prenatal care based on the Kotelchuk index (Kotelchuck, 1994, 1997), smoke during pregnancy, have one or more pre-pregnancy comorbidities or delivery related complications, have a low birth

weight infant, and have a Cesarean delivery. There were no statistically significant differences in the sex of the newborn baby between women with and without IDD.

Table 3 compares the prevalence of postpartum hospital admissions and ED visits among women with and without IDD. Compared to women without IDD, women with IDD had higher prevalence rates for hospital admission and ED visits during all critical postpartum periods. Women with IDD had at least two times higher rates for any hospitalizations within 1–42 days, 43–90 days, and 91–365 days after childbirth compared to women without IDD. Similarly, women with IDD had a higher risk for repeated hospitalizations (≥ 2) within 1–42 days, 43–90 days, and 91–365 days after childbirth. Women with IDD also had a longer duration of hospital stays in terms of average days during hospitalizations that occurred within 43–90 days (4.5 vs 3.4); however, the length of hospital stays from 1–42 days and 91–365 days were not significantly different.

Women with IDD had at least about two times higher prevalence rates of any ED visits within 1–42 days, 43–90 days, and 91–365 days after childbirth. Compared to women without IDD, women with IDD also had at least about four times higher prevalence rates of repeated ED visits (≥ 2) and frequent ED visits (≥ 4) within 1–42 days, 43–90 days, and 91–365 days after childbirth.

Table 4 reports the unadjusted and adjusted hazard ratios for the risk of postpartum hospital admissions between women with and without IDD. In the unadjusted analysis, women with IDD had a higher risk for any hospital admissions within 1–42 days after childbirth (HR=2.53; 95% CI, 1.67–3.83; $p<0.001$). The risk for hospital admissions was also high in subsequent periods, including within 43–90 days (HR=2.26; 95% CI, 1.01–5.43; $p<0.001$) and 91–365 days after childbirth (HR=4.84; 95% CI, 3.68–6.37; $p<0.001$). In the unadjusted analysis, women with IDD also had a higher risk for repeated hospital admissions (≥ 2) (HR=7.07; 95% CI, 2.93–17.06; $p<0.001$). The risk of repeated hospital admissions for women with IDD remained high in subsequent periods, including within 43–90 days (HR=5.77; 95% CI, 1.43–23.21; $p<0.001$) and 91–365 days post childbirth (HR=12.82; 95% CI, 8.14–20.20; $p<0.001$). These results somewhat attenuated after adjusting for covariates in model 1 and model 2 but the significance levels remained unchanged with the exception of any hospital admission within 43–90 days.

Table 5 reports the unadjusted and adjusted hazard ratios for the risk of postpartum ED visits between women with and without IDD. In the unadjusted analysis, women with IDD had a higher risk for any ED visit within 1–42 days after childbirth (HR=3.43; 95% CI, 2.89–4.06; $p<0.001$). The risk for ED visits was high in the subsequent periods, including within 43–90 days (HR=3.26; 95% CI, 2.61–4.07; $p<0.001$) and 91–365 days after childbirth (HR=2.22; 95% CI, 1.94–2.53; $p<0.001$). In the unadjusted analysis, women with IDD also had a higher risk for repeated (≥ 2) and frequent (≥ 4) ED visits. The risk of repeated (≥ 2) and frequent (≥ 4) ED visits for women with IDD further increased in the subsequent periods, including within 43–90 days and 91–365 days after childbirth. Although, these results somewhat attenuated after controlling for covariates in model 1 and model 2, significance levels remained robust.

Discussion

This paper offers a first examination of hospital and emergency department use during the critical postpartum periods, within 1–42 days, 43–90 days, and 91–365 days after childbirth among US women with IDD using population-based, longitudinally linked, administrative data. Consistent with our hypotheses, compared to women without IDD, women with IDD had a higher risk for any hospital admission and ED visit within 1–42 days, 43–90 days, and 91–365 days after childbirth. Interestingly, the risk of hospital admissions and ED visits increased in the subsequent postpartum periods (within 43–90 days and 91–365 days). The elevated risks for postpartum hospital admissions and ED visits remained robust after controlling for all available covariates.

The year following childbirth is a challenging time for many women. It is a period of transition extending from childbirth to one year post-delivery. In the postpartum period, women experience physical, social, and psychological changes, including the demands of taking care of a newborn, and increased vulnerability to many health problems including depression (Aber, Weiss, & Fawcett, 2013; Burgio et al., 2003; Declercq, Sakala, Corry, Applebaum, & Herrlich, 2014; Lowe et al., 2005). The health and well-being of the mother during this time has potentially lasting effects on the health of the mother and her infant (Brown, Cobigo, Lunskey, & Vigod, 2016). Given the significant disparities in health and healthcare access for women with intellectual and developmental disabilities, (Brown, Cobigo, Lunskey, Dennis, et al., 2016; Hilary K. Brown et al., 2017; Brown, Cobigo, Lunskey, & Vigod, 2016; McConnell, Llewellyn, & Bye, 1997; Mitra et al., 2015; Parish et al., 2015) and the findings from this study, there is a critical need to understand the postpartum health and needs of women with IDD and develop evidence-based interventions to better support them during this time. Future research needs to examine the main reasons for increased postpartum hospitalizations among women with and without IDD.

Postpartum office visit attendance has been recognized as a significant indicator of quality of postpartum care with the potential to improve the long-term health and well-being of the mother and the infant (ACOG Committee on Obstetric Practice, 2016). Although the current American Congress of Obstetrics and Gynecology (ACOG) recommends one postpartum visit within six weeks of delivery (ACOG Committee on Obstetric Practice, 2016), postpartum visit attendance rates are poor among U. S. women. Approximately 60% of U. S. women attend a postpartum obstetric visit within the recommended three months post-delivery (AAP and ACOG, 2012, ACOG Committee on Obstetric Practice, 2016). However, there are no published data on the utilization of postpartum office visits among women with IDD. The ACOG recommendation of one visit within six weeks of delivery and the Medicaid reimbursement policy is likely insufficient for women with IDD. Almost 80% of deliveries among women with IDD were to women with public insurance (Parish et al., 2015). Consequently, a modification in the Medicaid policy and ACOG recommendations for postpartum care is critical to improving the postpartum health of women with IDD (ACOG Committee on Obstetric Practice, 2016; Mitra, 2017). In addition, the ACOG guidelines for optimizing postpartum care through the development of anticipatory postpartum care plans during pregnancy may be particularly important for women with IDD given their elevated rates of adverse birth outcomes, pregnancy complications, and

postpartum hospital utilization (AAP and ACOG, 2012; ACOG Committee on Obstetric Practice, 2016).

Recognizing the importance of postpartum health and wellness, efforts to address the U. S. systems of care during the postpartum period are ongoing (Association of Maternal and Child Health Programs, 2014; Verbiest et al., 2016). These efforts recognize the need to provide seamless, comprehensive, integrated, woman-centered care beginning early in life through the entire reproductive lifespan, extending from preconception to prenatal and postpartum (Association of Maternal and Child Health Programs, 2014; Verbiest et al., 2016). The collective body of evidence on the perinatal health of women with IDD, in addition to the findings from this study underscore the need for an in-depth understanding of the needs, experiences, and health of women with IDD during the postpartum and the inclusion of their needs and experiences in the national “approach to woman-centered postpartum care” (Verbiest et al., 2016).

Strengths and Limitations

The limitations of this study include the lack of information about the women’s living situations and extent of social support, both of which are potentially associated with postpartum health and healthcare utilization. A second limitation of this study is that we could not assess the functional characteristics of the sample, including severity of their disability, their communication abilities, and type of residence in this study. Women with IDD are a heterogeneous group and this heterogeneity might contribute to variability in the likelihood of having postpartum hospital utilization. Third, there is no clinical corroboration of information in the PELL data. In addition, some women with IDD may not have been identified and included in this study because ICD-9 codes related to their IDD diagnosis were not entered into their records. Therefore, the findings from this study likely underestimate the number of women with IDD and introduce conservative bias into the results. Fourth, although these data represent the entire population of Massachusetts women who delivered between 2002–2012, the findings may not generalize to women living in other states. The study also did not include spontaneous or elective abortions during the first or early second trimester because Massachusetts law does not require the reporting of fetal deaths <20 weeks or birth weight <350 grams. Fifth, the small number of outcomes in the IDD group for some of the analyses resulted in large confidence intervals. Future studies need to use a larger sample size to examine these outcomes. Finally, combining multiple years of data presents a challenge in terms of controlling for potential confounding factors related to changes in policies and practices related to perinatal care between 2002 and 2012. Future research should examine postpartum hospitalizations with a larger sample and for one or fewer cross-section periods as well as by looking at the differences by type of IDD.

Despite these limitations, this study has notable strengths. First, to our knowledge, this is the first study of ED and hospital utilization among U. S. women with IDD during the critical postpartum periods, including within 1–42 days, 43–90 days, and 91–365 days after a childbirth. Second, this is a population-based study which does not rely on disability registries, limiting selection bias. Another strength is the use of longitudinally linked

administrative data to identify women with IDD and examine their risk for postpartum hospitalizations and ED visits.

Conclusion

This study found that women with IDD had markedly higher rates of postpartum hospital admissions and emergency department visits during the critical postpartum periods after a childbirth (within 1–42 days, 43–90 days, and 91–365 days). These findings were robust and persisted even after controlling for many social, demographic, and clinical characteristics. Given the heightened risk of pregnancy complications and adverse birth outcomes and the findings of this study, there is an urgent need for clinical guidelines related to the frequency and timing of postpartum care among new mothers with IDD. Further, this study provides evidence of the need for evidence-based interventions for new mothers with IDD to provide preventive care and routine assessments that would identify and manage complications for both the mother and the infant outside of the traditional postpartum healthcare framework.

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Table 1

Classification of Intellectual and Developmental Disability

Intellectual and developmental disabilities	ICD-9 codes
Mild mental retardation	317
Moderate mental retardation	318.0
Severe mental retardation	318.1
Profound mental retardation	318.2
Unspecified mental Retardation	319
Fragile X syndrome	759.83
Prader-Willi syndrome	759.81
Down syndrome	758.0
Rett syndrome	330.8
Lesch Nyhan	277.2
Cri du chat	758.31
Autistic disorder	299.0, 299.00, 299.01
Childhood disintegrative disorder	299.1, 299.10, 299.11
Other Specified pervasive developmental disorder	299.8, 299.80, 299.81
Unspecified pervasive developmental disorder	299.9, 299.90, 299.91
Tuberous sclerosis	759.5
Fetal alcohol syndrome	760.71
Cerebral palsy athetoid	333.71
Cerebral palsy diplegic	343.0
Cerebral palsy hemiplegic	343.1
Cerebral palsy quadriplegic	343.2
Cerebral palsy monoplegic	343.3
Other cerebral palsy	343.4
Infantile cerebral palsy	343.8
Cerebral palsy Spastic	343.9
Cerebral palsy spastic non-congenital non-infantile	344.89

Note: ICD-9-International Classification of Diseases

Table 2

Maternal Characteristics among Singleton Deliveries to Women with and without IDD in Massachusetts State, 2002–2012, N=779,513

Characteristics	IDD (n=1104)	Non-IDD (n=778,409)	p *
Maternal age at delivery			<0.01
<20	119	46,549	6.0
20–29	614	313,413	40.3
30–39	335	385,954	49.6
>39	36	32,493	4.2
Maternal education			<0.01
Less than high school	355	89,993	11.6
High school graduate	536	266,603	34.3
Some or more college education	208	420,057	54.1
Maternal Race/Ethnicity			<0.01
Non-Hispanic White	659	522,417	67.1
Non-Hispanic Black	167	67,274	8.6
Hispanic (any race)	226	114,338	14.7
Non-Hispanic Other	52	74,380	9.6
Marital status			<0.01
Not married	342	524,063	67.3
Married	762	254,346	32.7
Type of health insurance			<0.01
Private	233	499,480	64.3
Public	868	277,180	35.7
Adequacy of prenatal care ^a			<0.01
Inadequate	21	8,220	1.1
Intermediate	111	61,349	8
Adequate	401	353,287	46.2
Adequate Plus	544	341,643	44.7
Smoked during pregnancy			<0.01
No	900	721,210	92.7
Yes	204	57,199	7.3

Characteristics	IDD (n=1104)	Non-IDD (n=778,409)	<i>p</i> [*]
Gender of the newborn child			0.6
Male	575	398,806	51.2
Female	529	379,603	48.8
Birth parity			<0.01
First	508	355,522	45.8
Second	330	265,237	34.2
Third and above	262	155,124	20.0
One or more chronic health conditions ^b			<0.01
No	304	391,131	50.5
Yes	793	383,239	49.5
One or more delivery complications ^c			<0.01
No	554	440,767	56.9
Yes	540	333,815	43.1
Low birth weight ^d			<0.01
No	964	734,350	94.6
Yes	136	42,070	5.4
Cesarean delivery			<0.01
No	710	535,668	68.9
Yes	394	242,300	31.1
	Mean	SE	SE
Maternal age at delivery	26.9	0.18	29.6
			0.01
			<0.01

Source: Pregnancy to Early Life Longitudinal (PELL) Data, 2002–2012

^{*} *p*-values for differences, χ^2 -test or t-test.

Data are n (%) of deliveries, unless otherwise specified

Notes:

^a Adequacy of prenatal care characterized as inadequate, intermediate, adequate, or adequate plus using the Kotelchuck Index (Kotelchuck, 1994, 1997).

^b Risk factors during pregnancy include one of the following pre-existing chronic and pregnancy related comorbidities: diabetes (gestational or chronic), hypertension (pregnancy-related and chronic), cardiac disease, hydramnios/oligohydramnios, hemoglobinopathy, renal disease, RH sensitization, rubella infection during pregnancy, seizure disorders, sickle cell anemia, uterine bleeding, weight gain/loss, and other complications recorded.

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Delivery related complications include one of the following: abruptio placentae, other excessive bleeding, placenta previa, precipitous labor, prolonged labor, rupture of membrane, seizures during labor, anesthetic complications, breech/malpresentation, cephalopelvic disproportion, cord prolapse, dysfunctional labor, febrile, fetal distress, meconium moderate to heavy, and other complications of labor and delivery.

^dLow birth weight: Infant weighing <2,500g.

Abbreviations: IDD: Intellectual and developmental disability.

Table 3

Prevalence of Postpartum Hospitalizations and Emergency Department Visits among Singleton Deliveries to Women with and without IDD in Massachusetts, 2002–2012, N=779,513

Hospitalization type	IDD (n=1,104)	Non-IDD (n=778,409)	p*
1–42 DAYS			
Any hospitalizations	22	6,180	0.8 <0.01
2+ hospitalizations	<11	503	0.1 <0.01
Length of hospital stay			
Average, (SE) ^a	4.3	0.7	4 0.3 0.36
Median, (IQR)	3.5	2.5	3 2.4 -
Any postpartum ED visits	129	11.7	27,536 3.5 <0.01
2+ ED visits	93	8.4	12,352 1.6 <0.01
4+ ED visits	66	6.0	4,604 0.6 <0.01
43–90 DAYS			
Any hospitalizations	<11	0.5	1,606 0.2 0.07
2+ hospitalizations	<11	0.2	251 0.0 <0.01
Length of hospital stay			
Average, (SE) ^a	4.5	0.3	3.4 0.06 <0.01
Median, (IQR)	4	4.5	3 2.4 -
Any postpartum ED ^c visits	79	7.2	19,275 2.5 <0.01
2+ ED visits	61	5.5	8,985 1.2 <0.01
4+ ED visits	33	3	2,893 0.4 <0.01
91–365 DAYS			
Any hospitalizations	51	4.6	7,928 1.0 <0.01
2+ hospitalizations	19	1.7	1,108 0.1 <0.01
Length of hospital stay			
Average, (SE) ^a	3.8	0.3	3 0.03 0.08
Median, (IQR)	3	2.4	3 2.4 -
Any postpartum ED visits	215	19.5	85,507 11.0 <0.01
2+ ED visits	92	8.3	21,574 2.8 <0.01
4+ ED visits	33	3.0	3,663 0.5 <0.01

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Source: Pregnancy to Early Life Longitudinal (PELL) Data, 2002–2012

* p -values for differences, χ^2 -test, t -test or two-sample Wilcoxon-Mann-Whitney test.

Data are n(%) of deliveries, unless otherwise specified

Notes: To maintain confidentiality, cells with <11 cases cannot be reported;

^aTwo-sample Wilcoxon-Mann-Whitney (WMW) test is used to test the differences in average and median number of hospitalization by comparison groups.

Abbreviations: IDD - Intellectual and developmental disability; ED-emergency department; IQR-Inter quartile range; SE-standard deviation.

Table 4

Unadjusted and Adjusted Hazard Ratios for the Risk of Hospital Admissions among Singleton Deliveries to Women with and without IDD in Massachusetts, 2002–2012, N=779,513

Postpartum period	Hospitalization			
	Any hospital admission		2+ hospital admissions	
	HR	95% CI	HR	95% CI
1–42 DAYS				
No IDD	1	1	1	1
IDD (Unadj. model)	2.53 ***	1.67 – 3.83	7.07 ***	2.93 – 17.06
IDD (Adj. model 1 ^a)	2.39 ***	1.74 – 3.28	5.08 ***	2.71 – 9.53
IDD (Adj. pathway model 2 ^b)	2.15 ***	1.57 – 2.96	4.45 ***	2.37 – 8.35
43–90 DAYS				
No IDD	1	1	1	1
IDD (Unadj. model)	2.26 **	1.01 – 5.43	5.77 **	1.43 – 23.21
IDD (Adj. model 1 ^a)	1.86 **	1.03 – 3.37	3.22 **	1.20 – 8.63
IDD (Adj. pathway model 2 ^b)	1.73 *	0.96 – 3.13	2.82 **	1.05 – 7.55
91–365 DAYS				
No IDD	1	1	1	1
IDD (Unadj. model)	4.84 ***	3.68 – 6.37	12.82 ***	8.14 – 20.20
IDD (Adj. model 1 ^a)	3.28 ***	2.67 – 4.02	6.04 ***	4.23 – 8.62
IDD (Adj. pathway model 2 ^b)	3.04 ***	2.48 – 3.74	5.31 ***	3.72 – 7.58

Source: Pregnancy to Early Life Longitudinal (PELL) Data System; 2002–2012

 $p < 0.01$,

**
 $p < 0.05$,

*
 $p < 0.1$

Notes:

^a Adjusted model included the following covariates: maternal age, race/ethnicity, education, marital status, type of health insurance, adequacy of prenatal care based on Kotelchuck index (Kotelchuck, 1994, 1997), smoking during pregnancy, parity, and year of survey.

^b Adjusted pathway model included covariates in the model 1 plus pathway variables including pre-pregnancy health conditions or pregnancy related complications (e.g. diabetes, cardiac disease, etc.), delivery complications (e.g. excessive bleeding, placenta previa, etc.), sex of the newborn child, low birth weight, and cesarean delivery.

Abbreviations: IDD - Intellectual and Developmental Disability; HR-Hazard Ratios; CI-Confidence Interval.

Unadjusted and adjusted hazard ratios for the risk of ED visits Among Singleton Deliveries to Women with and without IDD in Massachusetts, 2002–2012, N=779,513

Table 5

Postpartum period	Emergency department visits							
	Any ED visit		Any 2+ ED visits		Any 4+ ED visits			
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
1–42 DAYS								
No IDD	1	1	1	1	1	1	1	1
IDD (Unadj. model)	3.43 ***	2.89 – 4.06	5.52 ***	4.52 – 6.75	10.52 ***	8.27 – 13.38		
IDD (Adj. model 1 ^a)	2.18 ***	1.83 – 2.59	2.66 ***	2.17 – 3.27	4.18 ***	3.25 – 5.37		
IDD (Adj. pathway model 2 ^b)	2.06 ***	1.74 – 2.45	2.47 ***	2.01 – 3.02	3.80 ***	2.96 – 4.87		
43–90 DAYS								
No IDD	1	1	1	1	1	1	1	1
IDD (Unadj. model)	3.26 ***	2.61 – 4.07	5.39 ***	4.18 – 6.96	9.05 ***	6.42 – 12.76		
IDD (Adj. model 1 ^a)	1.91 ***	1.52 – 2.39	2.55 ***	1.96 – 3.31	3.63 ***	2.54 – 5.19		
IDD (Adj. pathway model 2 ^b)	1.84 ***	1.47 – 2.31	2.41 ***	1.85 – 3.14	3.34 ***	2.34 – 4.77		
91–365 DAYS								
No IDD	1	1	1	1	1	1	1	1
IDD (Unadj. model)	2.22 ***	1.94 – 2.53	3.69 ***	3.01 – 4.52	7.67 ***	2.22 ***		
IDD (Adj. model 1 ^a)	1.42 ***	1.24 – 1.63	1.79 ***	1.45 – 2.20	3.06 ***	1.42 ***		
IDD (Adj. pathway model 2 ^b)	1.39 ***	1.21 – 1.59	1.70 ***	1.38 – 2.09	2.85 ***	1.39 ***		

Source: Pregnancy to Early Life Longitudinal (PELL) Data System; 2002–2012

*** $p < 0.01$,

** $p < 0.05$,

* $p < 0.1$

Notes:

^a Adjusted model included the following covariates: maternal age, race/ethnicity, education, marital status, type of health insurance, adequacy of prenatal care based on Kotelchuck index (Kotelchuck, 1994, 1997), smoking during pregnancy, parity, and year of survey.

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Adjusted pathway model included covariates in the model 1 plus pathway variables including pre-pregnancy health conditions or pregnancy related complications (e.g. diabetes, cardiac disease, etc.), delivery complications (e.g. excessive bleeding, placenta previa, etc.), sex of the newborn child, low birth weight, and cesarean delivery.

Abbreviations: IDD - Intellectual and Developmental Disability; ED-Emergency Department; HR-Hazard Ratios; CI-Confidence Interval.