Birth outcomes affecting infants of mothers with intellectual and developmental disabilities

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\textbf{Abbreviations:} IDD; intellectual and developmental disabilities, BD4LK; Big Data for Little Kids, NICU; neonatal intensive care unit, OR; odds ratio, uOR; unadjusted odds ratio, aOR; adjusted odds ratio, SD; standard deviation, IQR; interquartile range

\textbf{Table of contents summary:} Wisconsin Medicaid data linked to birth records find infants of mothers with intellectual and developmental disabilities are at higher odds of poor birth outcomes.

\textbf{What is known on this subject:} Infants born to mothers with intellectual and developmental disabilities may be at increased risk of being born preterm and of low birthweight; yet, more work is needed to confirm past findings and understand impacts of demographics and maternal pregnancy complications.

\textbf{What this study adds:} Infants born to mothers with intellectual and developmental disabilities in Wisconsin Medicaid are at increased odds, relative to infants, of being born...
preterm, low birthweight and small for gestational age with little attenuation after adjustment for maternal complications and demographic factors.
Dr. Rubenstein conceptualized and designed the study, carried out the analyses, drafted the manuscript, and reviewed and revised the manuscript.

Dr. Ehrenthal led the larger project in which the data were accessed, linked, and cleaned. Dr. Ehrenthal reviewed and revised the manuscript.

Dr. Kuo and Mr. Mallinson contributed to data cleaning, study design, and reviewed and revised the manuscript.

Drs. Bishop and Durkin reviewed and revised the manuscript.
Abstract: 250 words

Objectives: To examine birth outcomes of infants born to mothers with intellectual and developmental disabilities (IDD) and assess effects of demographics, maternal pregnancy complications, and IDD-type.

Methods: We used data from the Big Data for Little Kids Project which links Wisconsin birth records to Medicaid claims for live births covered by Medicaid from 2007 to 2016. We identified IDD using maternal prepregnancy Medicaid claims and ran multi-level logistic regressions clustered by mother to compare outcomes between infants with and without mothers with IDD. We added covariate sets for demographic factors and maternal pregnancy complications to examine confounding and potential mediation. We assessed outcomes by IDD-type (intellectual disability, genetic conditions, cerebral palsy, and autism spectrum disorder) to explore differences by categories of IDD.

Results: Infants of mothers with IDD were at greater odds of being born preterm (odds ratio [OR]: 1.60, 95% CI: 1.4, 1.8), low birth weight (OR: 1.90, 95% CI: 1.6, 2.2), and small for gestational age (OR: 1.5, 95% CI: 1.3, 1.7). Results were robust to adjustment for demographics and did not change when accounting for maternal pregnancy complications. Estimates did not meaningfully differ when grouped by IDD-type.

Conclusions: Infants born to mothers with IDD covered by Medicaid were at elevated odds for poor outcomes, which were not fully attributable to demographic differences of maternal complications. It is imperative to understand why children of mothers with IDD are at elevated risk so interventions and management can be developed to improve outcomes.
Intellectual and developmental disabilities (IDD) are conditions that present before the age of 18 and entail significant limitations in cognition, communication, and adaptive functioning (1). While IDD should not affect a person’s reproductive rights, women with IDD face disparity and inequities in reproductive health (2, 3). In addition, infants born to mothers with IDD may be at higher risk of being born preterm (4, 5) and small for gestational age (6) compared to infants of mothers without IDD. Long term child outcomes may be compounded if infants are born into socioeconomically disadvantaged situations, as infants with mothers with IDD often are (7, 8).

While evidence suggests increased risk of adverse outcomes for infants born to mothers with IDD, more work is needed to replicate past findings, assess additional infant outcomes, and examine impact of other contextual factors. US Medicaid data allow us to identify IDD through claims in a state-level system designed to serve low-income people, many of which meet disability eligibility. Medicaid samples may better account for socioeconomic confounding, as women with IDD are compared to a more similar low-income comparison group (9). The effect of maternal complications on infant outcomes in the context of IDD is largely unknown, as mothers with IDD are at greater risk of gestational diabetes and gestational hypertension (10, 11) compared to mothers without IDD. Increased risk for outcomes, such as preterm birth, may be explained by increased maternal pregnancy risks and complications.

In the context of these gaps in the literature, our objective was to describe birth outcomes of infants born to mothers with IDD and compare them to infants born to mothers without IDD in a cohort of live births to mothers covered by Wisconsin Medicaid. Data were from the Big Data for Little Kids project (BD4LK) that links Medicaid claims and birth record data for infants born
between 2007 and 2016. We examined results adjusting for demographic factors and maternal pregnancy complications and grouping by IDD-type. We hypothesized that odds of preterm birth and being small for gestational age would be increased for infants born to mothers with IDD compared to those born to mothers without IDD, even after adjusting for demographic and maternal pregnancy factors.

Methods

BD4LK and sample derivation

We used data from BD4LK, a longitudinal cohort of Wisconsin birth records for in state live births from 2007-2016. Live birth records were linked to administrative data sources including claims and encounters in the Wisconsin Medicaid system. Birth/death record data are linked to maternal Medicaid demographic files by deterministic matching by full name and birth date. This file is linked to claims by unique Medicaid ID. BD4LK has access to claims from up to one-year predelivery to delivery for all Medicaid deliveries (bounded by January 1, 2007 and December 31, 2016). In 2011, Wisconsin transitioned from the 1999 Revision of the US Standard Certificate of Live Birth (2007-2010 records) to the 2003 Revision (2011-2016 records). Variables were harmonized across birth records although there are certain variables unique to the 2003 revision that are only available in 2011-2016 births (i.e. breastfed at discharge, maternal BMI). Additional detail on BD4LK can be found elsewhere (12-14).

Our sample was comprised of all deliveries to mothers with at ≥1 Medicaid-paid delivery in Wisconsin during 2007-2016. Starting with 666,375 birth records in BD4LK, we excluded
deliveries to mothers who never linked to a Medicaid claim for live delivery (N=381,879; 57.3%) or with imperfect linkages across Medicaid claims (N=1,825; <0.3%). We excluded deliveries to mothers who’s only observed Medicaid-paid delivery occurred in 2013 due to potential data missingness related to data availability from Medicaid (N=7,806; 1.2%). Thus, our final analytic sample was of 274,865 infants (41.2% of all BD4LK birth records) born to 177,697 mothers.

Due to the time-bounds of our Medicaid data and the lack of availability of 2013 claims we created a subsample excluding births in 2007, 2013, and 2014, which ensured all mothers had the potential to have up to one year of prepregnancy claims. We used this sample of N = 195,691 children (71.2% of full analytic sample) in sensitivity analyses.

Classifying maternal IDD

Maternal IDD was determined by assessing Medicaid claims for International Classification of Disease 9 and 10 codes for IDD (15, 16). Women with IDD qualify for Medicaid by meeting income and asset requirements or by receiving a Social Security Disability Determination (which also has income requirements). IDD codes were identified from previous literature (4, 17-19) and are presented in Supplement 1. We grouped IDD into categories to examine effects of specific conditions: intellectual disability, genetic or chromosomal anomalies that cause IDD (‘genetic conditions’), cerebral palsy, and autism spectrum disorder. Mothers could be in more than one category.

Infant outcomes and covariates
Data for infant outcomes were from the birth record: clinical estimate of gestational age in completed weeks, categorical gestational age in weeks (<32, 32-34, 35-36, >37), preterm birth <37 weeks), birthweight and low birth weight (<2500 grams), <5th or <10th percentile size for gestational age (20), Apgar 5 minute score as a continuous variable and categorized as 1-3, 4-6, and 7-10 (21), infant transfer to other medical facility, infant death before 12 months of age, neonatal intensive care unit (NICU) admission (2011-2016 births only, N=156,135), and being breast fed at discharge (2011-2016 births only, N=156,135/

Demographic covariates from the birth record included birth year, birth order, plurality, child sex, urban rural classification of birth county (derived from National Center for Health Statistics 2013 Urban Rural Classification Scheme; (22)), and maternal race, ethnicity, age, nativity, and education. We evaluated whether there was information on the father on the birth record (based on having a response for paternal age, education, or race) as infant health outcomes are worse for infants without father’s information on the birth record compared to other children (23, 24).

Statistical analysis

We calculated distributions for categorical variables and means, standard deviations, median, and interquartile range for continuous variables. We ran multi-level logistic regression clustered by mother to calculate unadjusted odds ratios (uOR) and 95% confidence intervals (95% CI) and added additional adjustment sets to calculate adjusted odds ratios (aOR) for outcomes with adequate sample. First, we ran unadjusted analyses. Then, we added covariates for demographic characteristics: maternal race and Hispanic ethnicity, maternal age, urban-rural classification of birth county, father’s information on birth record, and birth year. Then, we added maternal
healthcare use and pregnancy complications: prenatal care in the first trimester, gestational hypertension, gestational diabetes, induction, caesarean delivery, tobacco use during pregnancy, and parity. Lastly, we ran a fully adjusted model excluding plural births as plurality is associated with preterm birth and small for gestational age (25). We then assessed most common outcomes (preterm birth, size for gestational age, and low birth weight) by IDD type. For the IDD-types with adequate sample size (intellectual disability and genetic conditions) we also ran the model adjusting for the covariate sets described above. We ran analyses using SAS version 9.4 (SAS Institute, Cary, NC). This study was approved by the University of Wisconsin-Madison Institutional Review Board.

Results

Of 274,865 infants in our final analytic sample, 1757 were born to mothers with IDD (1032 unique mothers). Five-hundred fifty-five children were born to mothers with intellectual disability, 777 had a mother with a genetic condition, 279 had a mother with cerebral palsy, and 156 had a mother with autism spectrum disorder. Of those born to mothers with IDD, the maternal racial and ethnic distribution was 71.3% white, 21.0% black, and 10.6% were Hispanic (Table 1). Overall, 5.6% of the births to mothers with IDD were to foreign born mothers. Of infants born to mothers without IDD (N=273,108), the maternal racial ethnic distribution was 72.0% white, 19.2% black and 14.6% were born to Hispanic mothers. Overall, 10.1% of the births to mothers without IDD were to foreign born.

The incidence of preterm birth was 14.9% in infants born to mothers with IDD compared to 9.2% among infants born to mothers without IDD (uOR: 1.60, 95% CI: 1.4, 1.8) (Table 2).
incidence of very preterm birth (<32 weeks) in infants of mothers with IDD was two times that of infants of mothers without IDD (2.8% compared to 1.4%; uOR: 2.28, 95% CI: 1.6, 3.2). Of infants born to mothers with IDD, 14.3% were <2500 grams at birth compared to 8.1% of infants born to mothers without IDD (uOR: 1.90, 95% CI: 1.6, 2.2). When accounting for both gestational age and birth weight, infants born to mothers with IDD had higher odds of being in the 5th percentile or lower for size for gestational age (8.5% compared to 5.4%; uOR: 1.62, 95% CI: 1.3, 2.0) and 10th percentile or lower (15.5% compared to 11.1%; uOR: 1.47, 95% CI: 1.3, 1.7).

For post-natal outcomes, a greater percentage of infants born to mothers with IDD were transferred to another hospital (8.5%) or the NICU (14.6%) as compared to infants of mothers without IDD (3.9% and 8.7% respectively). Conversely, a lower percentage of infants of mothers with IDD were breastfed at discharge (57.7%) compared to infants of mothers without IDD (69.7%). Of note, infant death was reported for 62 children to mothers with IDD (3.5%) and 1959 infant deaths to mothers without IDD (0.7%). In both groups approximately 60% of the infants died within 28 days of birth.

We found little difference when adding demographic characteristics, maternal health care use and pregnancy complications, and restricting to singleton births (Figure 1, point estimates and 95% CI presented in Supplement 2). We additionally performed sensitivity analysis restricting our data to infants whose mothers had no pregnancy complications (N=70456, 26.6% of full sample) rather than adjusting for each condition separately: results did not differ (Supplement 2).
While there was some variance in estimates, results were consistent in direction and magnitude across models with little clear patterns of attenuation or strengthening with additional covariates.

Compared to infants born to mothers without IDD, the odds of preterm birth were higher for infants born to mothers of all IDD types (Table 3). Maternal intellectual disability, genetic conditions, and cerebral palsy were each associated with increased odds of being born <2500 grams. Both maternal intellectual disability and genetic conditions were associated with increased odds of being <5th percentile and <10th percentile size for gestational age. However, after adjustment for demographic characteristics and maternal complications, the association between size for gestational age and intellectual disability was attenuated and no longer statistically significant (Supplement 3).

Discussion

Infants of mothers with IDD are likely to be at increased risk of adverse birth outcomes due to a combination of biological and socioeconomic factors. Our goal was to characterized disparities in birth outcomes for infants born to mothers with IDD, an understudied but growing population for which more research is vitally needed (6, 18). We compared birth outcomes by maternal IDD status within the population of infants whose mothers had Medicaid-covered deliveries, examining the impact of maternal demographics, healthcare use, and pregnancy complications. Across IDD-types and adjustment sets, infants born to mothers with IDD had higher odds of preterm birth, low birth weight, being small for gestational age, NICU admission, and infant death, as well as lower odds of being breastfed at discharge.
Our findings from a Wisconsin sample are consistent with past research on infant birth outcomes of mothers with IDD. Using the National Inpatient Sample, researchers found 13% of infant of mothers with IDD were born preterm compared to 8% of those born to mothers without IDD (4, 11). In California linked hospital discharge records from 2000-2010, 15.1% of infants born to mothers with IDD were preterm, significantly greater than the full cohort (26). In a similar linkage in Massachusetts, 12.4% of infants born to mothers with IDD were low birth weight compared to 5.4% in the non-IDD sample (27). In the Ontario health care system, 9.8% of infants born to mothers with IDD were preterm and 17.2% were <10th percentile for gestational age (10). Our study reaffirms past findings on outcomes for infants of mothers with IDD and adds estimates for additional outcomes such as Apgar scores, and being breastfed at discharge. While our data were from a health insurance plan in Wisconsin designed for low-income individuals, results were consistent with other samples of women with IDD in the US and Canada that were not restricted to one health plan.

We found five-times the odds of infant death for infants born to mothers with IDD compared to infants born to mothers without IDD, a finding similar to a study done of women with intellectual disability in Sweden (28). The increased risk of maternal complications, poor infant outcomes, and other infant health conditions associated with maternal IDD could result in failure to thrive (29) or birth defects (30) and possibly drive increased infant mortality. Women with IDD are capable of parenting and raising families (31), and our findings should not be interpreted otherwise. With additional years of data and further data on cause of death, we will be better able to understand pathways leading to increased mortality risk.
Demographic factors such as race (as a proxy for racism and disparity) and education are associated with birth complications (32-34) and a larger percentage of mothers with IDD in our data are black and have less education than mothers without IDD. Yet, compared to a general population comparison group the Medicaid-based sample comparison group is more similar to IDD-group in respect to demographic factors. The general similarity between the mothers with and without IDD may explain the minimal change we saw when adjusting for maternal race, ethnicity, age, geographic county, and education. We relied on the birth record for demographic variables and more detailed phenotypic and health history data are needed. In our data, mothers with IDD were at greater risk of gestational diabetes, gestational hypertension, and caesarean delivery compared to mothers without IDD; however, adjustment for these factors or restriction to infants of mothers without any complication made little impact on estimates for birth outcomes for infants. Maternal health care use and pregnancy complications may act as mediators on the pathway from maternal IDD to birth outcomes (35, 36), and while that was not manifest in our analysis that explored the direct effect of maternal IDD on outcomes, a more formal mediation analysis with data that can meet the assumptions of no unmeasured confounding (37) may be needed.

We saw increased odds of preterm birth, low birth weight, and being small for gestational age among infants of mothers with intellectual disability, genetic conditions, and cerebral palsy compared to mothers without IDD. Effects were smaller for autism spectrum disorder, which needs to be further explored with a larger sample. Our findings for infants of mothers with intellectual disability or cerebral palsy were aligned with past work on those specific conditions (38, 39). Similar outcomes may indicate similar social and health disparities faced across IDD
types. Still, within IDD type and across all IDD there is heterogeneity in presentation, co-occuring conditions, and disparities faced (40). These data are conditioned on live birth, so differential fertility (41) or pregnancy loss (38) by IDD-type are needed to understand the full picture of pregnancy. More detailed phenotypic and lifestyle to describe women with IDD can help inform outcomes specific to condition. With larger cohorts young women with IDD, specifically autism spectrum disorder (42), entering reproductive age, the power to identify specific mechanisms and effects within IDD types might be increased.

With elevated odds across adjustment sets and IDD-type, our findings raise questions as to why infants of women with IDD have elevated risk. Some outcomes, like NICU admission or infant transfer, may be a result of preterm birth (43). Residual confounding is likely a factor, as we only had information from the birth record which may not capture the extent of demographic differences between mothers with and without IDD. Women with IDD often lack access to appropriate sexual and reproductive healthcare (2, 6, 44) which can directly impact health behavior surrounding pregnancy and result in poor birth outcomes (45, 46). More data on pregnancy planning and pregnancy-related health-service usage in women with IDD are needed to explore this potential mechanism. Compared to women without IDD, women with IDD are also at greater risk of having co-occurring conditions such as anxiety, depression, epilepsy, and cardiovascular disease (19) and may be taking medication for those indications. These health conditions and their medication may increase risk for poor birth outcomes (47, 48). It will be important to further explore these factors so we can best serve women with IDD and their infants through pregnancy and infancy.
Our study was limited by our reliance on Medicaid claims for identifying IDD. We relied on prepregnancy claims over a limited time period and some mothers may have only entered the Medicaid system later in pregnancy or at childbirth. As other studies have used inpatient hospitalization to determine IDD, we believe our claims data captures a window in which IDD can be identified. Medicaid data are conditioned on being low-income; replication in an all payer claims database may expand findings outside the low-income population. We were limited to assessing outcomes and covariates from the birth record which may underreport maternal complications (49). In only having demographic data from the birth record, we did not have characteristics like living arrangement, employment status, and pregnancy planning which could inform findings. Our results are representative of Wisconsin Medicaid form 2007-2016 and may not be generalizable to other time frames or other populations.

Conclusion

We found that among Medicaid covered births, infants born to mothers with IDD were at elevated odds of preterm birth, low birth weight, being small for gestational age, being transferred to the NICU, and infant death compared to children of mothers without IDD. Our findings were robust to adjustment for demographic factors, maternal health care use and pregnancy complications, and results were similar IDD-type. It is imperative to understand why children of mothers with IDD are at elevated risk so interventions and management can be developed to improve outcomes in the future.

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Table 1 Demographic characteristics of infants born to women with a Medicaid live birth delivery in Wisconsin, 2007-2016; by intellectual and developmental disability status

|                                | Infants of mothers with intellectual and developmental disability | Infants of mothers without intellectual and developmental disabilities |
|--------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
|                                | N=1757                                                        | N=273108                                                      |
|                                | N     | %     | N     | %     |
| **Year of birth**              |       |       |       |       |
| 2007                           | 180   | 10.2  | 28375 | 10.4  |
| 2008                           | 243   | 13.8  | 29032 | 10.6  |
| 2009                           | 222   | 12.6  | 30153 | 11.0  |
| 2010                           | 192   | 10.9  | 29242 | 10.7  |
| 2011                           | 195   | 11.1  | 28983 | 10.6  |
| 2012                           | 193   | 11.0  | 28840 | 10.6  |
| 2013                           | 136   | 7.7   | 25242 | 9.2   |
| 2014                           | 149   | 8.5   | 25092 | 9.2   |
| 2015                           | 127   | 7.2   | 24328 | 8.9   |
| 2016                           | 120   | 6.8   | 23821 | 8.7   |
| **Birth order**                |       |       |       |       |
| First born                     | 557   | 31.7  | 93882 | 34.4  |
| Second born                    | 497   | 28.3  | 81326 | 29.8  |
| Third born                     | 334   | 19.0  | 51084 | 18.7  |
| Fourth born or later           | 369   | 21.0  | 46717 | 17.1  |
| Missing                        | 99    |       |       |       |
| **Plurality**                  |       |       |       |       |
| Multiple                       | 61    | 3.5   | 7409  | 2.7   |
| Singleton                      | 1696  | 96.5  | 265699| 97.3  |
| **Child sex**                  |       |       |       |       |
| Male                           | 912   | 51.9  | 139561 | 51.1 |
| Female                         | 845   | 48.1  | 133545| 48.9  |
| **County size where child was born a** |       |       |       |       |
| Large central metro            | 546   | 31.1  | 78540 | 28.8  |
| Large fringe metro             | 135   | 7.7   | 25553 | 9.4   |
| Medium metro                   | 247   | 14.1  | 39540 | 14.5  |
| Small metro                    | 448   | 25.5  | 70671 | 25.9  |
| Micropolitan                   | 195   | 11.1  | 32149 | 11.8  |
| Non-core                       | 186   | 10.6  | 26655 | 9.8   |
| **Maternal age at childbirth** |       |       |       |       |
| <=18                           | 68    | 3.9   | 8919  | 3.3   |
| 19-24                          | 772   | 43.9  | 118677| 43.5  |
| 25-29                          | 486   | 27.7  | 81042 | 29.7  |
| 30-34                          | 264   | 15.0  | 43932 | 16.1  |
| 35-39                          | 123   | 7.0   | 16847 | 6.2   |
| >=40                           | 44    | 2.5   | 3691  | 1.4   |
| **Maternal race**              |       |       |       |       |
| White                          | 736   | 71.3  | 196684| 72.0  |
| Black                          | 223   | 21.6  | 52398 | 19.2  |
| Asian                          | 49    | 4.7   | 17246 | 6.3   |
| Other                          | 24    | 2.3   | 6780  | 2.5   |
| **Hispanic ethnicity**         |       |       |       |       |
| Hispanic                       | 187   | 10.6  | 39819 | 14.6  |
|                                      | Non-Hispanic |   |   |   |
|--------------------------------------|--------------|---|---|---|
| **Mother foreign nativity**          |              |   |   |   |
| Yes                                  | 99           | 5.6| 27614 | 10.1 |
| No                                   | 1658         | 94.4| 245489 | 89.9 |
| Missing                              | -            | - | - | - |
| **Maternal education**               |              |   |   |   |
| <High school                         | 473          | 27.2| 59093 | 21.6 |
| Completed high school                | 826          | 47.4| 111017 | 40.6 |
| Some college                         | 349          | 20.0| 80407 | 29.4 |
| >= Completed college                 | 93           | 5.3| 20801 | 7.6 |
| Missing                              | 16           | 1706 | - | - |
| **Father presence on birth record**  |              |   |   |   |
| Yes                                  | 1521         | 86.6| 248063 | 90.8 |
| No                                   | 236          | 13.4| 25045 | 9.2 |
| **Caesarean delivery**               |              |   |   |   |
| Yes                                  | 436          | 26.3| 54366 | 20.8 |
| No                                   | 1220         | 73.7| 206608 | 79.2 |
| **Induced delivery**                 |              |   |   |   |
| Yes                                  | 498          | 28.4| 74963 | 27.5 |
| No                                   | 1254         | 71.6| 197925 | 72.5 |
| **Tobacco use during pregnancy**     |              |   |   |   |
| Yes                                  | 521          | 29.9| 72412 | 26.6 |
| No                                   | 1220         | 70.1| 199441 | 73.4 |
| **Gestational diabetes**             |              |   |   |   |
| Yes                                  | 123          | 7.0| 14985 | 5.5 |
| No                                   | 1634         | 93.0| 258123 | 94.5 |
| **Gestational hypertension**         |              |   |   |   |
| Yes                                  | 106          | 6.0| 13744 | 5.0 |
| No                                   | 1651         | 94.0| 259364 | 95.0 |
| **Prenatal care**                    |              |   |   |   |
| Yes                                  | 1241         | 72.8| 194549 | 73.4 |
| No                                   | 463          | 27.2| 70490 | 26.6 |

Cells with N<10 are suppressed

*a Based on National Center for Health Statistics 2013 Urban Rural Classification Scheme

*b Father presence on birth record determined by reported paternal age
Table 2 Occurrence and odds ratios of birth outcomes comparing infants born to mothers with and without intellectual and developmental disabilities in Wisconsin Medicaid, 2007-2016

|                      | Infants born to mothers with Intellectual and developmental disabilities | Infants born to mothers without intellectual and developmental disabilities | Unadjusted odds ratio<sup>a</sup> |
|----------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------|
|                      | N=1757                                                                   | N=273108                                                                    |                                  |
| **Gestational age**  |                                                                           |                                                                            |                                  |
| Preterm              |                                                                           |                                                                            |                                  |
| Preterm category     |                                                                           |                                                                            |                                  |
| <32 weeks            | 49                                                                        | 3819                                                                       | 1.60 1.4, 1.8                    |
| 32-34 weeks          | 61                                                                        | 6357                                                                       | 1.32 0.9, 1.9                    |
| 35-36 weeks          | 151                                                                       | 148561                                                                     | 1.54 1.4, 1.8                    |
| Term                 | 1488                                                                      | 247358                                                                     | REF                              |
| Missing              | -                                                                         | 721                                                                        |                                  |
| Mean, SD (weeks)     | 38.1                                                                      | 38.6                                                                       | 2.0                              |
| Median, IQR          | 39.0                                                                      | 39.0                                                                       | 2.0                              |
| **Birth weight**     |                                                                           |                                                                            |                                  |
| <2500 grams          | 251                                                                       | 22165                                                                      | 1.90 1.6, 2.2                    |
| ≥2500 grams          | 1501                                                                      | 250804                                                                     | REF                              |
| Missing              | -                                                                         | 137                                                                        |                                  |
| Mean, SD (grams)     | 3110.7                                                                    | 3263.3                                                                     | 589.8                            |
| Median, IQR          | 3175.0                                                                    | 3289.0                                                                     | 681.0                            |
| **Size for gestational age** |                                                                    |                                                                            |                                  |
| ≤5<sup>th</sup> percentile | 148                                                                       | 14912                                                                      | 1.62 1.3, 2.0                    |
| ≤10<sup>th</sup> percentile | 271                                                                       | 30348                                                                      | 1.47 1.3, 1.7                    |
| >10<sup>th</sup> percentile | 1477                                                                      | 242047                                                                     | REF                              |
| Missing              | -                                                                         | 729                                                                        |                                  |
| **Apgar 5-minute score** |                                                                     |                                                                            |                                  |
| 1-3                  | 29                                                                        | 1359                                                                       | 3.36 2.3, 5.0                    |
| 4-6                  | 44                                                                        | 4178                                                                       | 1.66 1.2, 2.3                    |
| 7-10                 | 1680                                                                      | 266858                                                                     | REF                              |
| Missing              | -                                                                         | 1248                                                                       |                                  |
|                      | 8.63                                                                      | 8.84                                                                       | 0.8                              |
|                          | Mean, SD | Median, IQR | Transfer to other medical facility | NICU admission<sup>b</sup> | Breastfed at discharge<sup>b</sup> | Infant death |
|--------------------------|----------|-------------|-----------------------------------|---------------------------|-------------------------------|--------------|
|                          |          |             | Yes                               | Yes                       | Yes                           | Yes          |
|                          |          |             | 144                               | 133                       | 479                           | 62           |
|                          |          |             | 8.5                               | 14.6                      | 57.7                          | 3.5          |
|                          |          |             | 10625                             | 13723                     | 99745                         | 1959         |
|                          |          |             | 3.9                               | 8.7                       | 69.7                          | 0.7          |
|                          |          |             | 2.48                              | 1.79                      | 0.57                          | 5.14         |
|                          |          |             | 2.1, 3.0                          | 1.5, 2.2                  | 0.5, 0.7                      | 3.9, 6.7     |
|                          |          |             | No                                | No                        | No                            | No           |
|                          |          |             | 1550                              | 781                       | 351                           | 1657         |
|                          |          |             | 91.5                              | 85.5                      | 42.3                          | 96.5         |
|                          |          |             | 260126                            | 142354                    | 43416                         | 271149       |
|                          |          |             | 95.5                              | 91.2                      | 30.3                          | 99.3         |
|                          |          |             | REF                               | REF                       | REF                           | REF          |
|                          |          |             |                                   |                           |                               |              |

SD: standard deviation, IQR: interquartile range, NICU: neonatal intensive care unit, CI: confidence interval, REF: reference

<sup>a</sup> Unadjusted odds ratios clustered by mother
<sup>b</sup> NICU admission and breast fed at discharge only for years 2011-2016; N=155252

Bold indicates statistical significance at an alpha=0.05 level.
Cells with values <10 are suppressed

Figure 1 Odds ratios for prevalent infant birth outcomes comparing children born to mothers with and without intellectual disabilities in Wisconsin Medicaid, 2007-2016

Demographics: maternal race, categorized age, Hispanic ethnicity, geographic county size of birth county, father’s information on birth record, birth year
Maternal health care use and pregnancy complications: Prenatal care in the first trimester, gestational hypertension, gestational diabetes, caesarean delivery, induction, parity, tobacco use during pregnancy
NICU admission and breastfed at discharge for 2011-2016 births only
All odds ratios clustered by mother
Table 3 Occurrence and odds ratios for birth outcomes comparing infants born to mothers with and without intellectual and developmental disabilities in Wisconsin Medicaid 2007-2016, by intellectual and developmental disability subtype

|                      | Intellectual disability N=552 | Genetic condition N=777 | Cerebral Palsy N=279 | Autism N=156 |
|----------------------|-------------------------------|-------------------------|-----------------------|--------------|
|                      | N %  OR 95% CI                | N %  OR 95% CI          | N %  OR 95% CI        | N %  OR 95% CI |
| **Gestational age**  |                               |                         |                       |              |
| Preterm              | 85 15.5 1.78 1.4, 2.3         | 111 14.3 1.70 1.4, 2.1 | 51 18.5 2.06 1.4, 3.0 | 23 14.9 1.72 1.1, 2.8 |
| Term                 | 464 84.5 85.7                 | 666 85.7 81.5           | 225 81.5 131 85.1    |              |
| Mean, SD             | 38.2 2.5                      | 38.1 2.3                | 37.8 3.2              | 38.4 2.2     |
| Median, IQR          | 39.0 2.0                      | 39.0 2.0                | 39.0 2.0              | 39.0 2.0     |
| **Birth weight**     |                               |                         |                       |              |
| <2500 grams          | 77 14.0 1.87 1.4, 2.5         | 117 15.1 2.05 1.6, 2.6 | 43 15.5 1.95 1.3, 2.9 | 17 11.1 1.36 0.8, 2.4 |
| >=2500 grams         | 475 86.0 660 84.9             | 234 84.5 136 88.9      |                       |              |
| Mean, SD             | 3089.9 681.3                  | 3134.6 666.6            | 3039.9 732.8          | 3209.8 563.4 |
| Median, IQR          | 3118.0 716.5                  | 3430.0 744.0            | 3119.0 707.0          | 3260.0 656.0 |
| **Size for gestational age** |                   |                         |                       |              |
| ≤5<sup>th</sup> percentile | 50 9.1 1.81 1.3, 2.4       | 71 9.1 1.74 1.3, 2.3   | 18 6.5 1.20 0.7, 2.1 | 11 7.2 1.31 0.6, 2.7 |
| ≤10<sup>th</sup> percentile | 92 16.8 1.64 1.3, 2.1     | 114 14.7 1.39 1.1, 1.7 | 45 16.3 1.52 1.0, 2.2 | 22 14.4 1.32 0.8, 2.2 |
| >10<sup>th</sup> percentile | 457 83.2 663 85.2           | 231 83.7 131 85.6      |                       |              |

SD: standard deviation, IQR: interquartile range; OR: odds ratio; CI: confidence interval
Missing values suppressed since cells <10
Odds ratios clustered by mother, unadjusted
