Supplementary Online Content

Clapp MA, James KE, Bates SV, Kaimal AJ. Patient and hospital factors associated with unexpected newborn complications among term neonates in US hospitals. *JAMA Netw Open.* 2020;3(2):e1919498. doi:10.1001/jamanetworkopen.2019.19498

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Severe Unexpected Newborn Complication Metric Approximation and Sensitivity Analyses

Severe Unexpected Newborn Complication Metric Approximation

Originally developed by the California Maternal Quality Care Collaborative, The Joint Commission adopted the Perinatal Quality Metric Unexpected Complications in Term Newborns (PC-06) in 2018.[1,2] The denominator for this metric is full term newborns without preexisting conditions, defined as singleton infants born at ≥37 weeks gestation with birth weights ≥2,500g without congenital malformation, exposure to maternal illicit drug use, or other pre-existing fetal conditions. The numerator for this metric is neonatal complication, stratified by severity (moderate or severe). Severe complications include death, transfer to another acute care facility, diagnosis codes for severe birth trauma, asphyxia, shock, respiratory complications, infection, and neurologic conditions. Moderate complications are mostly based on a combination of prolonged length of stay with less severe neonatal complication diagnosis codes. A full list of the diagnosis codes and conditions is found is available on the Joint Commission website.[1]

We approximated unexpected severe complications among term newborns using information available on the birth certificate. We focused on severe complications because, per the CMQCC documentation, "severe unexpected newborn complications is where most attention should be focused" and "severe unexpected newborn complications can be used as a balancing measure for QI efforts to reduce primary or NTSV cesarean birth rates."[2] In our analysis, the denominator was similar to the Joint Commission measure and defined as infants that were live born (5-minute Apgar >0), term (≥37 weeks gestation), singleton gestations, non-anomalous, and with birth weights ≥2,500 g. Births listed as or intended as extramural deliveries were also excluded. No information was available on maternal drug use. To calculate the numerator, diagnosis codes are not listed on the birth certificate; however, the 2003 version of the birth certificate does contain information on the occurrence of the following newborn complications: assisted ventilation required immediately following delivery, assisted ventilation required for more than 6 hours, neonatal intensive care unit (NICU) admission, use of surfactant replacement therapy, antibiotics received by the newborn for suspected neonatal sepsis, and seizure or serious neurologic dysfunction. Of these, we considered assisted ventilation >6 hours and seizure or serious neurologic dysfunction serious and unlikely to represent a false positive complication. In addition to these complications, we also considered 5-minute Apgar <3 as a severe complication, in accordance with other studies that studied significant neonatal complications.[3–6] Lastly, neonatal death and transfer to another facility were considered serious neonatal complications in line with the Joint Commission metric. A summary of the Joint Commission metric specifications and the data elements used from the birth certificate for this analysis are found in eTable 1.

The metric is applied only to infants that were born at the facility and excludes infants transferred in for care. The delivery institution completes the birth certificate record, which prevents outcomes the attribution of neonatal outcomes to accepting facilities in this data set.

Sensitivity Analyses

In the first sensitivity analysis, a fixed effect for state was added to the hierarchical models to adjust for any potential clustering effects among women or birth outcomes within a state.

Women with substance use disorder are an excluded population from the Joint Commission metric, as infants born to these mothers may experience withdrawal symptoms and require additional assistance after birth (i.e., a neonatal "complication" is not unexpected).

Information on illicit substance use exposure, such as opioids, is not captured on the birth certificate. As we were unable to specifically exclude these infants, the rates generated in this analysis may be higher in hospitals caring for more women with substance use disorders. As a sensitivity analysis, we excluded women with tobacco use, which is captured on the birth certificate. Up to 95% of pregnant women receiving medication-assisted treatment for opioid use disorder report having concurrent tobacco use.[7,8] Thus by excluding all tobacco users, we also likely exclude the vast majority of women with substance use disorders, who could be biasing the rate and variation estimates. The analyses described in the main text were performed in this population.

Furthermore, we were unable to distinguish the indications for neonatal transfer in this data set. A small percentage of women had the complication of “maternal transfer” (0.2%). In the primary analyses, all neonatal transfers were considered to be for neonatal indications (i.e., a neonate was not transferred to be with the mother after the mother was transferred to another facility). We compared hospital unexpected newborn complication rates including and excluding maternal transfers from the metric denominator to understand the degree to which neonatal transfers for non-neonatal indications could bias the results. The between-hospital variation and patient-level analyses were performed when maternal transfers were excluded.

The main analysis only included counties with one obstetric hospital as to study hospital-level variation. The maternal, delivery, and county characteristics of counties with only one obstetric hospital were compared to counties with more than one obstetric hospital. To demonstrate the generalizability of the findings to counties with more than one obstetric hospital, county-level variation in unexpected newborn complication rates including and excluding neonatal transfers from the metric numerator were compared. Between-county variation was calculated using the same mixed effects models as described in the primary analysis. Similarly, the patient-level analysis was performed to assess for the risk factors for unexpected neonatal complications in counties with more than one obstetric hospital.

eTable 1. Joint Commission Measure Approximation of Severe Unexpected Newborn Complication Using Birth Certificate Data Elements

	Joint Commission Measure	Birth Certificate Data Element
Criteria for severe neonatal complication	Death Transfer to another acute care facility ICD-10 diagnosis codes for: Severe birth trauma, hypoxia, shock, respiratory complications, infection, neurologic complications Length of stay > 4 days and ICD-10 code for sepsis	Neonatal demise Newborn transfer 5-minute Apgar ≤ 3 Newborn complications: assisted ventilation ≥ 6 hours, seizure / serious neurologic dysfunction
Denominator	Liveborn Singleton Birth weight ≥ 2,500 g No maternal illicit substance use	5-minute Apgar > 0 Singleton Birth weight ≥ 2,500 g *Sensitivity analysis – excluding maternal tobacco use

eTable 2. Adjusted Odds of Severe Unexpected Newborn Complication, Excluding Neonatal Transfer in the Metric Numerator, in the Patient-Level Analysis

	Characteristic	Fully Adjusted Odds Ratio (95% CI)	p-value
Maternal Characteristics	Maternal age (years)		
	<18	0.97 (0.84-1.11)	0.63
	18-24	*Reference*	
	25-29	0.97 (0.92-1.02)	0.18
	30-34	0.96 (0.91-1.01)	0.12
	35-39	0.99 (0.93-1.07)	0.87
	40+	1.10 (0.97-1.25)	0.12
	Maternal race		
	White	*Reference*	
	Black	1.07 (1.01-1.13)	0.03
	American Indian/Alaskan Native	0.90 (0.78-1.05)	0.19
	Asian or Pacific Islander	0.91 (0.81-1.01)	0.07
	Ethnicity		
	Hispanic	0.81 (0.76-0.86)	0.00
	Maternal education		
	Less than high school	0.97 (0.91-1.03)	0.36
	High school	*Reference*	
	Any post-secondary	0.95 (0.91-1.00)	0.04
	Payer at time of delivery		
	Private	*Reference*	
	Medicaid	1.14 (1.09-1.20)	0.00
	Self-pay	1.14 (1.01-1.28)	0.03
	Other	1.09 (0.99-1.20)	0.08
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	2.49 (2.21-2.80)	0.00
	Gestational	1.30 (1.21-1.39)	0.00
	Hypertension		
	Chronic	1.49 (1.34-1.66)	0.00
	Pregnancy-related	1.51 (1.41-1.61)	0.00
	Tobacco use	1.18 (1.12-1.25)	0.00
	Parity		
	Nulliparous	*Reference*	
	Multiparous	0.63 (0.61-0.66)	0.00
Delivery Characteristics	Gestational age at delivery (weeks)	0.95 (0.94-0.96)	0.00
	Delivery mode		
	Vaginal	*Reference*	
	Cesarean	2.36 (2.27-2.45)	0.00
	Induction of labor	0.99 (0.95-1.03)	0.51
	Birth weight (grams)	1.00 (1.00-1.00)	0.01
Hospital Characteristics	County delivery volume in sample	1.00 (1.00-1.00)	0.89
	Percent of Medicaid covered deliveries	0.76 (0.50-1.16)	0.20
	Percent of county population in rural areas	1.00 (1.00-1.00)	0.98
	Level of neonatal care		
	High	*Reference*	
	Low	1.05 (0.89-1.24)	0.58

The fully adjusted model accounted for the random effect of the hospital, the fixed effect of year, and for all covariates listed in the table. The references for the maternal comorbidities are women without those individual conditions. CI, confidence interval.

eTable 3. Adjusted Odds of Severe Unexpected Newborn Complication in Patient-Level Analysis in the Model Including a State-Level Fixed Effect

	Characteristic	Adjusted Odds Ratio (95% CI)	p-value
Maternal Characteristics	Maternal age (years)		
	<18	0.94 (0.85-1.05)	0.27
	18-24	*Reference*	
	25-29	1.02 (0.98-1.05)	0.3
	30-34	1.03 (0.99-1.07)	0.16
	35-39	1.06 (1.01-1.11)	0.03
	40+	1.21 (1.10-1.32)	<0.01
	Maternal race		
	White	*Reference*	
	Black	0.98 (0.94-1.02)	0.37
	American Indian/Alaskan Native	0.93 (0.83-1.03)	0.17
	Asian or Pacific Islander	0.84 (0.77-0.91)	<0.01
	Ethnicity		
	Hispanic	0.76 (0.73-0.80)	<0.01
	Maternal education		
	Less than high school	1.02 (0.97-1.06)	0.44
	High school	*Reference*	
	Any post-secondary	0.93 (0.90-0.96)	<0.01
	Payer at time of delivery		
	Private	*Reference*	
	Medicaid	1.17 (1.13-1.21)	<0.01
	Self-pay	1.26 (1.16-1.36)	<0.01
	Other	1.12 (1.04-1.20)	<0.01
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	2.97 (2.73-3.24)	<0.01
	Gestational	1.36 (1.29-1.43)	<0.01
	Hypertension		
	Chronic	1.47 (1.35-1.59)	<0.01
	Pregnancy-related	1.51 (1.44-1.59)	<0.01
	Tobacco use	1.31 (1.26-1.36)	<0.01
	Parity		
	Nulliparous	*Reference*	
	Multiparous	0.70 (0.68-0.72)	<0.01
Delivery Characteristics	Gestational age at delivery (weeks)	0.94 (0.93-0.95)	<0.01
	Delivery mode		
	Vaginal	*Reference*	
	Cesarean	2.11 (2.05-2.16)	<0.01
	Induction of labor	0.90 (0.87-0.93)	<0.01
	Birth weight (grams)	1.00 (1.00-1.00)	0.08
Hospital Characteristics	County delivery volume in sample	1.00 (1.00-1.00)	<0.01
	Percent of Medicaid covered deliveries	1.39 (0.99-1.95)	0.06
	Percent of county population in rural areas	1.00 (1.00-1.00)	0.2
	Level of neonatal care		
	High	*Reference*	
	Low	1.45 (1.29-1.62)	<0.01

The adjusted model accounted for the random effect of the hospital, the fixed effects of the state and year, and for all covariates listed in the table. The references for the maternal comorbidities are women without those individual conditions. CI, confidence interval.

eTable 4. Adjusted Odds of Severe Unexpected Newborn Complication in Patient-Level Analysis Among Nonusers of Tobacco

	Characteristic	Adjusted Odds Ratio (95% CI)	p-value
Maternal Characteristics	Maternal age (years)		
	<18	0.94 (0.84-1.04)	0.25
	18-24	*Reference*	
	25-29	0.97 (0.93-1.01)	0.11
	30-34	0.97 (0.92-1.01)	0.12
	35-39	0.98 (0.93-1.04)	0.58
	40+	1.14 (1.04-1.26)	0.01
	Maternal race		
	White	*Reference*	
	Black	0.98 (0.93-1.03)	0.40
	American Indian/Alaskan Native	0.86 (0.76-0.98)	0.03
	Asian or Pacific Islander	0.86 (0.79-0.93)	<0.01
	Ethnicity		
	Hispanic	0.76 (0.72-0.80)	<0.01
	Maternal education		
	Less than high school	1.02 (0.97-1.07)	0.51
	High school	*Reference*	
	Any post-secondary	0.92 (0.88-0.95)	<0.01
	Payer at time of delivery		
	Private	*Reference*	
	Medicaid	1.13 (1.09-1.17)	<0.01
	Self-pay	1.18 (1.08-1.29)	<0.01
	Other	1.08 (1.00-1.17)	0.05
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	2.93 (2.67-3.22)	<0.01
	Gestational	1.38 (1.31-1.46)	<0.01
	Hypertension	*Reference*	
	Chronic	1.45 (1.32-1.58)	<0.01
	Pregnancy-related	1.52 (1.44-1.60)	<0.01
	Parity		
	Nulliparous	*Reference*	
	Multiparous	0.70 (0.67-0.72)	<0.01
Delivery Characteristics	Gestational age at delivery (weeks)	0.93 (0.92-0.94)	<0.01
	Delivery mode		
	Vaginal	*Reference*	
	Cesarean	2.19 (2.12-2.25)	<0.01
	Induction of labor	0.93 (0.90-0.96)	<0.01
	Birth weight (grams)	1.00 (1.00-1.00)	<0.01
Hospital Characteristics	County delivery volume in sample	1.00 (1.00-1.00)	<0.01
	Percent of Medicaid covered deliveries	0.94 (0.70-1.26)	0.68
	Percent of county population in rural areas	1.00 (1.00-1.01)	0.02
	Level of neonatal care		
	High	*Reference*	
	Low	1.52 (1.35-1.71)	<0.01

The adjusted model accounted for the random effect of the hospital, the fixed effect of year, and for all covariates listed in the table. The references for the maternal comorbidities are women without those individual conditions. CI, confidence interval.

eTable 5. Adjusted Odds of Severe Unexpected Newborn Complication in Patient-Level Analysis Excluding Maternal Transfers

	Characteristic	Adjusted Odds Ratio (95% CI)	p-value
Maternal Characteristics	Maternal age (years)		
	<18	0.94 (0.85-1.04)	0.23
	18-24	*Reference*	
	25-29	1.02 (0.98-1.06)	0.27
	30-34	1.03 (0.99-1.07)	0.12
	35-39	1.07 (1.01-1.12)	0.02
	40+	1.20 (1.09-1.32)	<0.01
	Maternal race		
	White	*Reference*	
	Black	0.97 (0.93-1.02)	0.25
	American Indian/Alaskan Native	0.92 (0.83-1.03)	0.17
	Asian or Pacific Islander	0.84 (0.77-0.92)	<0.01
	Ethnicity		
	Hispanic	0.77 (0.73-0.80)	<0.01
	Maternal education		
	Less than high school	1.02 (0.97-1.06)	0.46
	High school	*Reference*	
	Any post-secondary	0.93 (0.90-0.96)	<0.01
	Payer at time of delivery		
	Private	*Reference*	
	Medicaid	1.17 (1.13-1.21)	<0.01
	Self-pay	1.24 (1.14-1.34)	<0.01
	Other	1.11 (1.03-1.19)	0.01
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	2.98 (2.73-3.25)	<0.01
	Gestational	1.36 (1.29-1.43)	<0.01
	Hypertension		
	Chronic	1.47 (1.35-1.59)	<0.01
	Pregnancy-related	1.52 (1.45-1.59)	<0.01
	Tobacco use	1.31 (1.26-1.36)	<0.01
	Parity		
	Nulliparous	*Reference*	
	Multiparous	0.70 (0.68-0.72)	<0.01
Delivery Characteristics	Gestational age at delivery (weeks)	0.94 (0.93-0.95)	<0.01
	Delivery mode		
	Vaginal	*Reference*	
	Cesarean	2.10 (2.05-2.16)	<0.01
	Induction of labor	0.90 (0.87-0.93)	<0.01
	Birth weight (grams)	0.94 (0.93-0.95)	<0.01
Hospital Characteristics	County delivery volume in sample	1.00 (1.00-1.00)	<0.01
	Percent of Medicaid covered deliveries	0.92 (0.69-1.23)	0.56
	Percent of county population in rural areas	1.00 (1.00-1.01)	0.03
	Level of neonatal care		
	High	*Reference*	
	Low	1.55 (1.38-1.74)	<0.01

The adjusted model accounted for the random effect of the hospital, the fixed effect of year, and for all covariates listed in the table. The references for the maternal comorbidities are women without those individual conditions. CI, confidence interval.

eTable 6. Comparison on Maternal, Delivery, and Hospitals Characteristics Between Counties With 1 vs >1 Obstetric Hospital

	Characteristic	Counties with 1 hospital with obstetric beds (included in the analysis) n=1,754,852 N= 563	Counties with >1 hospital with obstetric beds (excluded in the analysis) n=7,163,084 N= 389
Maternal	Maternal age (years)		
	<18	29,489 (1.7%)	94,333 (1.3%)
	18-24	539,193 (30.7%)	1,627,989 (22.7%)
	25-29	551,920 (31.5%)	2,073,119 (28.9%)
	30-34	422,216 (24.1%)	2,107,597 (29.4%)
	35-39	177,659 (10.1%)	1,036,522 (14.5%)
	40+	34,375 (2.0%)	223,524 (3.1%)
	Maternal race		
	White	1,425,367 (81.2%)	5,312,591 (74.2%)
	Black	246,396 (14.0%)	1,145,839 (16.0%)
	American Indian/Alaskan Native	25,314 (1.4%)	63,724 (0.9%)
	Asian or Pacific Islander	57,775 (3.3%)	640,930 (8.9%)
	Ethnicity		
	Hispanic	246,262 (14.0%)	1,924,916 (26.9%)
	Missing	6,485 (0.4%)	68,288 (1.0%)
	Maternal education		
	Less than high school	236,509 (13.5%)	928,917 (13.0%)
	High school	504,823 (28.8%)	1,667,382 (23.3%)
	Any post-secondary	1,002,600 (57.1%)	4,462,590 (62.3%)
	Missing	10,920 (0.6%)	104,195 (1.5%)
	Payer at time of delivery		
	Medicaid	794,381 (45.3%)	2,924,195 (40.8%)
	Private	812,711 (46.3%)	3,682,735 (51.4%)
	Self-pay	60,466 (3.4%)	24,2377 (3.4%)
	Other	77,170 (4.4%)	273,265 (3.8%)
	Missing	10,124 (0.6%)	40,512 (0.6%)
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	12,480 (0.7%)	51,372 (0.7%)
	Gestational	94,645 (5.4%)	422,062 (5.9%)
	Hypertension		
	Chronic	27,639 (1.6%)	100,321 (1.4%)
	Pregnancy-induced	91,963 (5.2%)	353,537 (4.9%)
	Tobacco use	203,069 (11.6%)	358,482 (5.0%)
	Missing	1,668 (0.1%)	3,987 (0.1%)
	Parity		
	Nulliparous	548,780 (31.3%)	2299,470 (32.1%)
	Multiparous	1,199,352 (68.3%)	4826,789 (67.4%)
	Missing	6,720 (0.4%)	36,825 (0.5%)
Delivery	Gestational age (wks), mean (sd)	39.3 (1.5)	39.3 (1.4)
	Delivery mode		
	Vaginal	1,254,846 (71.5%)	5,025,638 (70.2%)
	Cesarean	499,182 (28.4%)	2,135,563 (29.8%)
	Missing	824 (<0.1%)	1,883 (<0.1%)
	Induction of labor	519,719 (29.6%)	1,800,440 (25.1%)
	Missing	679 (<0.1%)	2,672 (<0.1%)
	Infant birth weight (grams), mean (sd)	3,412 (436)	3,406 (431)

	Missing	256 (<0.1%)	3,142 (<0.1%)
	Maternal transfer	3,101 (0.2%)	12,592 (0.2%)
	Missing	684 (<0.1%)	2,264 (<0.1%)
County	Average annual hospital delivery volume	2,043 (1,353, 3,508)	3,208 (1,527, 6,740)
	Percent of births covered by Medicaid	49.0 (37.2, 60.5)	40.8 (32.0, 51.2)
	Percent of county population in rural area	37.2 (24.2, 53.9)	13.5 (4.9, 27.0)
	Hospitals with NICU beds	209 (37.1%)	307 (78.9%)

All maternal and delivery characteristics are presented as number of deliveries (n (% of deliveries)), unless otherwise noted. County characteristics are presented as median (interquartile range) or n (%).
NICU, neonatal intensive care unit; sd, standard deviation.
P-values <0.001 for all comparisons. NICU, neonatal intensive care unit.

eTable 7. Comparison of Neonatal Complications Between Counties With 1 vs >1 Obstetric Hospital

	Deliveries in counties with 1 hospital with obstetric beds (included in the analysis) n=1,754,852	Deliveries in counties with >1 hospital with obstetric beds (excluded in the analysis) n=7,163,084	p-value
Neonatal complications	24,604 (1.4%)	719,21 (1.0%)	<0.001
Transfer	14,678 (0.8%)	32,201 (0.5%)	<0.001
Assisted ventilation ≥6 hours	8,259 (0.5%)	29,058 (0.4%)	<0.001
Seizure	627 (<0.1%)	1,563 (<0.1%)	<0.001
Neonatal death	1,035 (0.1%)	6,835 (0.1%)	<0.001
5-minute Apgar ≤3	4,365 (0.2%)	16,217 (0.2%)	<0.001
Missing	3,960 (0.2%)	10,480 (0.1%)	<0.001

All complication data are presented as n (% of deliveries).

eTable 8. Between-County Variation Estimations in Counties With >1 Obstetric Hospital

Model	Intraclass Correlation Coefficient (95% CI)
Year only	9.9% (8.7-11.3%)
Year, patient factors	9.4% (8.2-10.7%)
Year, patient, county factors	8.3% (7.2-9.5%)

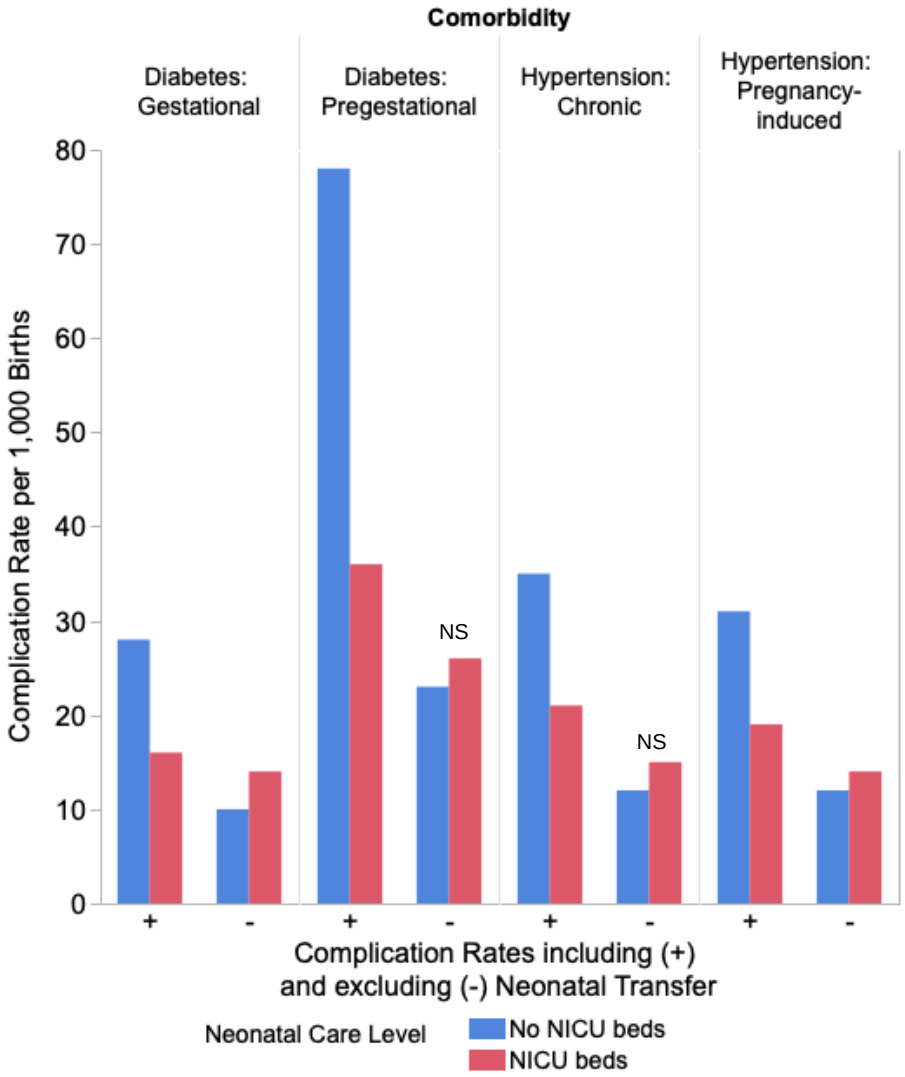
CI, confidence interval.

eTable 9. Adjusted Odds of Severe Unexpected Newborn Complication in the Patient-Level Analysis in Counties With >1 Obstetric Hospital

	Characteristic	Adjusted Odds Ratio (95% CI)	p-value
Maternal Characteristics	Maternal age (years)		
	<18	1.13 (1.06-1.20)	0.00
	18-24	*Reference*	
	25-29	0.98 (0.96-1.00)	0.09
	30-34	0.95 (0.92-0.97)	0.00
	35-39	0.97 (0.95-1.00)	0.06
	40+	1.06 (1.01-1.11)	0.02
	Maternal race		
	White	*Reference*	
	Black	1.06 (1.04-1.09)	0.00
	American Indian/Alaskan Native	1.05 (0.98-1.13)	0.19
	Asian or Pacific Islander	0.83 (0.80-0.86)	0.00
	Ethnicity		
	Hispanic	0.81 (0.79-0.83)	0.00
	Maternal education		
	Less than high school	1.03 (1.00-1.06)	0.02
	High school		
	Any post-secondary	0.93 (0.91-0.95)	0.00
	Payer at time of delivery		
	Private	*Reference*	
	Medicaid	1.21 (1.18-1.23)	0.00
	Self-pay	1.28 (1.22-1.33)	0.00
	Other	1.44 (1.39-1.50)	0.00
	Maternal comorbidities		
	Diabetes		
	Pre-gestational	2.70 (2.57-2.84)	0.00
	Gestational	1.36 (1.32-1.40)	0.00
	Hypertension		
	Chronic	1.53 (1.46-1.61)	0.00
	Pregnancy-related	1.50 (1.45-1.54)	0.00
	Tobacco use	1.38 (1.34-1.42)	0.00
	Parity		
	Nulliparous		
	Multiparous	0.67 (0.66-0.68)	0.00
Delivery Characteristics	Gestational age at delivery (weeks)	0.96 (0.95-0.96)	0.00
	Delivery mode		
	Vaginal	*Reference*	
	Cesarean	2.19 (2.16-2.22)	0.00
	Induction of labor	1.05 (1.03-1.06)	0.00
	Infant birth weight (grams)	1.00 (1.00-1.00)	0.00
Hospital Characteristics	Delivery volume	1.00 (1.00-1.00)	0.01
	Percent of Medicaid covered deliveries	0.67 (0.44-1.01)	0.06
	Percent of county population in rural areas	1.01 (1.00-1.01)	0.02
	Level of neonatal care		
	High	*Reference*	
	Low	1.30 (1.09-1.54)	0.00

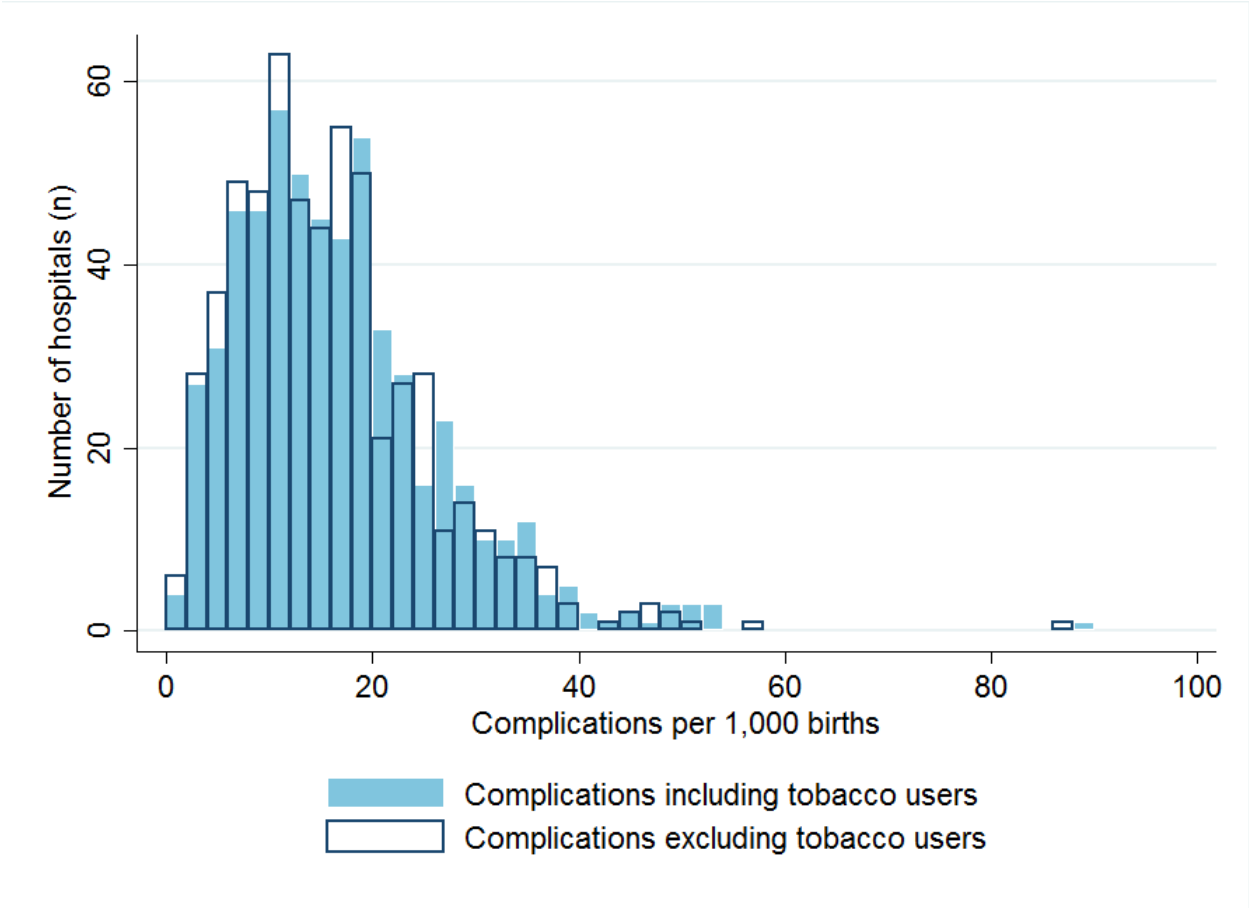
The adjusted model accounted for the random effect of the county, the fixed effect of year, and for all covariates listed in the table. The references for the maternal comorbidities are women without those individual conditions. CI, confidence interval.

eFigure 1. Comparison of Complication Rates (Including and Excluding Neonatal Transfers From the Metric Numerator) by Comorbidity and by Level of Neonatal Care



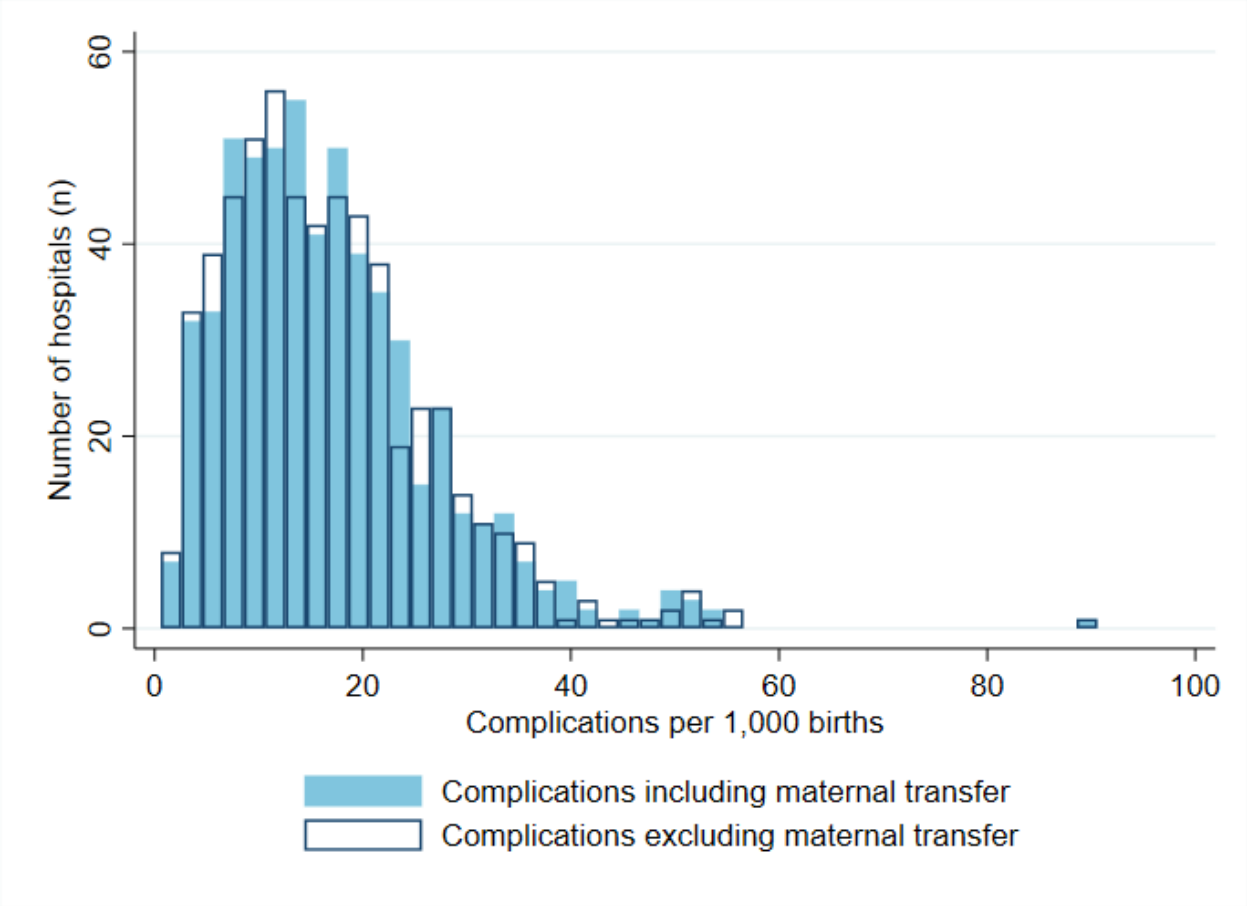
The unexpected newborn complication rates are shown by four comorbidities (gestational diabetes, pregestational diabetes, chronic hypertension, and pregnancy-induced hypertension). Among each comorbidity, the relationship between neonatal transfer and neonatal level of care is demonstrated. P-values for all comparisons are <0.001, expect where noted on the figure. “NS,” non-significant. NICU, neonatal intensive care unit.

eFigure 2. Distribution of Hospital Rates of Severe Unexpected Newborn Complications Among All Women and Among Nonusers of Tobacco



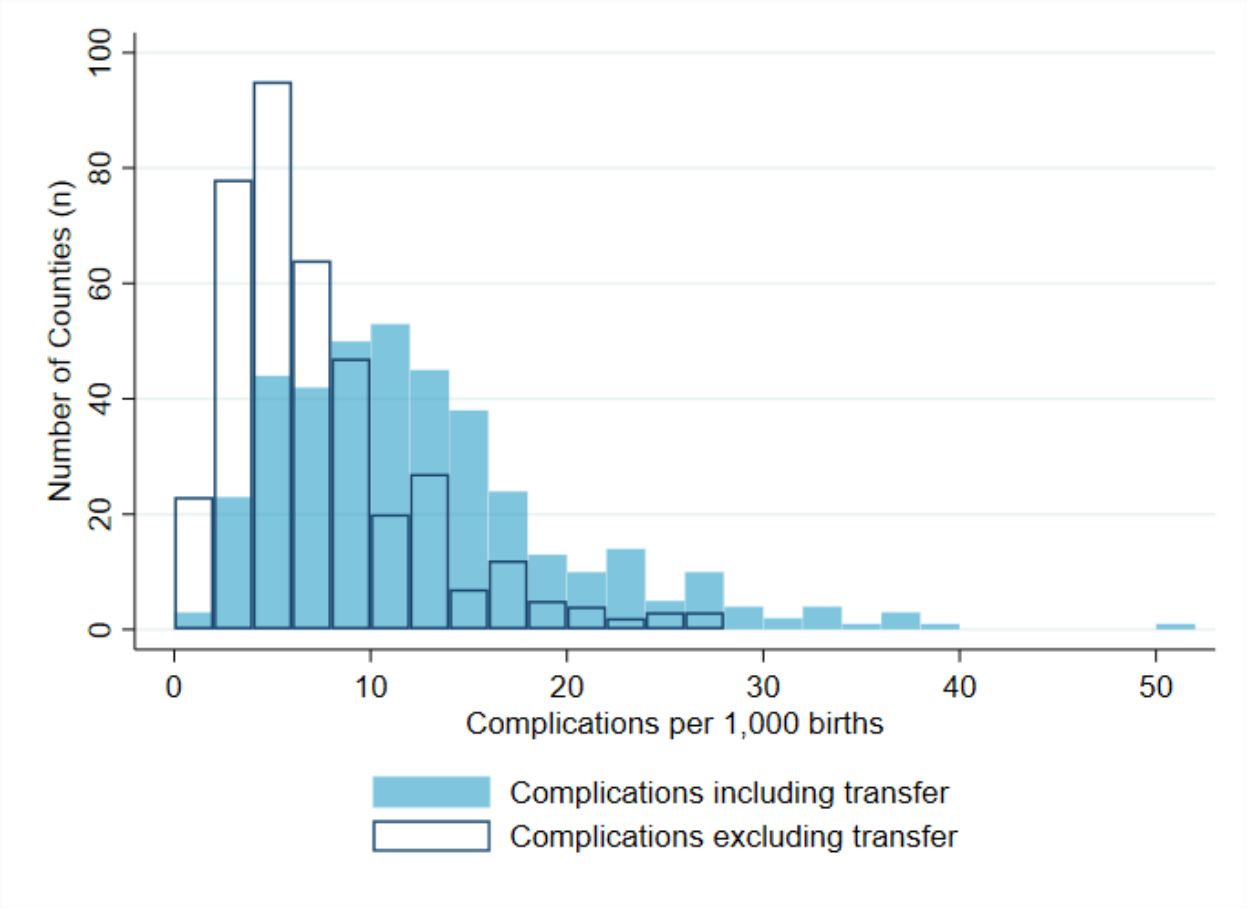
The light blue shaded bars represent the distribution of hospital rates of severe unexpected newborn complications, which includes infants born to tobacco users. The white bars with the dark outline show the distribution of hospital rates of severe unexpected newborn complications shifts when infants born to tobacco are excluded as means of also excluding the majority of illicit drug users.

eFigure 3. Distribution of Hospital Rates of Severe Unexpected Newborn Complications Including and Excluding Maternal Transfers From the Metric Denominator



The light blue shaded bars represent the distribution of hospital rates of severe unexpected newborn complications, which includes maternal transfers. The white bars with the dark outline show the distribution of hospital rates of severe unexpected newborn complications shifts when maternal transfers are excluded.

eFigure 4. Comparison of Distributions of Complication Rates Including and Excluding Transfer From the Metric Numerator Among Counties With >1 Obstetric Hospital



The light blue shaded bars represent the distribution of county rates of severe unexpected newborn complications, which includes neonatal transfer as a complication per the Joint Commission metric. The median and interquartile range (IQR) of the complication rate was 11.3 (7.1-15.7). The white bars with the dark blue outline show how the distribution of county rates of severe unexpected newborn complications shifts when neonatal transfers are excluded. The median and IQR excluding transfers was reduced to 6.0 (3.9-9.4).

eReferences.

1. The Joint Commission. Specifications Manual for Joint Commission National Quality Measures. Perinatal Care - PC-06 v2018B. https://manual.jointcommission.org/releases/TJC2018B/MIF0393.html. Accessed May 16, 2019.
2. California Maternal Quality Care Collaborative. Unexpected Complications in Term Newborns. https://www.cmqcc.org/focus-areas/quality-metrics/unexpected-complications-term-newborns. Accessed May 16, 2019.
3. Casey BM, McIntire DD, Leveno KJ. The continuing value of the Apgar score for the assessment of newborn infants. *N Engl J Med*. 2001;344(7):467-471. doi:10.1056/NEJM200102153440701
4. Iliodromiti S, Mackay DF, Smith GCS, Pell JP, Nelson SM. Apgar score and the risk of cause-specific infant mortality: a population-based cohort study. *Lancet Lond Engl*. 2014;384(9956):1749-1755. doi:10.1016/S0140-6736(14)61135-1
5. Tita ATN, Landon MB, Spong CY, et al. Timing of elective repeat cesarean delivery at term and neonatal outcomes. *N Engl J Med*. 2009;360(2):111-120. doi:10.1056/NEJMoa0803267
6. Grobman WA, Rice MM, Reddy UM, et al. Labor Induction versus Expectant Management in Low-Risk Nulliparous Women. *N Engl J Med*. 2018;379(6):513-523. doi:10.1056/NEJMoa1800566
7. Chisolm MS, Fitzsimons H, Leoutsakos J-MS, et al. A Comparison of Cigarette Smoking Profiles in Opioid-Dependent Pregnant Patients Receiving Methadone or Buprenorphine. *Nicotine Tob Res*. 2013;15(7):1297-1304. doi:10.1093/ntr/nts274
8. Akerman SC, Brunette MF, Green AI, Goodman DJ, Blunt HB, Heil SH. Treating Tobacco Use Disorder in Pregnant Women in Medication-Assisted Treatment for an Opioid Use Disorder: A Systematic Review. *J Subst Abuse Treat*. 2015;52:40-47. doi:10.1016/j.jsat.2014.12.002