



**A Multivariate Analysis of Adverse Pregnancy Outcomes
to Black non-Hispanic Mothers, 2005-2010**



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Our Vision – Healthy Kansans Living in Safe and Sustainable Environments

Our Mission – To protect and improve the health and environment of all Kansans

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Executive Summary

For many years, national and regional studies of birth outcomes in the United States have indicated that Black non-Hispanic mothers have elevated rates of adverse pregnancy outcomes relative to White non-Hispanic mothers. Various explanations for the differences have been proposed, most involving a large set of alleged risk factors, but none have been accepted as a full explanation of the phenomena.

For this study, a longitudinal dataset including all births to Kansas residents during the 2005-2010 period was assembled from the Kansas Vital Records database. Due to the relatively small size of the Black non-Hispanic population in Kansas, it was recognized that statistically reliable comparisons were possible only for the most common adverse outcomes, so low birth weight or prematurity was selected for analysis rather than a less common adverse outcome such as congenital anomalies or infant mortality. For each population group, a likelihood ratio was computed to determine whether a given risk factor was associated with an increased incidence of low birth weight or prematurity. Likelihood ratios for Black non-Hispanics were then compared to those for White non-Hispanics to determine whether the risk factor had a greater impact on Black non-Hispanics than on White non-Hispanics.

Our analyses confirmed that Kansas Black non-Hispanic mothers are 1.6 times more likely to experience a low birth weight or premature birth than Kansas White non-Hispanic mothers. The same risk factors were found to be associated with low birth weight or prematurity for both population groups. However, almost all individual risk factors had a greater impact on White non-Hispanic mothers than on Black non-Hispanic mothers – Black non-Hispanic mothers with the risk factor were less likely to experience a low birth weight or premature birth than were White non-Hispanic mothers with the same risk factor. This difference was only partially offset by the fact that Black non-Hispanic mothers were 1.2 times more likely than White non-Hispanic mothers to have one of the risk factors. Higher low birth weight or prematurity rates for Black non-Hispanic mothers were largely due to a much higher base rate: Black non-Hispanic mothers

without any of the major medical risk factors were still 1.8 times more likely to deliver a low birth weight or premature infant than White non-Hispanic mothers.

Introduction

The Kansas Annual Summary of Vital Statistics indicates that Black non-Hispanic (NH) resident mothers are much more likely to suffer negative pregnancy outcomes than White NH mothers. For example, infant death rates for Black NH mothers have been more than twice those for White NH mothers for all but two of the past twenty years. Furthermore, the rate of low birth weights (under 2500 grams) to Black NH mothers is also twice that for White NH mothers.

The persistence of such disparities is a challenge to the guiding mission of the Kansas Department of Health and Environment (KDHE), “To protect and improve the health and environment of *all* Kansans.” (Emphasis added.)

The analyses that follow will indicate the major disparities in birth outcomes between population groups, attempt to account for those disparities by evaluating the impact of the risk factors most frequently cited in the literature, and discuss any residual disparities not accounted for by the risk factors.

Background

Racial disparities in birth outcomes in the United States have been noted for many years. Since Black non-Hispanic mothers are more likely to be poor than White non-Hispanic mothers, socio-economic factors have often been considered to be a major contributor to racial disparities in birth outcomes. [1] [2]

Poverty is frequently associated with lower access to health care. America’s Community Health Centers (CHCs) were established during the 1960s to address this issue by serving as primary care providers for underserved populations in both inner-city and rural areas. One of the services provided by CHCs has been prenatal care for expectant mothers. [3]

Starting in 1984 a series of Federally mandated expansions of state Medicaid programs for pregnant women were implemented to increase financial access to prenatal care for low income and near poor women. However, by 1994 research literature began to suggest that pre-natal care did not provide all the anticipated benefits, and that racial disparities had not disappeared and had not been significantly reduced. [4]

In the succeeding years many studies were produced examining possible risk factors for adverse birth outcomes, but some researchers concluded that the risk factors did not adequately account for the disparities, whether taken individually or collectively. [5]

Methods

Plan of study

238,523 records of Kansas resident singleton births in the Kansas Vital Records Database for the years 2005–2010 were analyzed to identify where disparities in birth outcomes between Black non-Hispanics and White non-Hispanics existed, and to determine the extent to which these disparities could be explained in terms of risk factors indicated in the national literature. The 2005-2010 period was selected because 2005 was the year Kansas implemented the 2003 Revision of the standard birth certificate and a new version of the Vital Records Database. The large sample size led to tighter confidence intervals in rate calculations, making more rate differences between population groups statistically significant.

Variables selected for study

Over the past thirty years, studies on adverse birth outcomes have identified many indicators that should be considered for inclusion in any further analyses. Many, but not all, of these indicators are provided on the standard birth certificate. [6] [7] [8] [9] [10]

The indicators included in this study may be classified in three groups: adverse pregnancy outcomes, maternal risk factors, and maternal demographic factors. Some indicators fit in more than one category: for instance, pregnancy-induced diabetes or hypertension are negative outcomes for the mother, but are risk factors for the infant. Several indicators listed are composites, including one or more items from a particular section of the Kansas birth certificate. For details see the Definitions listed in the Appendix at the end of this document.

Adverse pregnancy outcomes: Low birth weight or prematurity, pregnancy-induced diabetes or hypertension, abnormal conditions of newborn, dangerous onset of labor, low APGAR score, dangerous course of labor and delivery, congenital anomalies, and maternal morbidities.

Maternal risk factors: hypertension, infertility treatment, diabetes, inadequate prenatal care, infections during pregnancy, vaginal bleeding during pregnancy prior to labor, smoking during pregnancy, BMI outside normal range, alcohol use during pregnancy, previous pre-term birth, short birth interval, and previous delivery by cesarean section.

Maternal demographic factors: population group, residence (rural/urban), age, country of origin, marital status, source of payment for delivery, and education.

Statistical concepts used

1. Rate: The percent of a population group that experienced a given outcome, or had some risk factor.
2. Likelihood ratio: The ratio of the rate an event occurs in one population to the rate it occurs in another population. For example, if an event happens to 25 percent of group A, but to 50 percent of group B, then one can say that group B is twice as likely (50 percent divided by 25 percent) to experience the event than group A.

3. Logistic regression: A form of regression analysis used to model the outcome of a binary (yes/no) variable based on one or more predictor variables. When more than one predictor variable is used, the odds ratio calculated for each is adjusted for the presence of the other, and is called an adjusted odds ratio. (An odds ratio is the ratio of the odds of an event occurring in one group to the odds of it occurring in another group. What is normally given as the odds ratio is the natural logarithm of this ratio.) Earlier analyses of disparities in Kansas birth outcomes using logistic regression may be found in the work of V. James Guillory. [11]

Results

General characteristics of the 2005–2010 dataset

Of the 238,523 singleton births during the 2005-2010 period, 170,898 (71.6%) were to White non-Hispanic mothers, 16,301 (6.8%) were to Black non-Hispanic mothers, 38,530 (16.2%) were to Hispanic mothers, and the remaining 12,965 (5.4%) were to mothers of some other population group or of unknown population group. Most mothers were in the 18-34 age-group, but 24,727 (10.4%) were under 20 years of age (of whom 7,249 or 3.0% were under 18 years of age), and 25,353 (10.6%) were 35 years of age or older.

Adverse pregnancy outcomes were not rare: there were 55,907 (23.4%) singleton deliveries with adverse outcomes for either mother or infant. The most common adverse outcomes were low birth weight or premature infants (22,638, or 9.5%), infants with abnormal conditions (17,698, or 7.4%), mothers with pre-eclampsia, eclampsia or gestational diabetes (17,479, or 7.3%), infants with congenital anomalies (4,021, or 1.7%), and mothers with other morbidities associated with labor and delivery (3,980, or 1.7%). (Note: since more than one adverse outcome can be associated with any given pregnancy, the sum of the number of specific adverse outcomes is greater than the number of deliveries with any adverse outcome.)

The risk factors for adverse birth outcomes, especially for low birth weight, were present in over half of the pregnancies leading to a singleton birth—126,380 (53.0%) of the mothers involved had at least one of the risk factors. Approximately a fifth (52,363 or 22.0%) were either obese (pre-pregnancy BMI ≥ 30) or severely underweight (pre-pregnancy BMI < 16); 37,560 (15.7%) smoked at some point during the pregnancy; 33,496 (14.0%) received inadequate prenatal care; 31,697 (13.3%) delivered at a date less than eighteen months since a previous delivery; 11,386 (4.8%) had some form of hypertension (either pre-pregnancy hypertension, gestational hypertension, or eclampsia); 10,688 (4.5%) had some form of diabetes (either pre-pregnancy diabetes or gestational diabetes); 8,291 (3.5%) were treated for a sexually transmitted disease during pregnancy; 6,659 (2.8%) has at least one previous pre-term delivery; and 3,103 (1.3%) had vaginal bleeding during pregnancy.

Disparities between Black non-Hispanic and White non-Hispanic singleton birth outcomes

A simple population group analysis of adverse birth outcomes confirms that there are statistically significant differences between Black non-Hispanics and White non-Hispanics. Black non-Hispanic infants were 1.6 times more likely to be low birth weight or premature than White non-

Hispanic infants (14.9% vs. 9.1%). Black non-Hispanic infants were 1.3 times more likely to have congenital anomalies that can be detected soon after birth than White non-Hispanic infants (2.3% vs. 1.7%). Black non-Hispanic infants were 1.3 times more likely to have other abnormal conditions than White non-Hispanic infants (9.5% vs. 7.4%).

On the other hand, Black non-Hispanic mothers were 0.9 times less likely to have pregnancy-induced hypertension or diabetes than White non-Hispanic mothers (6.4% vs. 7.2%), and Black non-Hispanic mothers were 0.6 times less likely to have other morbidities associated with labor and delivery than White non-Hispanic mothers (1.1% vs. 1.7%).

The remainder of this analysis is devoted to disparities in low birth weight or prematurity. Congenital anomalies and “other maternal morbidities associated with labor and delivery” did not occur in large enough numbers for an analysis that introduced additional fields to retain statistical significance. “Other abnormal conditions of newborn” and pregnancy-induced hypertension or diabetes are categories combining disparate outcomes that individually are likely to have distinct contributing factors.

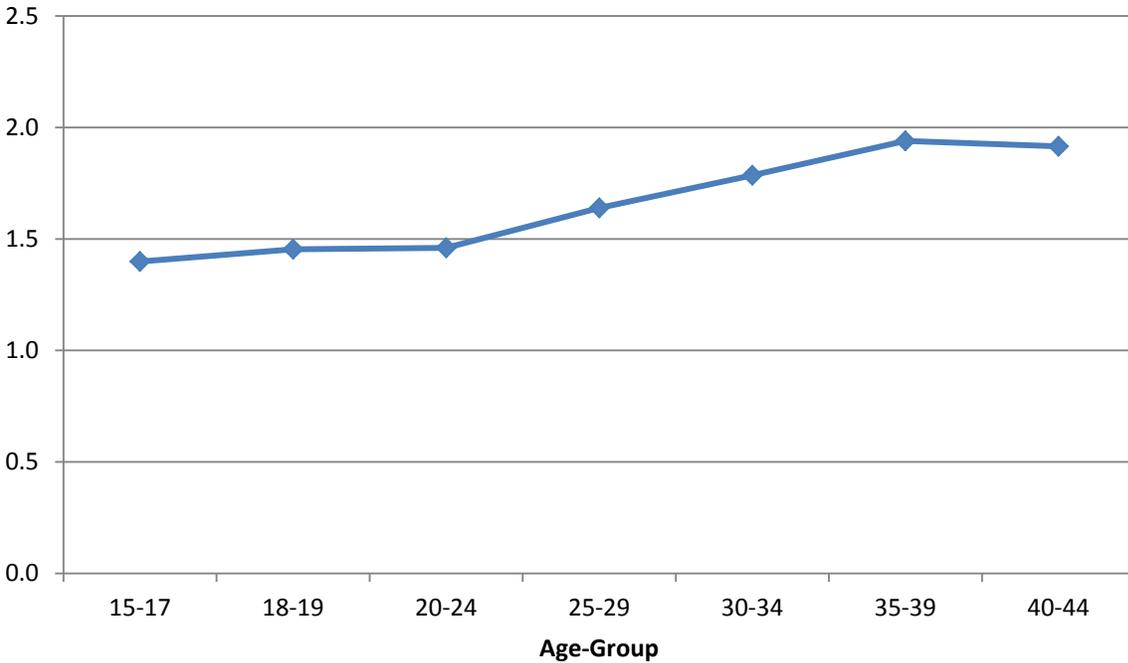
Factors contributing to low birth weight or prematurity in singleton births

Logistic Regression analyses of the relationships between low birth weight or prematurity outcomes and the most important risk factors show that the odds for Black non-Hispanic mothers of delivering a low birth weight or premature infant are 1.5 times the odds for White non-Hispanic mothers (see Table 1).

Table 1. Adjusted Odds Ratios (AORs) for Low Birth Weight or Prematurity Outcomes by Selected Risk Factors. Kansas Residents, 2005-2010.			
Risk Factor (1/0)	AOR	LCI	UCI
Previous pre-term birth (Y/N)	4.6	4.1	5.1
Vaginal bleeding during pregnancy (Y/N)	3.3	2.8	4.0
Hypertension (any form) (Y/N)	2.8	2.5	3.2
Congenital anomalies this delivery (Y/N)	1.9	1.6	2.4
Maternal infections this pregnancy (Y/N)	1.7	1.6	1.9
Smoking during pregnancy (Y/N)	1.7	1.6	1.8
Diabetes (any form) (Y/N)	1.6	1.4	1.8
Population group of mother (Black NH/White NH)	1.5	1.4	1.7
Short interval between pregnancies (Y/N)	1.4	1.3	1.5
Marital status (Y/N)	1.2	1.1	1.3
Previous cesarean delivery (Y/N)	1.1	1.0	1.2

Maternal age is not a contributing cause to the disparity between Black non-Hispanic mothers and White non-Hispanic mothers. Black non-Hispanic mothers were more likely to have a low birth weight or premature infant than White non-Hispanic mothers at every age (Figure 1).

**Figure 1. Likelihood of LBW/Prematurity in Singleton Births
Black non-Hispanics relative to White non-Hispanics,
Kansas Residents, 2005-2010**

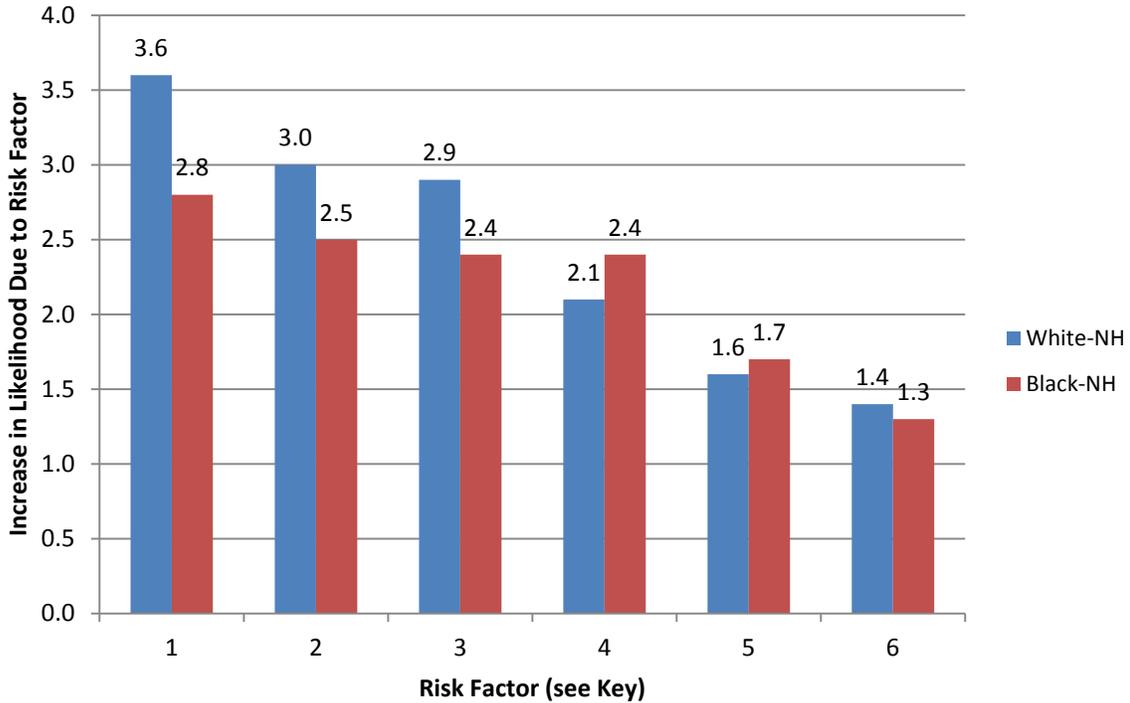


Part of the greater prevalence of low birth weight or prematurity among Black non-Hispanic mothers as compared to White non-Hispanic mothers may be due to the greater prevalence of the known risk factors for low birth weight or prematurity among Black non-Hispanic mothers. Black non-Hispanic mothers were 1.2 times more likely to have one of the major risk factors than White non-Hispanic mothers: 10,023 out of 16,301 (61.5%) live births to Black non-Hispanic mothers involved at least one of the risk factors, a greater proportion than the 86,240 out of 170,898 (50.5%) live births to White non-Hispanic mothers that involved one of the risk factors.

However, most risk factors had a weaker effect on Black non-Hispanic mothers than on White non-Hispanic mothers (Figures 2a, 2b and Tables 1a, 1b). For example, for White non-Hispanic mothers, pre-mature or low birth weight live births were 3.0 times more likely when some form with some form of maternal hypertension was reported, while for Black non-Hispanic mothers, this outcome was 2.5 times more likely if some form of maternal hypertension was reported.

The only important risk factors with a stronger effect on Black non-Hispanic mothers than on White non-Hispanic mothers were alcohol and tobacco use during pregnancy. For example, for Black non-Hispanic mothers pre-mature or low birth weight live births were 2.4 times more likely when the mother consumed alcohol during the pregnancy, but for White non-Hispanic mothers this outcome was 2.1 times more likely if the mother consumed alcohol during the pregnancy.

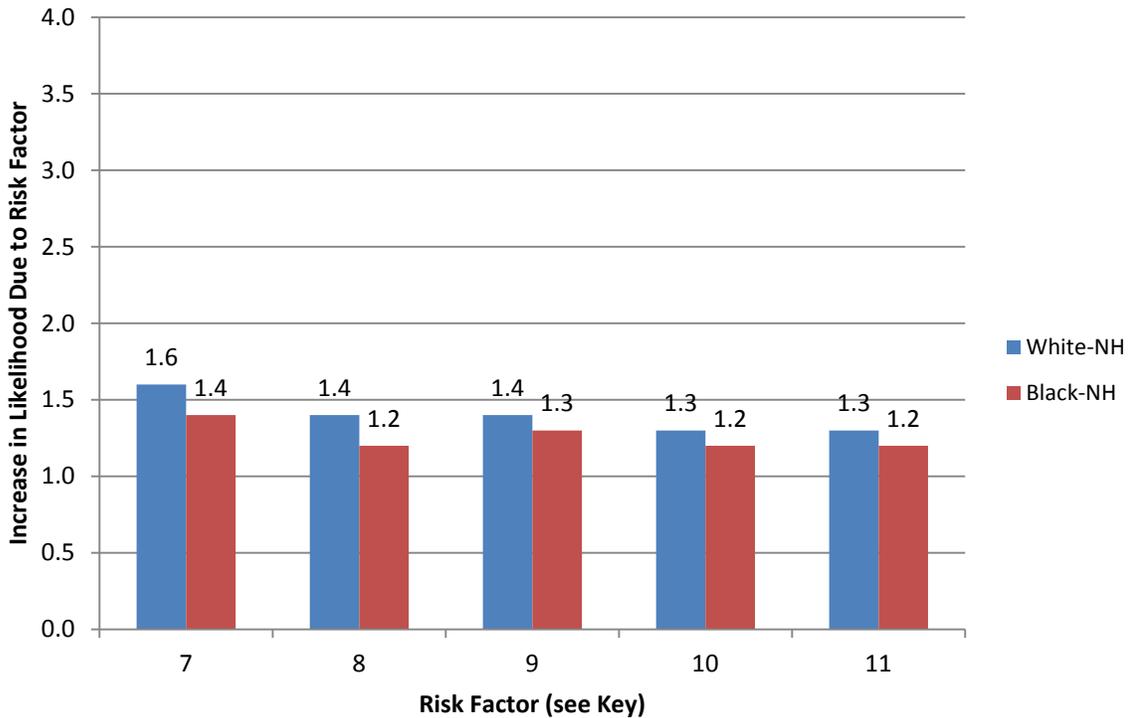
Figure 2a. Increased Likelihood of LBW/Prematurity by Risk Factor and Population Group, Kansas Resident Singleton Live Births, 2005-2010



Key for Figures 2a, 2b:

1. Mother had a previous pre-term delivery. Reference is no previous preterm delivery.
2. Maternal hypertension (any form). Reference is no maternal hypertension.
3. Vaginal bleeding during pregnancy. Reference is no vaginal bleeding during pregnancy.
4. Maternal alcohol consumption during pregnancy. Reference is no maternal alcohol during pregnancy.
5. Maternal smoking during pregnancy. Reference is no maternal smoking during pregnancy.
6. Birth spacing less than 18 months. Reference is birth spacing at least 18 months.
7. Maternal education less than high school diploma or GED. Reference is any college education (with or without degree).
8. Paternal education less than high school diploma or GED. Reference is any college education (with or without degree).
9. Maternal marital status. Reference is mother married.
10. Maternal education ended with high school education or GED. Reference is any college education (with or without degree).
11. Paternal education ended with high school or GED. Reference is any college education (with or without degree).

Figure 2b. Increased Likelihood of LBW/Prematurity by Risk Factor and Population Group, Kansas Resident Singleton Live Births, 2005-2010



Black non-Hispanic mothers gained more benefit from TRICARE (military insurance) than White non-Hispanic mothers. White non-Hispanic mothers with TRICARE were just as likely to have LBW/premature infants as White non-Hispanic mothers with private insurance (likelihood = 1.0), but Black non-Hispanic mothers with TRICARE were significantly less likely to have LBW/premature infants than Black non-Hispanic mothers with private insurance (likelihood = 0.7).

Black non-Hispanic mothers without any of the major medical risk factors were 1.8 times more likely to deliver a low birth weight or premature infant than White non-Hispanic mothers (11.4% vs. 6.4%). This residual disparity will not disappear if identified social risk factors (like education level or marital status) were also excluded, since the social risk factors also have less impact on low birth weight or pre-maturity for Black non-Hispanics than for White non-Hispanics (Figure 2b, Table 1b).

Discussion

Limitations

1) Several risk factors considered at the beginning of this project were excluded in the final analyses because the rate of LBW/prematurity for Black non-Hispanic mothers with the risk factor was not statistically distinguishable from the rate for Black non-Hispanic mothers without the risk factor. These factors did have statistically significant effects for White non-Hispanic

mothers. This was due to the Black non-Hispanics cohort being relatively small, resulting in wider confidence intervals and less likelihood of statistical significance. Risk factors with statistically significant impacts for White non-Hispanics but not for Black non-Hispanics included diabetes (any type), previous cesarean section, infertility treatment, sexually transmitted disease during pregnancy, inadequate prenatal care, and reliance on Medicaid as primary payer (Table 2).

2) All data used in the study were taken from the Kansas Birth Certificate, and could not directly account for risk factors not covered by that document, including factors like poverty and the mother's nutritional status.

3) This study could not address questions about the impact of racism on birth outcomes for Black non-Hispanic mothers because no information on that subject is collected for the Birth Certificate.

Topics for further study

Analyses similar to those in this report could be expanded to cover Hispanics, but the number of births in the 2005–2010 period for other population groups was too low to support statistically significant comparisons in most cases.

The analyses presented in this research summary indicate that a previous pre-term birth is the single strongest risk factor for a low birth weight or premature birth. An analysis of the incidence of low birth weight or prematurity in first births (nulliparity=0) might provide some explanation of what starts a sequence of low birth weight or premature live births, if the number of events is large enough to provide usable statistics.

Conclusions

Birth certificate data from the 2005–2010 period indicated the continued existence of disparities in birth outcomes between Black non-Hispanic and White non-Hispanic mothers, with Black non-Hispanics 1.6 times more likely to bear a premature or low birth weight infant.

Black non-Hispanic mothers were 1.2 times more likely than White non-Hispanic mothers to have one of the risk factors for low birth weight or prematurity identified in previous literature.

The same risk factors were associated with low birth weight or prematurity for both Black non-Hispanic and White non-Hispanic mothers, but in most cases a given risk factor increased the likelihood of low birth weight or prematurity more for White non-Hispanics than for Black non-Hispanics.

Removing all births with one or more of the major risk factors from the analysis dataset did not eliminate disparities between Black non-Hispanics and White non-Hispanics.

Further analysis of the underlying causes of higher rates of low birth weight or prematurity in the Black non-Hispanic population will probably require additional data that are not a part of the Kansas birth registration process.

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Detailed Tables and Appendix

Tables

1. Tables 1a, 1b. Increased Likelihood of Low Birth Weight or Prematurity by Selected Risk Factors and Population Group, for Kansas Resident Singleton Live Births, 2005-2010
2. Table 2. Risk factors for low birth weight and or prematurity excluded from discussion due to statistical insignificance for Black-non Hispanic mothers.

Appendix

1. Definitions

Table 1a. Increased Likelihood of Low Birth Weight or Prematurity by Selected Risk Factors and Population Group, for Kansas Resident Singleton Live Births, 2005-2010

Population Group	Count of Low Event	Total Births for Group	% with Low Outcome	Ratio to Reference Group
Risk Factor: Previous pre-term birth (PPTB)				
White-NH (no PPTB)	14,147	166,136	8.5	
White-NH (PPTB)	1,456	4,704	31.0	3.6
Black-NH (no PPTB)	2,167	15,628	13.9	
Black-NH (PPTB)	263	669	39.3	2.8
Risk Factor: Hypertension, any form (HYPE)				
White-NH (no HYPE)	13,441	162,171	8.3	
White-NH (HYPE)	2,162	8,669	24.9	3.0
Black-NH (no HYPE)	2,119	15,401	13.8	
Black-NH (HYPE)	311	896	34.7	2.5
Risk Factor: Vaginal bleeding during pregnancy (VBDP)				
White-NH (no VBDP)	14,992	168,453	8.9	
White-NH (VBDP)	611	2,387	25.6	2.9
Black-NH (no VBDP)	2,358	16,096	14.6	
Black-NH (VBDP)	72	201	35.8	2.4
Risk Factor: Maternal alcohol consumption during pregnancy (ALCO)				
White-NH (no ALCO)	15,521	170,408	9.1	
White-NH (ALCO)	82	432	19.0	2.1
Black-NH (no ALCO)	2,405	16,227	14.8	
Black-NH (ALCO)	25	70	35.7	2.4
Risk Factor: Maternal Smoking during pregnancy (SMOK)				
White-NH (no SMOK)	10,707	131,910	8.1	
White-NH (SMOK)	4,115	31,117	13.2	1.6
Black-NH (no SMOK)	1,717	12,952	13.3	
Black-NH (SMOK)	640	2,845	22.5	1.7
Risk Factor: Birth spacing less than 18 months (SBSP)				
White-NH (no SBSP)	6,952	86,929	8.0	
White-NH (SBSP)	2,507	22,915	10.9	1.4
Black-NH (no SBSP)	1,100	7,960	13.8	
Black-NH (SBSP)	520	2,799	18.6	1.3

Table 1b. Increased Likelihood of Low Birth Weight or Prematurity by Selected Risk Factors and Population Group, for Kansas Resident Singleton Live Births, 2005-2010

Population Group	Count of Low Event	Total Births for Group	% with Low Outcome	Ratio to Reference Group
Risk Factor: Mother has no HS diploma or GED (MHDP) (College is reference group)				
White-NH (no MHDP)	2,310	18,483	12.5	1.6
White-NH (MCOL)	8,964	111,780	8.0	
Black-NH (no MHDP)	646	3,661	17.6	1.4
Black-NH (MCOL)	853	6,687	12.8	
Risk Factor: Father has no HS diploma or GED (FHDP) (College is reference group)				
White-NH (no FHDP)	1,380	12,521	11.0	1.4
White-NH (FCOL)	7,334	94,542	7.8	
Black-NH (no FHDP)	370	2,803	13.2	1.2
Black-NH (FCOL)	748	6,768	11.1	
Risk Factor: Mother's Marital Status (MARR)				
White-NH (MARR)	9,694	119,166	8.1	
White-NH (no-MARR)	5,884	51,498	11.4	1.4
Black-NH (MARR)	521	4,305	12.1	
Black-NH (no-MARR)	1,904	11,974	15.9	1.3
Risk Factor: Mother has only HS diploma or GED (MHDP) (College is reference group)				
White-NH (MHDP)	4,147	38,911	10.7	1.3
White-NH (MCOL)	8,964	111,780	8.0	
Black-NH (MHDP)	899	5,810	15.5	1.2
Black-NH (MCOL)	853	6,687	12.8	
Risk Factor: Father has only HS diploma or GED (FHDP) (College is reference group)				
White-NH (FHDP)	4,047	40,147	10.1	1.3
White-NH (FCOL)	7,334	94,542	7.8	
Black-NH (FHDP)	845	6,247	13.5	1.2
Black-NH (FCOL)	748	6,768	11.1	

Table 2. Risk factors for low birth weight and or prematurity excluded from discussion due to statistical insignificance for Black-non Hispanic mothers.

	Low Events	Total Births	Rate	LCI	UCI	Relative Likelihood
Risk Factor: Diabetes, any form (DIAB). (No diabetes is reference.)						
White-NH (no DIAB)	14,569	163,839	8.9	8.7	9.0	
White-NH (DIAB)	1,034	7,001	14.8	13.8	15.7	1.7
Black-NH (no DIAB)	2,335	15,761	14.8	14.2	15.5	
Black-NH (DIAB)	95	536	17.7	13.9	21.6	1.2
Risk Factor: Payer is Medicaid (MDCD). (Private insurance is reference.)						
White-NH (PI)	7,756	99,725	7.8	7.6	8.0	
White-NH (MDCD)	4,848	42,264	11.5	11.1	11.8	1.5
Black-NH (PI)	472	3,643	13.0	11.7	14.2	
Black-NH (MDCD)	1,260	8,347	15.1	14.2	16.0	1.2
Risk Factor: Pregnancy involved infertility treatment (INFT). (No INFT is reference.)						
White-NH (no INFT)	15,413	169,365	9.1	9.0	9.3	
White-NH (INFT)	190	1,475	12.9	10.9	14.8	1.4
Black-NH (no INFT)	2,424	16,267	14.9	14.3	15.5	
Black-NH (INFT)	6	30	20.0	2.5	37.5	1.3
Risk Factor: Inadequate prenatal care (INPC). (Better than INPC is reference.)						
White-NH (no INPC)	12,177	142,554	8.5	8.4	8.7	
White-NH (INPC)	1,884	17,888	10.5	10.0	11.0	1.2
Black-NH (no INPC)	1,550	11,006	14.1	13.3	14.8	
Black-NH (INPC)	523	3,600	14.5	13.2	15.9	1.0
Risk Factor: STD during pregnancy (STD). (No STD is reference.)						
White-NH (no STD)	15,047	165,466	9.1	8.9	9.2	
White-NH (STD)	558	5,412	10.3	9.4	11.2	1.1
Black-NH (no STD)	2,259	15,097	15.0	14.3	15.6	
Black-NH (STD)	172	1,203	14.3	12.0	16.6	1.0
Risk Factor: Previous cesarean delivery (PCES). (No PCES is reference.)						
White-NH (no PCES)	13,545	150,237	9.0	8.9	9.2	
White-NH (PCES)	2,058	20,603	10.0	9.5	10.4	1.1
Black-NH (no PCES)	2,112	14,142	14.9	14.3	15.6	
Black-NH (PCES)	318	2,155	14.8	13.0	16.5	1.0

LCI = Lower Confidence Interval.

UCI = Upper Confidence Interval.

Highlighted confidence intervals in successive rows call attention to overlap, indicating that the difference in rates between the two rows is not statistically significant.

Appendix 1: Definitions

Abnormal conditions of newborn includes any of the items from Box 71 of the Kansas birth certificate: assisted ventilation required immediately following delivery, assisted ventilation required for more than six hours, NICU admission, newborn given surfactant replacement therapy, antibiotics received by the newborn for suspected neonatal sepsis, seizure or serious neurological dysfunction, significant birth injury (skeletal fracture(s), peripheral nerve injury, or soft tissue/solid organ hemorrhage which requires intervention)

Congenital anomalies includes any of the items in Box 74 of the Kansas birth certificate: anencephaly, meningomyelocele/spinal bifida, cyanotic congenital heart disease, congenital diaphragmatic hernia, omphalocele, gastroschisis, limb reduction defect, cleft lip with or without cleft palate, cleft palate, down syndrome, suspected chromosomal disorder.

Dangerous conditions of labor and delivery includes some, but not all, of the items in Box 68 of the Kansas birth certificate: steroids (glucocorticoids) for fetal lung maturation received by the mother prior to delivery, clinical chorioamnionitis diagnosed during labor of maternal temperature GE 38 C.

Dangerous onset of labor includes one of the items from Box 67 of the Kansas birth certificate: premature rupture of the membranes (prolonged, GE 12 hours).

Infections during pregnancy includes any of the items in Box 70 of the Kansas birth certificates, and refers mainly to sexually transmitted diseases: gonorrhea, syphilis, herpes simplex virus (HSV), chlamydia, hepatitis B, hepatitis C, AIDS or HIV.

Major medical risk factors is a subset of the risk factors, identified in the literature as particularly important. The components of this subset are: mother's pre-pregnancy BMI very low or very high, maternal smoking during pregnancy, maternal hypertension (pre-pregnancy, gestational, or eclampsia), maternal diabetes (pre-pregnancy or gestational), inadequate prenatal care, treatment for sexually transmitted diseases during pregnancy, short interval between pregnancies (under 18 months), a previous pre-term birth, and vaginal bleeding during pregnancy.

Maternal morbidities includes any of the items in Box 69 of the Kansas birth certificate: maternal transfusion, third or fourth degree perineal laceration, ruptured uterus, unplanned hysterectomy, admission to intensive care unit, unplanned operating room procedure following delivery.