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Maternal age, birth order, and race: differential effects on birthweight

Geeta K Swamy[1], **Sharon Edwards**[2], **Alan Gelfand**[3], **Sherman A James**[4], and **Marie Lynn Miranda**[2]

[1]Department of Obstetrics and Gynecology, Duke University Medical Center, Durham, North Carolina, USA

[2]Nicholas School of the Environment, Duke University, Durham, North Carolina, USA

[3]Department of Statistics, Duke University, Durham, North Carolina, USA

[4]Sanford Institute of Public Policy, Duke University, Durham, North Carolina, USA

Abstract

Background—Studies examining the influence of maternal age and birth order on birthweight have not effectively disentangled the relative contributions of each factor to birthweight, especially as they may differ by race.

Methods—A population-based, cross-sectional study of North Carolina births from 1999 to 2003 was performed. Analysis was restricted to 510 288 singleton births from 28 to 42 weeks' gestation with no congenital anomalies. Multivariable linear regression was used to model maternal age and birth order on birthweight, adjusting for infant sex, education, marital status, tobacco use and race.

Results—Mean birthweight was lower for non-Hispanic black individuals (NHB, 3166 g) compared with non-Hispanic white individuals (NHW, 3409 g) and Hispanic individuals (3348 g). Controlling for covariates, birthweight increased with maternal age until the early 30s. Race-specific modelling showed that the upper extremes of maternal age had a significant depressive effect on birthweight for NHW and NHB (35+ years, p<0.001), but only age less than 25 years was a significant contributor to lower birthweights for Hispanic individuals, p<0.0001. Among all racial subgroups, birth order had a greater influence on birthweight than maternal age, with the largest incremental increase from first to second births. Among NHB, birth order accounted for a smaller increment in birthweight than for NHW and Hispanic women.

Conclusion—Birth order exerts a greater influence on birthweight than maternal age, with signficantly different effects across racial subgroups.

Correspondence to. Dr Marie Lynn Miranda, Children's Environmental Health, Initiative, Nicholas School of the, Environment and Earth, Sciences, Box 90328, Durham, NC 27708, USA; mmiranda@duke.edu.

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One of the most persistent health disparities in America is the difference in birth outcomes between African-American and white women.[1–3] In 2007, compared with non-Hispanic white (NHW), non-Hispanic black (NHB) babies were twice as likely to be low birthweight (LBW) (13.8% vs 7.2%) and almost three times as likely to be very LBW (3.2% vs 1.2%).[4] The incidence of LBW is 13.8% for NHB, compared with 7.2% and 6.9% in NHW and Hispanic babies, respectively. The relative differences have remained fairly constant over the past few decades, narrowing only slightly due to an increase in white multifetal gestations.[5]

Maternal age and birth order, or parity, are important determinants of fetal growth and therefore birthweight. Advancing maternal age is associated with an increasing incidence of pre-existing and pregnancy-related medical complications, such as hypertension and diabetes, as well as genetic and congenital malformations in the offspring.[6–9] Increasing parity has been associated with increasing pre-pregnancy maternal weight, which has direct effects on maternal health and possibly birthweight.[1011] Furthermore, increasing parity implies having children in the home already, which could increase social and financial stress for families.[1213]

Early studies of birthweight from the 1950s to the 1970s demonstrated varied approaches, often assessed the contribution of maternal age and birth order separately, and had differing analytical results.[14–19] Assessing birth order only, Camilleri and Cremona[14] and James[17] found that birthweight increased with parity. Including both maternal age and birth order, Gebre-Medhin *et al*,[15] Gibson and McKeown[16] and O'Sullivan *et al*[19] found that birthweight increased with advancing age and birth order but the authors did not examine the relative contributions separately. Murphy and Mulcahy's[18] Irish study found birthweight increased with maternal age to 30–34 years and with parity through the fourth child. In a newer study, Seidman *et al*,[20] using the Jerusalem Perinatal Study, controlled for maternal age in multivariable analysis and found that birthweight increased with parity. In an analysis of women having at least 10 deliveries, Juntunen *et al*[21] found that parity was an independent determinant of birthweight even until the tenth delivery. More recently, Wilcox *et al*[22] examined 3457 British term births with no maternal complications and detected a 138 g increase in the mean crude birthweight from first to second pregnancy. Although they provide a good foundation, these studies are not necessarily applicable to our current understanding of maternal age, parity and birthweight as they were all conducted 10–60 years ago or outside of the USA.

While it is generally accepted that women have larger babies as they get older and as they have more children, it is unclear how this phenomenon manifests across racial and ethnic subgroups. The 'weathering hypothesis', proposed by Geronimus,[23] posits that the cumulative and interactive adverse effects of social inequality compound with age, leading to birth outcome disparities through young and middle adulthood. Investigations of weathering have shown that adverse outcomes increase with advancing maternal age at a particularly steep rate among NHB compared with NHW.[23–25] If this relationship is robust, we would expect that birthweight among NHB may increase at a slower rate or even decrease with advancing maternal age and parity, as black women 'weather' compared with NHW.

Weathering hypothesis analyses have varied from limitation to first births, separation of first and second births, and the inclusion of maternal medical conditions.[23–25] These analyses typically focus on the rates of LBW and prematurity rather than birthweight across the entire gestational age spectrum.[23–27] Analyses of birthweight-by-gestation distributions have shown that NHB infants are generally smaller than NHW for a given gestational age.[28–30] However, such analyses were descriptive in nature and failed to adjust for significant differences among the three groups (eg, maternal age, parity, education and medical complications). In addition, given the rapidly growing Hispanic population in the USA, and the observation that Hispanic rates of LBW and preterm birth are comparable to NHW, only recently has attention been paid to the evaluation of birthweight by gestation for Hispanic individuals.[31–33]

Given the historic increase in birthweight internationally, combined with the distinctly different racial composition and associated health disparities in the USA, re-examination of the influences of maternal age and birth order with special attention to racial differences is warranted.[33] We thus sought to determine how advancing maternal age and birth order individually and jointly influence birthweight and whether differential effects occur across racial subgroups.

METHODS

The North Carolina detailed birth record database contains extensive information on all documented live births in the State of North Carolina, including maternal age, birthweight, gestational age, plurality, maternal medical complications, congenital anomalies, tobacco and alcohol use, number of living children, number of children born alive and now dead and maternal and paternal demographic characteristics. Access to the data, as well as methods for receiving, storing, linking and analysing data and presenting results related to this study, were all governed by a research protocol (#1081) approved by Duke University’s institutional review board.

From 1999 to 2003, 579 594 live births occurred in North Carolina. In order to isolate the relative contributions of advancing maternal age and birth order on birthweight, we restricted our analysis to singleton births between 28 and 42 weeks’ gestational age. Maternal age was limited to 15–44 years and birth order was limited to the first to fourth births. Births with congenital anomalies were excluded. Self-reported maternal race and ethnicity were used to establish three distinct subgroups: NHW, NHB and Hispanic women. The following numbers of births were excluded from the dataset: 18 561 multifetal gestations, 4708 births less than 28 or over 42 weeks’ gestation, 1769 births to mothers under 15 or over 44 years of age, 16 508 births with birth order greater than four, 5287 births with congenital anomalies and 20 828 mothers of other racial subgroups. Among the 511 933 births meeting all inclusion criteria, 1645 observations with missing data for at least one covariate (infant sex, maternal education and maternal marital status, maternal smoking status) or birthweight less than 400 g were omitted from the analyses. Among the 510 288 remaining births, 326 761 were NHW, 122 351 were NHB and 61 176 were Hispanic. Twelve per cent of the Hispanic women in our study population were US born.

Multivariable linear regression modelling of birthweight as explained by maternal age and birth order was implemented on 510 288 births. Models were adjusted for infant sex, maternal education, maternal race, marital status, tobacco use and interaction terms for maternal age and birth order. Maternal age 25–29 years, first births, male infant sex, completed high school education, NHW and married served as the reference groups for all analyses. All analyses were conducted using SAS version 9.1.3 employing an α value of 0.01.

RESULTS

Table 1 describes maternal demographic characteristics and birth outcomes. The majority of subjects were NHW (64%) followed by NHB (24%) and Hispanic (12%). NHB and Hispanic women were more likely to be younger, have lower educational achievement and be unmarried than NHW women. The birth order distribution is roughly equivalent across all three racial/ethnic groups, although a greater portion of births to NHW women are first and second births and a smaller portion are third and fourth births compared with NHB and Hispanic women. Mean birthweight was less for NHB (3166 g) and Hispanic (3348 g) compared with NHW (3409 g) babies (joint comparison $p<0.0001$).

Detailed results of mean birthweight by maternal age and birth order are presented in table 2. Reading down the columns, birthweight for first-born infants increases with maternal age from 15 to 19 years to 25–29 years. It remains stable until 35–39 years when birthweight appears to decrease to the 40–44 year range. For second, third and fourth-born infants, birthweight increases with maternal age from 15 to 19 years to 30–34 years. Reading across the rows of table 2, birthweight increases appreciably from first to second births, with a relatively small incremental increase in the younger maternal age categories.

Figure 1A also graphically depicts mean birthweight by maternal age and birth order. Fourth births were excluded from the graph because of significant instability in the curve due to small individual cell sample sizes. Examination of the three curves clearly demonstrates that first births are generally smaller than both second and third births. The mean birthweight for first births is less than second births for all maternal ages greater than 18 years, with the fluctuation before 18 years of age likely to be due to the smaller number of second births in this category. In addition, the mean birthweight is less for first births than for third births for maternal age greater than 26 years. In contrast, the second and third births curves cross several times. Third births lie below second births at younger maternal ages (<33 years) and above at older ages (33–40 years), with greater variability after age 40 years.

Figures 1B–D further stratify maternal age, birth order and mean birthweight by racial subgroup. There are notable differences and similarities attributable to racial subgroups. For example, when comparing first and second births, the curves appear to diverge at age 19 years for Hispanic women and age 23 years for NHW and NHB women. This indicates that both the magnitude and the timing of the effect of maternal age on birthweight may occur disparately by race. However, the generalisation that second and third-born babies are usually ‘heavier’ than first-born babies holds true for all three race groups.

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Whereas figure 1 is informative, it fails to control for standard and well-documented covariates such as the sex of the infant, maternal education, maternal race, marital status and tobacco use. Table 3 presents the results of multivariable regression models of birthweight for the full sample and for racial subgroups, controlling for covariates. Parameter estimates can be interpreted as gram changes in birthweight. All covariates were significant predictors in the model. Male sex accounted for a 116 g increment in birthweight (p<0.0001). Unmarried mothers, on average, had offspring that were 43 g smaller (p<0.0001). Maternal education categories followed the expected dose–response pattern; ie, lower educational attainment was associated with lower birthweight (all p<0.0001). Tobacco use accounted for the largest decrement in birthweight of 226 g (p<0.001). Compared with the NHW referent group, Hispanic ethnicity and NHB race corresponded to 48 and 224 g decrements in birthweight, respectively (both p<0.0001).

Infants of mothers aged 15–19 years had weights indistinguishable from those of the 25–29 year reference group. Mothers in the 20–24 year age group had larger infants than 25–29-year-old mothers (p<0.0001). Mothers aged 30–34, 35–39 and 40–44 years had infants with significantly lower birthweights of 22, 66 and 114 g, respectively (both p<0.0001). This adjusted analysis confirms the descriptive results in figure 1: birthweight increases with maternal age, but only until the early-30s.

Second, third, and fourth births tended to produce significantly heavier infants weighing 115, 114 and 115 g more than first-born infants, respectively (all p<0.0001). Also, parity had a larger impact on birthweight compared with maternal age, as noted by the overall larger parameter estimates for birth order than maternal age categories.

The interaction term that crosses maternal age with birth order documents the dual influence of these two variables on birthweight. For example, for women in the 15–19 years age category, second birth order has an adverse effect on birthweight (p<0.0001), suggesting that the positive influence on birthweight of second birth order is mitigated by the negative influence of having a second child at such a young age (~80 g reduction). Whereas the interaction with third birth order is the same (~80 g reduction), fourth birth order for mothers aged 15–19 years was also negative but was not statistically significant. This is most likely due to the small number of births in this category (n=175).

For women in the 20–24 years age group, the interaction of age and any birth order category was associated with a significantly adverse effect on birthweight. In contrast, for mothers in the 30–34 year age group, the interaction of age and any birth order was associated with a statistically significant increase in birthweight. This suggests that beyond the maternal age and birth order influences in isolation, the combination of being 30–34 years old and being parous leads to estimated increases in birthweight of 16, 46 and 51 g, for second, third and fourth births, respectively. While the sizes of these coefficients are small, the interactive effects remain important. Similar patterns are seen for the 35–39 and 40–44 years age groups.

In order to examine how maternal age and birth order affect birthweight differentially across racial/ethnic lines, similar models of birthweight were constructed separately for NHW, NHB and Hispanic women, as shown in table 3. As in the full model, covariates of infant sex, maternal education, marital status and tobacco use were statistically significant in all three models. Whereas the parameter estimates cannot be directly contrasted across the models, the magnitude, relationship to other covariates and achievement of statistical significance within each individual model can be compared. For NHW mothers, age followed a pattern similar to the full model except for the 15–19 year age category, which had a positive and significant impact on birthweight. Whereas maternal age less than 30 years was not significant for NHB women, this was not the case for Hispanic women. The younger maternal age categories, 15–19 and 20–24 years, had a significant and negative effect on infant birthweight, whereas the older age categories were not statistically different from the 25–29-year-old referent group.

Parity was associated with an increase in birthweight among all three racial subgroups, with the largest incremental increase between first and second births (120, 101 and 103 g for NHW, NHB and Hispanic women, respectively). Note that parity has a smaller effect for NHB than for the other groups. Low maternal educational attainment and not being married have a larger depressive effect on birthweight among infants born to NHW women. High educational attainment has the largest positive effect on birthweight among infants born to NHB women.

The interaction terms of maternal age and birth order provide some interesting results. Having a second, third, or fourth child at maternal age 20–24 years magnified the negative effect on birthweight for infants born to NHW and NHB women, but not so for those born to Hispanic women. The interaction terms for Hispanic women were not significant for women aged 30–44 years. However, for NHW and NHB women, an increment to birthweight for women having second, third and fourth births while aged 30–34 years was observed for both groups. A similar pattern was observed for women aged 35–39 years.

DISCUSSION

Using a large population-level cohort of births from New Carolina, we examined the joint effects of maternal age and birth order on birthweight and how these effects vary across racial subpopulations. By restricting our analysis to singleton births without congenital anomalies, we were able to focus on the relative contribution of maternal age and parity in comparison with previous studies and also control for important maternal demographic and behavioural characteristics.

Graphical representation of mean birthweight by maternal age and parity demonstrates interesting relationships among the different curves. These key curve crossover points (26 years for first to third and 32 years for second to third) represent time points after which the interaction of maternal age and parity has a positive effect on birthweight. For example, women having a third birth in their early 30s compared with their early 20s are more likely to have adequate spacing between births. (The older women are also more likely to have achieved a more stable financial status.) As a result, both the maternal age component and parity component exert a positive influence on birthweight, with the not-so-surprising result that the joint influence is synergistic.

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Higher parity at younger maternal ages, particularly 15–19 year olds having their second or third birth, appears to have adverse effects on birthweight. Blankson *et al*[34] found that adolescents with an adverse outcome such as preterm birth or fetal growth restriction during their first pregnancy had a significantly increased risk of recurrence in their second pregnancy. This is especially troubling given that 30–50% of primiparous adolescents will have a second birth within 12–24 months.[35] In addition, pregnant adolescents often have additional risk factors that can affect birth outcomes, for example inadequate prenatal care, tobacco and substance use, single parenthood and ongoing reproductive development and maturation.[36]

While controlling for parity, we determined that birthweight increases with maternal age up to the early 30s but then tends to level off. The largest effect of parity on birthweight comes at the transition from first to second births when, on average, a 115 g incremental increase in birthweight was seen. The increases in birthweight from first to third or fourth births are statistically significant, but the incremental change with each subsequent birth is negligible (−1 and 0 g for third and fourth births, respectively). Therefore, both higher parity and advancing maternal age tend to increase birthweight, with the former effect larger than the latter.

Both the graphical displays and multivariable linear regression modelling results demonstrate that first births are clearly distinct from second, third and fourth births, regardless of racial subgroup. Other than at the extremes of age, first-born infants are generally smaller than infants of higher birth order, for reasons that are unclear. Studies of pregnancy outcomes often restrict analyses to first births, thus limiting the ability to evaluate any interactive effect of parity and maternal age. Our results underscore the importance of including and specifically addressing the contribution of parity in investigations of pregnancy outcomes.

The contributions of maternal age and birth order in our study sample notably differed by race. Parity, but not maternal age, strongly affected birthweight for Hispanic women, whereas both maternal age and birth order appreciably influenced infant birthweight for NHW and NHB women. The weathering hypothesis of Geronimus[23] originally focused on the accumulation of negative effects associated with advancing maternal age only. The contribution of higher parity on birth outcomes and birthweight could be an additionally important aspect of 'weathering'. In their examination of the contribution of maternal age to racial disparities in birthweight, Rauh and colleagues[24] analysed first and second births separately. They demonstrated that low birthweight did increase with advancing age at a steeper rate for NHB than for NHW; however, this was mostly explained by the increasing rates among first births only, whereas the rates of low birthweight remained relatively constant across maternal ages for both races. Although the mean birthweight did increase with both maternal age and parity for all race groups, our findings show that the increase in birthweight among NHB women is not as steep as the incremental increase for the other racial subgroups. Consistent with the ‘weathering’ hypothesis, it is thus plausible that the cumulative impact of social and economic adversity faced by NHB women has a collective effect on birthweight.

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Because our analysis utilised a cross-sectional dataset, we are not able to address how maternal age and parity affect birthweight within an individual mother. Furthermore, modelling of mean birthweight may diminish or obscure the importance of births with weights at the extremes, either very small or very large. Whereas differences in the prevalence of LBW by race are well known, less is known about the incidence of large-for-gestational age (LGA) or macrosomia by race.[4] We did examine the contribution of race to LGA (results not shown) and found that both Hispanic and NHB women had a lower risk compared with NHW women. Diabetes, a known contributor to LGA, was actually highest among NHB women and lowest among Hispanic women in our study population. Further research is warranted to determine why NHW women are at higher risk for delivering macrosomic infants.

Although we included mothers with medical conditions such as hypertension, diabetes and anaemia in our study population, we chose not to adjust for these as covariates in our analysis. Maternal medical conditions probably function as intermediate effects or outcomes of advancing maternal age and parity on birthweight, particularly given the varying prevalence of disease by race. Furthermore, maternal medical complications may not be reported accurately in birth certificate registries. An additional constraint of using birth record data for analysis is the lack of detailed socioeconomic measures such as employment status or individual/household income, making it difficult for us to examine the social patterning of maternal age. While we were limited to using maternal education and marital status as measures of social status, both factors were significant contributors to infant birthweight regardless of maternal racial group. Overall, our investigation provides an important insight into the significant racial disparities in pregnancy outcomes in the USA and identifies the need for additional analyses across the entire distribution of births.[4]

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What is already known on this subject

One of the most persistent and unexplained health disparities in the USA is the difference in birth outcomes. For example, LBW occurs among 13.8% of NHB births compared with 7.2% and 6.9% among NHW and Hispanic births, respectively. Maternal age and birth order are important determinants of birthweight. Birthweight has been shown to increase with advancing maternal age and birth order. However, studies thus far have not effectively disentangled the relative contributions of each factor to birthweight, especially as they may differ by race.

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What this study adds

We utilised a population-level birth cohort in the USA to examine how advancing maternal age and birth order individually and jointly influence birthweight and whether differential effects occur across racial subgroups. Birthweight increased with maternal age until the early 30s. In race-specific modelling, maternal age 35 years or greater had a significant depressive effect on birthweight for NHW and NHB, but only age less than 25 years was a significant contributor to LBW for Hispanic women. Overall, birth order had a greater influence on birthweight than maternal age, with the largest incremental increase from first to second births. However, birth order accounted for a smaller increment in birthweight for NHB than for NHW and Hispanic women. Our investigation provides a valuable insight into the significant racial disparities in birth outcomes in the USA and the importance of including and specifically addressing the contribution of birth order in future research.

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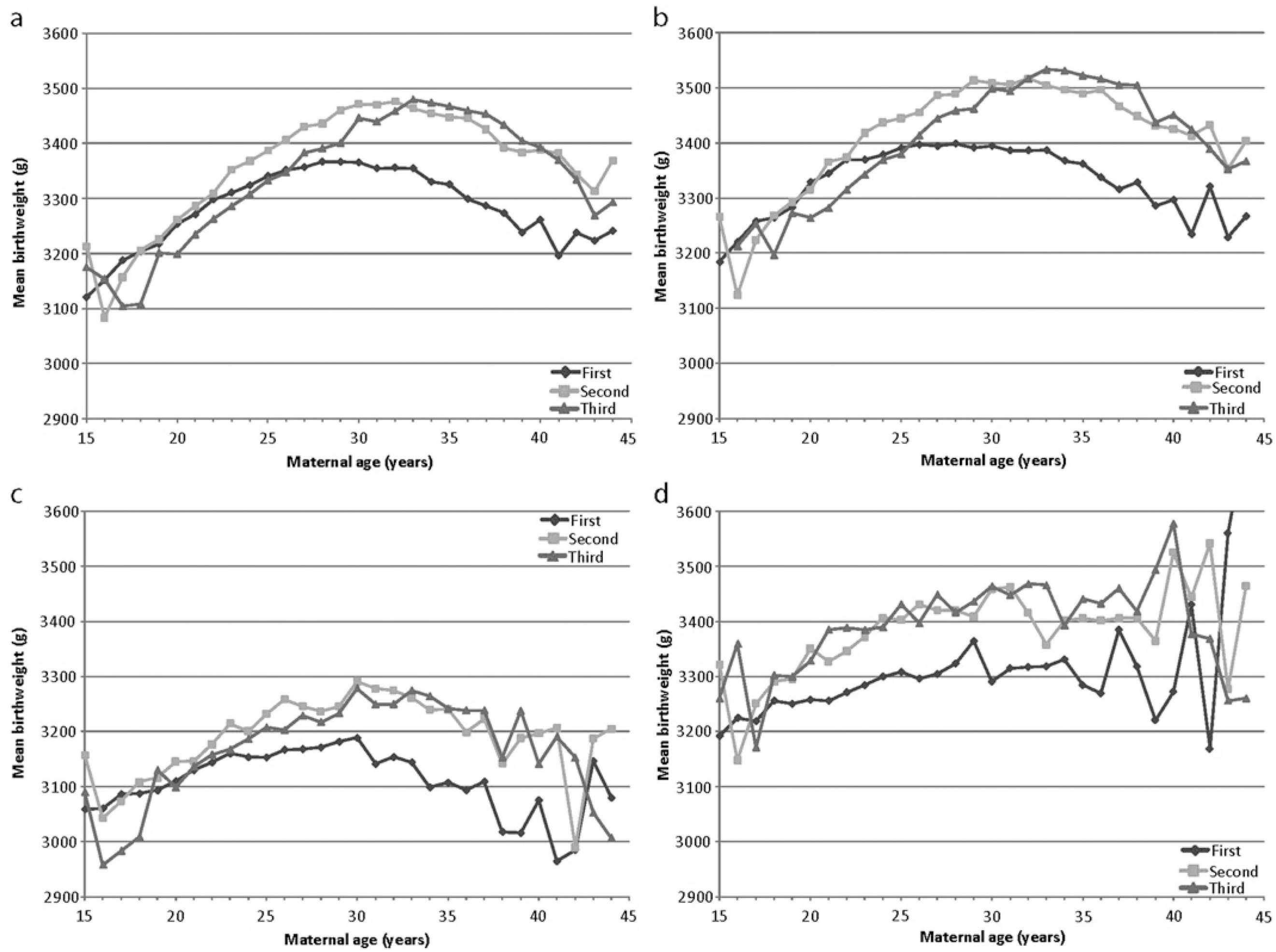

Figure 1.
Mean birthweight versus maternal age by parity for (A) all racial subgroups, (B) non-Hispanic (NH) white individuals only, (C) non-Hispanic black individuals only and (D) Hispanic individuals only.

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Table 1

Demographic characteristics by racial group

	All N=510 288 %	**NHW N=326 761 %**	**NHB N=122 351 %**	**Hispanic N=61 176 %**
Maternal age (years)				
15–19	12.69	9.36	19.94	16.02
20–24	28.26	23.82	35.41	37.67
25–29	27.04	28.40	22.95	27.91
30–34	21.67	25.98	14.17	13.64
35–39	8.88	10.72	6.34	4.10
40–44	1.47	1.72	1.20	0.66
Maternal education (completed)				
Middle school	5.97	1.68	1.60	37.59
Some high school	16.03	12.02	21.60	26.26
High school	30.58	28.84	39.32	22.38
Some college	23.39	24.40	24.05	8.38
College	25.03	33.05	13.43	5.39
Unmarried	33.91	19.52	66.21	46.17
Birth order				
First	43.33	44.95	40.33	40.66
Second	35.07	35.99	33.54	33.18
Third	16.10	14.74	18.62	18.36
Fourth	5.50	4.31	7.50	7.80
Infant sex male	51.07	51.23	50.64	51.10
Gestational age in weeks (mean, SD)	38.82 (1.83)	38.86 (1.75)	38.59 (2.07)	39.03 (1.71)
Birthweight in grams (mean, SD)	3343.63 (557.97)	3409.15 (547.47)	3166.25 (568.67)	3348.39 (513.20)

All values are expressed as percentages unless otherwise specified.

NHB, non-Hispanic black; NHW, non-Hispanic white.

Table 2

Mean birthweight in grams by maternal age and birth order

	Parity							
	First		Second		Third		Fourth	
Maternal age (years)	Sample size	Mean BW (g)	Sample size	Mean BW (g)	Sample size	Mean BW (g)	Sample size	Mean BW (g)
15–19	51285	3194	11658	3206	1652	3173	175	3124
20–24	67314	3287	51743	3317	20008	3268	5127	3213
25–29	53697	3356	50382	3424	25071	3268	8811	3331
30–34	35488	3355	44714	3468	22336	3458	8025	3421
35–39	11401	3295	17781	3429	11242	3451	4870	3427
40–44	1931	3235	2671	3372	1866	3361	1040	3414

BW, birthweight.

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Table 3

Linear regression models of birthweight

Parameter	Overall Model Estimate	Overall Model Pr > |t|	Model NHWhite only Estimate	Model NHWhite only Pr > |t|	Model NHBlack only Estimate	Model NHBlack only Pr > |t|	Model Hispanic only Estimate	Model Hispanic only Pr > |t|
Intercept	3320.0	<0.0001	3316.92	<0.0001	3104.29	<0.0001	3287.44	<0.0001
Male	116.20	<0.0001	120.70	<0.0001	112.20	<0.0001	100.15	<0.0001
Maternal age								
15–19	−1.15	0.7590	17.33	0.0004	1.46	0.8628	−59.61	<0.0001
20–24	20.13	<0.0001	35.02	<0.0001	15.95	0.0459	−37.20	<0.0001
30–34	−21.85	<0.0001	−19.59	<0.0001	−34.25	0.0014	−12.90	0.3734
35–39	−66.47	<0.0001	−61.54	<0.0001	−99.8	<0.0001	−31.09	0.2151
40–44	−114.32	<0.0001	−117.20	<0.0001	−129.40	<0.0001	17.81	0.7777
Birth order								
Second	115.19	<0.0001	119.96	<0.0001	100.56	<0.0001	103.40	<0.0001
Third	114.03	<0.0001	117.49	<0.0001	94.34	<0.0001	118.31	<0.0001
Fourth	114.53	<0.0001	102.79	<0.0001	85.34	<0.0001	160.18	<0.0001
Maternal education								
Middle school	−44.54	<0.0001	−86.28	<0.0001	−24.39	0.0632	−33.17	<0.0001
Some high school	−39.37	<0.0001	−57.01	<0.0001	−31.31	<0.0001	−15.42	0.0097
Some college	26.27	<0.0001	25.95	<0.0001	31.75	<0.0001	2.11	0.8000
College	62.80	<0.0001	60.95	<0.0001	79.14	<0.0001	10.74	0.2986
Not married	−43.32	<0.0001	−42.97	<0.0001	−54.95	<0.0001	−29.08	<0.0001
Tobacco Use	−225.96	<0.0001	−238.36	<0.0001	−166.17	<0.0001	−135.79	<0.0001
Maternal race								
Non-Hispanic	−223.96	<0.0001						
black								
Hispanic	−47.89	<0.0001						
Age * Birth order interaction								
15–19 * second	−79.72	<0.0001	−86.99	<0.0001	−65.73	<0.0001	−59.25	0.0003

Parameter	Overall Model		Model NHWhite only		Model NHBlack only		Model Hispanic only	
	Estimate	Pr > |t|	Estimate	Pr > |t|	Estimate	Pr > |t|	Estimate	Pr > |t|
15–19 * third	−79.78	<0.0001	−94.83	<0.0001	−64.30	0.0027	−62.80	0.0601
15–19 * fourth	−94.18	0.0212	−157.90	0.0710	−85.57	0.1049	44.73	0.7018
20–24 * second	−48.33	<0.0001	−53.85	<0.0001	−42.46	<0.0001	−8.79	0.4748
20–24 * third	−57.19	<0.0001	−79.05	<0.0001	−37.96	0.0017	0.14	0.9925
20–24 * fourth	−73.65	<0.0001	−88.65	<0.0001	−45.14	0.0073	−57.03	0.0155
30–34 * second	16.39	0.0011	11.06	0.0522	35.66	0.0101	18.79	0.3120
30–34 * third	45.79	<0.0001	7.44	<0.0001	55.44	0.0003	35.71	0.0621
30–34 * fourth	50.53	<0.0001	63.76	<0.0001	58.22	0.0024	5.51	0.8095
35–39 * second	25.35	0.0004	22.47	0.0054	39.92	0.0359	5.78	0.8570
35–39 * third	68.00	<0.0001	66.88	<0.0001	83.46	<0.0001	35.97	0.2596
35–39 * fourth	73.58	<0.0001	84.72	<0.0001	98.12	<0.0001	14.19	0.6828
40–44 * second	28.61	0.0789	25.78	0.1582	34.39	0.3938	22.04	0.7798
40–44 * third	45.56	0.0105	48.75	0.0174	33.15	0.4287	4.68	0.9530
40–44 * fourth	108.86	<0.0001	148.71	<0.0001	95.32	0.0546	−136.61	0.0880

By definition, race was not included as a covariate in the race-specific models.

Grey highlighting denotes statistical significance using α=0.01.

Reference groups=female sex, maternal age 25–29 years, married, non-smoker, first birth order, high school completed, non-Hispanic (NH) white race, interaction term 25–29 years.

* First birth overall and each individual age category.