

ADVANCING MATERNAL AGE AND INFANT BIRTH WEIGHT AMONG URBAN AFRICAN AMERICANS: THE EFFECT OF NEIGHBORHOOD POVERTY

Objective: This study sought to determine whether neighborhood poverty modifies the relationship between maternal age and infant birth weight among urban African Americans.

Design: Stratified analyses were performed on the vital records of African Americans born in Chicago by means of 1992–1995 computerized birth file with appended 1990 US Census income and 1995 Chicago Department of Public Health data. Four neighborhood-level variables (low median family income, high rates of unemployment, homicide, and lead poisoning) were analyzed.

Setting: This is a population-based study.

Results: Twenty-one percent ($n=21,811$) of women resided in nonimpoverished neighborhoods (zero ecologic risk factors); 23% ($n=24,914$) of women lived in extremely impoverished neighborhoods (four ecologic risk factors). In nonimpoverished neighborhoods, 30–34 year old women had a moderately low birth weight (1500–2499 g) rate of 13.9% compared to 10.3% for women aged 20–24 years; risk difference (95% confidence interval [CI])=3.5 (2.2–4.6). In contrast, extremely impoverished women aged 30–34 years had a moderately low birth weight rate of 19.8% compared to 11.8% for women aged 20–24 years; risk difference (95% CI)=7.7 (6.1–9.3). This trend persisted among women who received early prenatal care and were primagravids or of low parity. Neighborhood poverty did not modify the association of advancing maternal age and the risk of very low birth weight (<1500 g).

Conclusions: Neighborhood poverty accelerates the rise in moderately low birth weight but not very low birth weight; rates were associated with advancing maternal age among urban African Americans. (*Ethn Dis.* 2006;16:180–186)

Key Words: African-American, Low Birth Weight, Maternal Age, Prenatal Care, Poverty, Weathering

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INTRODUCTION

Healthy People 2010 calls for the elimination of the racial disparity in infant mortality.¹ Unfortunately, numerous published studies have been unable to explain why African-American women are twice as likely to deliver low birth weight (<2500 g, LBW) infants as non-Latino White women.^{2–6} Young and advanced maternal age are known risk factors for LBW infants among White women.^{2,3,7} However, the maternal age pattern of infant LBW is different for African-American women. Instead of the U-shaped age curve for infant LBW among White women,^{7–9} a limited literature shows that the risk of infant LBW for African-American women grows monotonically with advancing age.⁷ Infant LBW rates start to rise among African-American women in their late twenties and early thirties.⁷ Geronimus termed the deterioration in reproductive health status over the childbearing years among African-American women as “weathering.”¹⁰ The Weathering Hypothesis conceptualizes the physical consequences of social inequality on female reproductive outcome.¹⁰

Residential segregation is a longstanding defining characteristic of American life.¹¹ A disproportionately large percentage of African-American women reside in urban neighborhoods with concentrated poverty and high rates of violent crimes.¹¹ An expanding

*Infant LBW rates start to rise among African-American women in their late twenties and early thirties.*⁷

literature shows that residential environment has reproductive health consequences for both races.^{2,7,12–17} Geronimus found that the rates of moderately low birth weight (1500–2499 g, MLBW) and very low birth weight (<1500 g, VLBW) infants among African-American women who resided in low-income Michigan neighborhoods increased as age rose from 20 to 34 years.⁷ Rauh et al reported that among African Americans in New York City, neighborhood poverty exacerbated the effect of maternal aging on infant MLBW but not VLBW risk.¹³ Both studies used a single income variable to define residential environment, and neighborhood income variables may not fully capture important contributors of weathering.^{18,19} For example, we found a negative association between maternal residence in violent (compared to nonviolent), low-income neighborhoods and pregnancy outcome among African Americans.¹⁹ The extent to which neighborhood context as defined by multiple variables modifies the association of advancing maternal age and low birth weight components among urban African Americans is incompletely understood.

The effect of neighborhood poverty on the association of advancing maternal age and infant birth weight among African Americans may reflect the

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contribution of individual-level variables. Reflecting the relation of residential environment to both infant LBW and maternal risk status,^{2,20} impoverished (compared to nonimpoverished) women at specific age categories may be more likely to receive inadequate prenatal care and be of high parity, known risk factors for LBW.^{2,3,20,21} To our knowledge no study has disentangled the contribution of neighborhood poverty, advancing maternal age, and inadequate prenatal care usage to African-American infant birth weight.

We used Illinois vital records to ascertain whether: 1) neighborhood poverty (as defined by multiple ecologic variables) increases the risk of infant MLBW and VLBW associated with advancing age among African-American women; 2) the early initiation of prenatal care weakens the relationship between neighborhood poverty, maternal age, and infant birth weight; and 3) parity differentially modifies the association of advancing age and low birth weight components among nonimpoverished and impoverished African-American women in Chicago.

METHODS

We analyzed the 1992–1995 Illinois vital records of African-American singleton infants born to Chicago residents. Based on maternal place of residence listed on the birth certificate, 1990 US Census income information, and 1995 Chicago Department of Public Health data were appended to each birth record. Chicago has 77 community areas; each is a meaningful ecologic unit.²² Four community area variables were empirically dichotomized to measure the absence or presence of risk: median family income <\$15,000/year, unemployment rate >19%, homicide rate >1.3/1,000, and lead poisoning rates >2.8/1,000.¹⁸ We combined the four community-level variables into a single ecologic risk factor

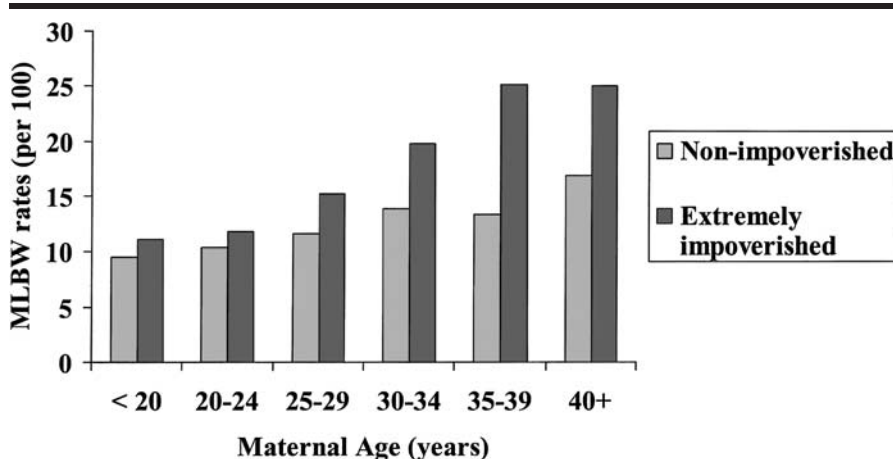


Fig 1. Moderate low birth weight (1500–2499 g, MLBW) rates by maternal age and residential environment

(ERF). Neighborhoods with zero ERF were classified as nonimpoverished; neighborhoods with four ERF were classified as extremely impoverished. Individual-level risk factors examined were trimester of prenatal care initiation and parity.

As an initial step in exploring the relationship between neighborhood poverty and African-American infant birth weight, the distribution of the ERF was examined. We calculated MLBW and VLBW rates according to age among women who resided in nonimpoverished and extremely impoverished neighborhoods. To determine the contribution of prenatal care and parity to relationship between neighborhood poverty, maternal age, and infant low birth weight components, we calculated age-specific MLBW and VLBW rates according to prenatal care usage and parity in nonimpoverished and extremely impoverished neighborhoods. Among primagravid women who received adequate prenatal care, MLBW and VLBW rates were then calculated for women who resided in nonimpoverished and extremely impoverished neighborhoods.

For each two-by-two analysis, the risk difference (RD) was calculated; the 95% confidence interval (CI) was estimated with the Taylor series meth-

od.²³ Statistical significance was defined by nonoverlapping RD (95% CI) in nonimpoverished vs extremely impoverished neighborhoods.

RESULTS

Twenty-one percent ($n=21,811$) of African-American mothers resided in nonimpoverished neighborhoods (as defined by the presence of 0 ERF); 23% ($n=24,914$) of African-American mothers lived in extremely impoverished areas (as defined by the presence of four ERF). In both cohorts, infant MLBW rates rose with advancing maternal age; however, the increase was accelerated in extremely impoverished neighborhoods (Figure 1). In nonimpoverished neighborhoods, the RD (95% CI) for women aged 25–29 (compared to 20–24) years equaled 1.3 (0.1–2.5); the RD (95% CI) for women aged 30–34 (compared to 20–24) years equaled 3.5 (2.2–4.9). In extremely impoverished areas, the RD (95% CI) for women aged 25–29 (compared to 20–24) years equaled 3.4 (2.2–4.6); the RD (95% CI) for women aged 30–34 (compared to 20–24) years was 7.7 (6.1–9.3).

Table 1 shows neighborhood-specific MLBW rates according to maternal age

Table 1. Moderately low birth-weight (1500–2499 g) rates by maternal age, prenatal care, and residential environment, Chicago, Illinois, 1992–1995

Maternal Age (years)	Prenatal Care			
	Inadequate		Adequate	
	Nonimpoverished	Extremely Impoverished	Nonimpoverished	Extremely Impoverished
	Moderately Low Birth-Weight Rates Per 100 (n)			
<20	10.1 (220)	10.8 (367)	9.1 (262)	11 (452)
20–24	11.9 (283)	13.0 (428)	9.4 (404)	10.8 (552)
25–29	14.1 (205)	18.9 (364)	10.6 (364)	12.4 (371)
30–34	20.9 (203)*	29.3 (147)†	11.1 (273)‡	17.8 (383)§
35–40	20.3 (84)	29.3 (147)	10.7 (11.8)	21.7 (150)
>40	24.0 (19)	35.6 (26)	13.0 (19)	18.5 (22)

* 30–34 years compared to 20–24 years; RD (95% CI)=9.0 (6.1–11.8).
 † 30–34 years compared to 20–24 years; RD (95% CI)=16.2 (12.1–20.4).
 ‡ 30–34 years compared to 20–24 years; RD (95% CI)=1.7 (0.1–3.3).
 § 30–34 years compared to 20–24 years; RD (95% CI)=7.0 (4.8–8.8).

and prenatal care. In nonimpoverished communities, the RD (95% CI) in MLBW rates for women aged 35–39 (compared to 20–24) years who received inadequate prenatal care equaled 8.4 (4.8–11.9). In contrast, extremely impoverished women aged 35–39 (compared to 20–24) years who received inadequate prenatal care had a RD (95% CI) in MLBW rates of 16.2 (12.1–20.4). Neighborhood poverty had an earlier and stronger effect on the association of MLBW and advancing age among women who received adequate prenatal care. In nonimpoverished neigh-

borhoods, the RD (95% CI) for women aged 30–34 (compared to 20–24) years who received adequate prenatal care equaled 1.7 (0.1–3.3); among women aged 35–39 (compared to 20–24) years the RD (95% CI) was 1.3 (–0.8–3.3). In extremely impoverished areas, the RD (95% CI) for women aged 30–34 (compared to 20–24) years who received adequate prenatal care widened to 7.0 (4.8–8.8); among women aged 35–39 (compared to 20–24) years, the RD (95% CI) equaled 10.3 (7.2–13.5).

Extreme neighborhood poverty (compared to nonpoverty) accelerated

the effect of advancing age on MLBW rates only among primagravids and women of low parity (Table 2). In nonimpoverished areas, the RD (95% CI) for first-time mothers aged 30–34 (compared to 20–24) years equaled 1.6 (0.9–4.1). In contrast, in extremely impoverished neighborhoods the RD (95% CI) among primagravids aged 30–34 (compared to 20–24) years equaled 9.3 (4.2–14.3). A similar differential occurred between women of low parity aged 30–34 (compared to 20–24) years in nonimpoverished and extremely impoverished neighborhoods;

Table 2. Moderately low birth-weight (1500–2444 g) rates by maternal age, parity, and residential environment, Chicago, Illinois, 1992–1995

Maternal Age (years)	Parity					
	0		1–3		4+	
	Nonimpoverished	Extremely Impoverished	Nonimpoverished	Impoverished	Nonimpoverished	Extremely Impoverished
	Moderately Low Birth-Weight Rates Per 100 (n)					
<20	8.7 (295)	10.9 (467)	11.8 (186)	12.4 (370)	—	22.6 (7)
20–24	9.0 (202)	10.5 (178)	11.2 (444)	11.4 (616)	11.3 (40)	18.7 (155)
25–29	7.9 (104)	13.1 (73)	12.5 (366)	14.2 (410)	16.8 (596)	16.3 (168)
30–34	10.6 (80)*	19.9 (52)†	13.5 (277)‡	18.0 (288)§	22.2 (119)¶	25.4 (235)¶¶
35–40	9.3 (22)	18.1 (15)	13.0 (118)	23.4 (142)	19.4 (61)	27.4 (135)
>40	16.3 (7)	30.8 (4)	17.0 (9)	32.5 (20)	16.9 (11)	18.7 (17)

* 30–34 years compared to 20–24 years; RD (95% CI)=1.6 (–0.9–4.1).
 † 30–34 years compared to 20–24 years; RD (95% CI)=9.4 (4.4–14.5).
 ‡ 30–34 years compared to 20–24 years; RD (95% CI)=2.4 (0.6–4.1).
 § 30–34 years compared to 20–24 years; RD (95% CI)=6.6 (4.5–8.6).
 ¶ 30–34 years compared to 20–24 years; RD (95% CI)=10.9 (6.0–15.9).
 ¶¶ 30–34 years compared to 20–24 years; RD (95% CI)=6.8 (2.9–10.6).

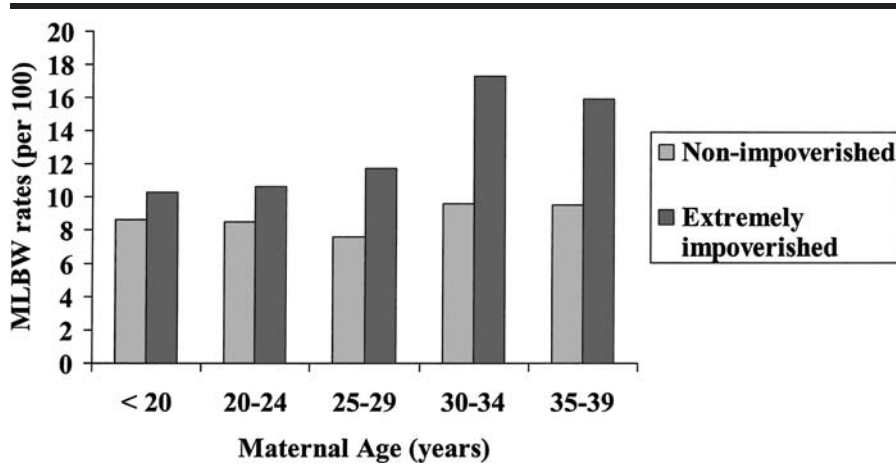


Fig 2. Moderate low birth weight (1500–2499 g, MLBW) rates among primigravid who received adequate prenatal care by age and residential environment

RD (95% CI)=2.4 (0.6–4.1) and 6.6 (4.5–8.6), respectively. A monotonic rise in MLBW rates with advancing maternal age was not observed among women of high parity regardless of neighborhood poverty.

Figure 2 illustrates infant MLBW rates among primigravids who received adequate prenatal care according to residential environment. The increase in MLBW rates associated with advancing maternal age was accelerated in extremely impoverished neighborhoods. In nonimpoverished communities, primigravids aged 30–34 years who received adequate prenatal care had a MLBW rate of 9.6% compared to 8.5% for primigravids aged 20–24 years who received adequate prenatal care, RD (95% CI)=1.0 (–1.6–3.6); the RD (95% CI) among primigravids aged 35–39 (compared to 20–24) years who received adequate prenatal care equaled 0.9 (–3.3–5.2). In extremely impoverished neighborhoods, primigravid women aged 30–34 who received adequate prenatal care had a MLBW rate of 17.3% compared to 10.6% for primigravid women aged 20–34 years who received adequate prenatal care, RD (95% CI)=6.8 (1.2–12.3); among primigravid women aged 35–39 (compared to 20–24) years who received adequate prenatal care the RD (95% CI) equaled 5.3 (3.9–14.5).

Lastly, we examined the infant VLBW rates according to maternal age and residential environment. Neighborhood poverty did not accelerate the negative effect of advancing maternal age of VLBW rates (Figure 3). This trend persisted regardless of prenatal care usage (Table 2) and parity (Table 3).

DISCUSSION

Our study shows that among urban African Americans the rise in MLBW rates associated with advancing maternal

age is accelerated in extremely impoverished (compared to nonimpoverished) neighborhoods. In extremely impoverished neighborhoods, MLBW rates begin to rise among African-American women in their late twenties. We found that extremely impoverished 30- to 34- (compared to 20- to 24-) year old African-American women have a two-fold greater MLBW risk difference than their nonimpoverished peers. Most striking, neighborhood poverty increases the risk of MLBW associated with advancing age among primigravid women who receive adequate prenatal care, a low-risk subgroup. The rise in VLBW rates associated with advancing maternal age is not accelerated in extremely impoverished (compared to nonimpoverished) neighborhoods. These findings show that neighborhood poverty contributes to the weathering phenomenon among urban African-American women and strongly suggest that neighborhood factors contribute to the racial disparity in infant birth weight.

The conventional investigative approach to the racial disparity infant birth weight has been based on the implicit assumption that a set of risk factors differs in quantity between the races but exerts similar effects on African-American and White women.

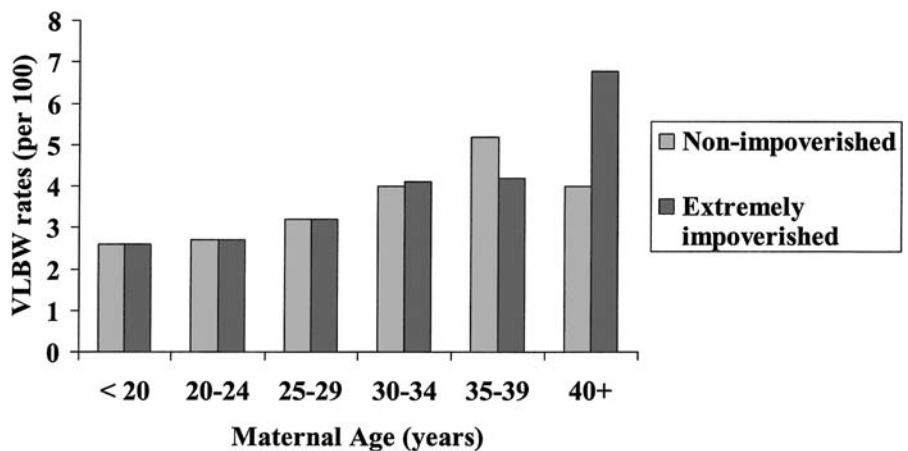


Fig 3. Very low birth weight (<1500 g, VLBW) rates by maternal age and residential environment

Table 3. Very low birth-weight (<1500 g) rates by maternal age, prenatal care, and residential environment, Chicago, Illinois, 1992–1995

Maternal Age (years)	Prenatal Care			
	Inadequate		Adequate	
	Nonimpo- verished	Extremely Impo- verished	Nonimpo- verished	Extremely Impo- verished
Very Low Birth-Weight Rates Per 100 (n)				
<20	2.8 (63)	2.4 (82)	2.5 (71)	2.9 (119)
20–24	2.8 (66)	3.4 (111)	2.7 (117)	2.2 (106)
25–29	3.0 (43)	4.1 (74)	3.3 (114)	2.6 (75)
30–34	4.9 (20)*	5.6 (62)†	3.7 (91)‡	3.3 (56)§
35–40	4.8 (20)	6.8 (34)	5.4 (59)	3.0 (21)
>40	5.1 (4)	8.2 (6)	3.4 (5)	5.9 (7)

* 30–34 years compared to 20–24 years; RD (95% CI)=2.2 (0.6–3.7).
 † 30–34 years compared to 20–24 years; RD (95% CI)=2.2 (0.8–3.6).
 ‡ 30–34 years compared to 20–24 years; RD (95% CI)=1.0 (0.1–1.9).
 § 30–34 years compared to 20–24 years; RD (95% CI)=1.0 (0.1–2.0).

However, White women rarely reside in impoverished urban neighborhoods. In Chicago, 88% of White women live in neighborhoods with no ecologic risk factors, and <1% reside in communities with four ecologic risk factors.¹⁸ The present study shows that only 21% of African-American women live in areas with none of our ecologic risk factors. Moreover, ≈25% reside in neighborhoods with all four of our ecologic risk factors. Given the profound racial disparity in exposure to neighborhood-level risk factors, exam-

ining the effect of extreme neighborhood impoverishment on the association of maternal age and infant birth weight only among African-American women seems plausible.

Confirming earlier studies that used a single income variable to define neighborhood poverty,^{7,13} we found a stark differential in MLBW rates associated with advancing age among African-American women exposed to the extremes of residential environments as measured by multiple ecologic variables. The accelerated deterioration in

infant MLBW over the childbearing years among African-American women who reside in extremely impoverished (compared to nonimpoverished) neighborhoods provides additional evidence that weathering is indeed the physical consequence of environmental and social hardships. Moreover, the early initiation of prenatal care is unable to reverse the negative effect of neighborhood poverty on African-American female health. This finding suggests that the intensive concentration of extreme urban poverty produces such a powerful destructive force that isolated changes in prenatal care are unlikely to dramatically attenuate the weathering phenomenon. A broader public health policy paradigm is warranted to address the pregnancy disadvantage of African-American women who reside in extremely impoverished neighborhoods. It should take into account the daily experiences of the African-American population. Novel risk factors amenable to intervention may emerge from such a policy agenda.

As expected, MLBW rates for nonimpoverished African-American women rise monotonically with maternal age. This finding contrasts with the U-shaped age curve for infant birth weight

Table 4. Very low birth-weight (<1500 g) rates by maternal age, parity, and residential environment, Chicago, Illinois, 1992–1995

Maternal Age (years)	Parity					
	0		1–3		4+	
	Nonimpo- verished	Extremely Impo- verished	Nonimpo- verished	Extremely Impo- verished	Nonimpo- verished	Extremely Impo- verished
Very Low Birth-Weight Rates Per 100 (n)						
<20	2.4 (82)	2.9 (129)	3.4 (51)	6.2 (64)	—	—
20–24	2.8 (63)	3.4 (58)	2.9 (105)	2.4 (117)	3.9 (14)	4.1 (37)
25–29	4.3 (57)	2.7 (15)	2.4 (64)	3.9 (101)	2.7 (16)	3.9 (40)
30–34	5.6 (42)*	4.2 (11)†	4.0 (74)‡	3.7 (51)§	3.9 (21)¶	5.4 (56)¶¶
35–40	8.9 (21)	7.2 (6)	5.8 (4.9)	5.3 (26)	2.9 (9)	4.7 (23)
>40	—	—	—	11.7 (7)	—	5.5 (5)

* 30–34 years compared to 20–24 years; RD (95% CI)=2.8 (1.0–4.5).
 † 30–34 years compared to 20–24 years; RD (95% CI)=0.8 (–1.8–3.3).
 ‡ 30–34 years compared to 20–24 years; RD (95% CI)=1.1 (0–2.1).
 § 30–34 years compared to 20–24 years; RD (95% CI)=1.4 (0.3–2.4).
 ¶ 30–34 years compared to 20–24 years; RD (95% CI)=–0.4 (–2.9–2.1).
 ¶¶ 30–34 years compared to 20–24 years; RD (95% CI)=1.3 (–0.6–3.2).

We found that extremely impoverished 30- to 34- (compared to 20- to 24-) year old African-American women have a two-fold greater MLBW risk difference than their nonimpoverished peers.

among White women.⁷ However, we speculate that a large percentage of nonimpoverished African-American adult women were exposed to neighborhood poverty during childhood. An expanding literature suggests that life-course factors are detrimental to female adult reproductive outcome.²⁴ Further research is warranted to determine the birth weight patterns of African-American infants born to women with a lifelong residence in nonimpoverished neighborhoods.

Low birth weight infants are composed of two cohorts: moderately low birth weight (1500–2499 g, MLBW) and very low birth weight (<1500 g, VLBW). The former are composed of both preterm (<37 weeks) and growth-retarded term infants. In contrast, the overwhelming majority of VLBW infants are preterm. The present study highlights that neighborhood poverty has a greater effect on the association of MLBW rates and advancing maternal age than it does on the relationship between VLBW rates and advancing maternal age. Rauh et al found similar results among New York City residents.¹³ These findings signal that neighborhood poverty has a stronger effect on the association of advancing maternal age and intrauterine growth retardation than it does on the association of advancing maternal age and prematurity.

An age-related monotonic rise in low birth weight components does not

occur among African-American women of high parity. Moreover, neighborhood poverty fails to alter this pattern. Since parity is an indirect proxy measure of inter-pregnancy interval, the high LBW rate among 20- to 24-year-old women of high parity and the consequent small risk difference in LBW components between high-parity women in their early thirties and early twenties is not unexpected.

Our population-based investigation has important limitations. First, neighborhood poverty was defined by place of residence at the time of delivery. We had no information on duration of neighborhood residence. Second, nonimpoverished African-American neighborhoods are often contiguous with impoverished areas.²² Thus, residents in the former are likely to still experience environmental and social hardships associated with neighborhood poverty. Lastly, our neighborhood-level variables are strong proxies for poverty, but they are weak measures of affluence. Reflecting improved general opportunities that optimize childhood and adult health, we speculate that maternal age has a U-shaped relation to infant birth weight among African-American women who reside in affluent neighborhoods. Further research is needed to determine the extent to which neighborhood affluence weakens the association of advancing maternal age and infant birth weight among African Americans.

In summary, we found that neighborhood poverty accelerates the rise in MLBW but not VLBW rates associated with advancing maternal age among urban African Americans.

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Data analysis and interpretation: Collins, Simon, Jackson; Drolet

Manuscript draft: Collins, Simon

Statistical expertise: Drolet

Acquisition of funding: Collins

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