New Insights into Racial and Ethnic Group Differences in Birth Outcomes

James W. Collins, Jr.
5/28/08
# INFANT MORTALITY RATES

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Singapore</td>
<td>2.7</td>
</tr>
<tr>
<td>2</td>
<td>Hong Kong</td>
<td>2.9</td>
</tr>
<tr>
<td>3</td>
<td><strong>Japan</strong></td>
<td><strong>3.0</strong></td>
</tr>
<tr>
<td>4</td>
<td>Sweden</td>
<td>3.2</td>
</tr>
<tr>
<td>5</td>
<td>Norway</td>
<td>3.8</td>
</tr>
<tr>
<td>6</td>
<td>Finland</td>
<td>3.8</td>
</tr>
<tr>
<td>7</td>
<td>Czech Republic</td>
<td>4.1</td>
</tr>
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<td>8</td>
<td>Denmark</td>
<td>4.2</td>
</tr>
<tr>
<td>9</td>
<td>France</td>
<td>4.4</td>
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<tr>
<td>10</td>
<td>Spain</td>
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<tr>
<td>11</td>
<td>Germany</td>
<td>4.4</td>
</tr>
<tr>
<td>12</td>
<td>Italy</td>
<td>4.6</td>
</tr>
<tr>
<td>13</td>
<td>Austria</td>
<td>4.8</td>
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<tr>
<td>14</td>
<td>Switzerland</td>
<td>4.9</td>
</tr>
<tr>
<td>15</td>
<td>Australia</td>
<td>4.9</td>
</tr>
<tr>
<td>16</td>
<td>Canada</td>
<td>5.3</td>
</tr>
<tr>
<td>17</td>
<td>Netherlands</td>
<td>5.3</td>
</tr>
<tr>
<td>18</td>
<td>Greece</td>
<td>5.4</td>
</tr>
<tr>
<td>19</td>
<td>Belgium</td>
<td>5.4</td>
</tr>
<tr>
<td>20</td>
<td>Portugal</td>
<td>5.6</td>
</tr>
<tr>
<td>21</td>
<td>United Kingdom</td>
<td>5.6</td>
</tr>
<tr>
<td>22</td>
<td>Israel</td>
<td>5.8</td>
</tr>
<tr>
<td>23</td>
<td>Ireland</td>
<td>5.9</td>
</tr>
<tr>
<td>24</td>
<td>New Zealand</td>
<td>6.1</td>
</tr>
<tr>
<td>25</td>
<td>Cuba</td>
<td>6.2</td>
</tr>
<tr>
<td>26</td>
<td><strong>United States</strong></td>
<td><strong>6.8</strong></td>
</tr>
</tbody>
</table>
• 19,350 infants a year could be prevented if the IMR in our country was lowered to the level achieved in Japan.

• A sum greater than the total number of deaths among all children aged 1 to 15 years.
Infant Mortality Rate by State, 2002-2004

Per 1,000 live births

- 9.0 or more (4)
- 8.0 - 8.9 (8)
- 7.0 - 7.9 (11)
- 6.0 - 6.9 (16)
- Less than 6.0 (12)

Source: NVSS, NCHS, CDC.

2010 Target = 4.5
CITIES WITH THE HIGHEST IMR

-- District of Columbia
-- Detroit
-- Atlanta
-- Newark
-- Cleveland

-- Norfolk
-- Baltimore
-- Chicago
-- Philadelphia
-- Milwaukee
6,000 African-American infant deaths a year could be prevented if the IMR of African-Americans was lowered to the level of whites.
**Cause-Specific Infant Death Rates: United States**

<table>
<thead>
<tr>
<th>Causes of Infant Death</th>
<th>White</th>
<th>African-American</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital malformations</td>
<td>1.4</td>
<td>1.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Disorders related to short gestation</td>
<td>0.8</td>
<td>2.9</td>
<td>3.9</td>
</tr>
<tr>
<td>SIDS</td>
<td>0.5</td>
<td>1.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Pregnancy complications</td>
<td>0.3</td>
<td>0.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Complications of placenta, cord, membranes</td>
<td>0.2</td>
<td>0.4</td>
<td>2.0</td>
</tr>
</tbody>
</table>
NEONATAL MORTALITY RATES

African-American
White

NMR (per 1,000 livebirths)

Birth Weight-Specific Mortality

Neonatal Mortality Rate (NMR)

Birth Weight Distribution
• LBW (< 2500g) infants account for 7.9% of births and 66% of deaths.
• VLBW (< 1500g) infants account for 1.5% of births and 50% of deaths.
16% of VLBW infants are moderately or severely handicapped
RATIONALING

22 Costs vs. benefits
Holding fragile neonatal lives in the balance: Should society spend so much on so few?
BORN TO DIE?
Science is keeping tiny premature infants alive.

Should it?

Exploring the frontiers of medicine and ethics
FETAL ORIGINS OF ADULT DISEASE

Poor fetal growth and small size at birth are associated with an increased risk of coronary heart disease, stroke, hypertension, Type 2 diabetes, and osteoporosis in adulthood.
Six Decade Trend in Low Birth Weight Rates in the United States

African-Americans
Whites
Six Decade Trend in Very Low Birth Weight Rates in the United States

![Graph showing the trend of very low birth weight rates (VLBW) from 1950 to 2000 for African-Americans and Whites. The graph indicates an increase in VLBW rates for both groups over the decades.](image-url)
Low Birth Weight Rates by Maternal Education and Race
(Chicago, IL)
RACIAL GAP IN PERINATAL OUTCOME AMONG INFANTS CONCEIVED BY ART
(Schieve et al, Obstet Gynecol, 2004)
Transgenerational Factors

Factors, conditions, and environments experienced by one generation that relate to the pregnancy outcome of the next generation
FINDING HOME
AN IMMIGRANT FAMILY'S JOURNEY THROUGH THE GENERATIONS
In American Bondage

The European slave trade was both lucrative and brutal. Historians estimate that between 10 and 15 percent of the slaves who left Africa died along the route of the “Middle Passage.”

<table>
<thead>
<tr>
<th>Slaves leaving:</th>
<th>13,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>British North America and U.S.</td>
<td></td>
</tr>
<tr>
<td>British Empire</td>
<td></td>
</tr>
<tr>
<td>Slaves arriving:</td>
<td></td>
</tr>
<tr>
<td>West Indies</td>
<td>4,000,000</td>
</tr>
<tr>
<td>Brazil</td>
<td>4,000,000</td>
</tr>
<tr>
<td>Spanish Empire</td>
<td>2,500,000</td>
</tr>
<tr>
<td>N. America, U.S.</td>
<td>500,000</td>
</tr>
<tr>
<td>Europe</td>
<td>200,000</td>
</tr>
</tbody>
</table>

*Including Cuba. Source: Hugh Thomas, “The Slave Trade”
American Slavery: 1619-1865

“The bound labor of at least twelve generations of black people”.

- Slavery created wealth for slaveholders, wealth that was translated into extraordinary political power. The slave trade and the products created by slaves’ labor, particularly cotton, provided the basis for America’s wealth as a nation, underwriting the country’s industrial revolution and enabling it to project its power into the rest of the world.
<table>
<thead>
<tr>
<th>TIME SPAN</th>
<th>CITIZENSHIP STATUS -YRS</th>
<th>Experience accounts for this proportion of time in US</th>
<th>STATUS</th>
<th>HEALTH &amp; HEALTH SYSTEM EXPERIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1619-1865</td>
<td>246 years</td>
<td>64%</td>
<td>Chattel slavery</td>
<td>Disparate/inequitable treatment poor health status &amp; outcomes. “Slave health deficit” &amp; “Slave health sub-system” in effect</td>
</tr>
<tr>
<td>1865-1965</td>
<td>100 years</td>
<td>26%</td>
<td>Virtually no citizenship rights</td>
<td>Absent or inferior treatment and facilities. <em>De jure</em> segregation/ discrimination in South, <em>de facto</em> throughout most of health system. “Slave health deficit” uncorrected</td>
</tr>
<tr>
<td>1965-2006</td>
<td>41 years</td>
<td>10%</td>
<td>Most citizenship rights: <em>USA struggles to transition from segregation &amp; discrimination to integration of AA</em></td>
<td>So. med school desegregation 1948. Imhotep Hospital Integration Conf 1957-1964, hospital desegregation in federal courts 1964. Disparate health status, outcomes, and services with apartheid, discrimination, institutional racism and bias in effect.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>387 years</td>
<td>100%</td>
<td>“Struggle”</td>
<td><em>HEALTH DISPARITIES/ INEQUITIES</em></td>
</tr>
</tbody>
</table>

Differing Birth Weight Among Infants of U.S.-Born Blacks, African-Born Blacks, and U.S.-Born Whites

Richard J. David, M.D., and James W. Collins, Jr., M.D., M.P.H.
Differing Birth Weight in Illinois
(David and Collins, NEJM, 1997)

% LBW (< 2500g)

- US-born Blacks
- African-born Blacks
- US-born Whites
Differing LBW Rates Among Low-risk Women in Illinois
(David and Collins, NEJM, 1997)
Differing VLBW Rates Among Low-risk Women in Illinois
(David and Collins, NEJM, 1997)
Maternal Race and Infant Birth Weight Among Low-Risk Women in Illinois

(Pallotto et al, AJE, 2000)

James W. Collins, Jr.,¹ Shou-Yien Wu,² and Richard J. David²
Change in Mean Birth Weight Across a Generation (Collins et al, AJE, 2002)
MLBW Rates Across a Generation
(Collins et al, AJE, 2002)
Change in Mean Birth Weight Among infants of Married Women Across a Generation (Collins et al, AJE, 2002)
MLBW Rates Among Infants of Married Women Across a Generation (Collins et al, AJE, 2002)
Changing Research Focus from Pregnancy to Pre-Pregnancy Factors

• **Early-Life Programming Hypothesis:**
  -- Impaired fetal growth is a risk factor for later poor reproductive outcome.

• **Cumulative Pathway Hypothesis:**
  -- Life-long exposure to chronic stress is a risk factor for poor reproductive outcome.
Developmental Origins Model of Female Reproductive Outcome

(Maternal low birth weight is a proxy measure of aberrant fetal reproductive programming and is a risk factor for future poor pregnancy outcome)
INFANT LBW RATES BY MATERNAL BIRTH WEIGHT AND RACE
(Illinois Transgenerational Dataset)
INFANT LBW RATES BY MATERNAL BIRTH WEIGHT AND RACE
(Collins et al, MCHJ, 2003)

Infant LBW rates (per 100)

Maternal LBW
Maternal non-LBW

Whites [N=187,074; RR=1.9 (1.8-2.0)]
AA [N=58,858; RR=1.8 (1.7-1.9)]
INFANT LBW RATES BY MATERNAL BIRTH WEIGHT AND EDUCATION
(WHITES, ADEQUATE PC)
(Collins et al, MCHJ, 2003)
INFANT LBW RATES BY MATERNAL BIRTH WEIGHT AND EDUCATION

(AA, ADEQUATE PC)

(Collins et al, MCHJ, 2003)
INFANT LBW RATES BY MATERNAL BIRTH WEIGHT AND RACE (LOW-RISK ADULTS)

College-educated, married mothers who received adequate PC

![Graph showing infant LBW rates by maternal birth weight and race for college-educated, married mothers who received adequate PC. The graph compares African-Americans and Whites.](image-url)
POPULATION ATTRIBUTABLE RISK OF MATERNAL LBW

Percent

AFRICAN-AMERICANS

WHITES
INFANT SGA RATES BY MATERNAL BIRTH WEIGHT AND RACE
(Simon et al, MCHJ, 2006)

Whites [N=203,698; RR=1.8 (1.8-1.9)]
AA [N=61,849; RR=1.6 (1.5-1.7)]
INFANT PRETERM RATES BY MATERNAL BIRTH WEIGHT AND RACE
(Simon et al, MCHJ, 2006)

Infant preterm rates (per 100)

Whites [N=203,698; RR=1.3 (1.3-1.4)]
AA [N=61,849; RR=1.6 (1.5-1.7)]

Maternal LBW
Maternal non-LBW
Cumulative Pathways
Percentage of Infants Born Into Poverty

White 4 %
African-American 46%
“for the last few days whole lots of things been going on like shoting, killing, dyeing, death. that happens every day, every week, any month. like they tried to kill my cousin my uncle almost tried to hurt my grandfather to take his money. everywhere you go you see people on streets, in aban don building, on the corners, breaking in houses, getting stopped by police. every day the same things happen.”

—Composition written by a 6th-grade pupil from Robert Taylor Homes.
RACE-SPECIFIC LBW RATES BY LIFELONG RESIDENTIAL ENVIRONMENT
(Collins et al, in press)
African American Mothers’ Lifetime Residential Environment and Infant LBW (PAS, 2007)
• Young and advanced maternal age are known risk factors for infant low birth weight (<2500g, LBW) among Whites.

• A limited literature shows that the risk of infant LBW for African-American women grows monotonically with advancing age.

• Geronimus termed the deterioration in reproductive health status over the childbearing years among African-American women as “weathering” (Ethn Dis, 1992).
RESEARCH QUESTION

To what extent does neighborhood poverty modify the risk of low birth weight (< 2500g, LBW) associated with advancing age among urban African-American women?
METHODS

• Ecologic Risk Factor (ERF): median family income < $15,000/yr, unemployment > 19%, homicide rate > 1.3/1,000, lead poisoning rate > 2.8/1,000.

• Neighborhoods with four ERF were empirically defined as extremely impoverished.

• Neighborhoods with zero ERF were defined as non-impoverished.
DISTRIBUTION OF AA WOMEN’S
\((N=104,676)\) EXPOSURE TO ERF
LBW RATES BY MATERNAL AGE AND NEIGHBORHOOD POVERTY: 
African-Americans 
(Collins et al, Ethn Dis, 2006)
LBW RISK DIFFERENCE BETWEEN 30-34 AND 20-24 YEAR OLD WOMEN BY NEIGHBORHOOD POVERTY
LBW rates by Age and Lifelong Residential Environment among African-American Women; Cook County IL (in press)
VLBW RATES AMONG WOMEN WITH LIFELONG RESIDENCE IN AFFLUENT CHICAGO NEIGHBORHOODS
(Collins et al, Ethn Dis, 2007)
Prosperity still can't buy security, peace of mind in black middle-class areas

By Ron Grossman and Byron P. White
TRIBUNE STAFF WRITERS
Web-posted: Saturday, February 1, 1997
African-American Mothers’ Perception of Their Residential Environment, Stressful Life Events, and Very Low Birthweight

James W. Collins, Jr.,¹ Richard J. David,² Rebecca Symons,¹ Arden Handler,³ Stephen Wall,¹ and Steven Andes⁴
<table>
<thead>
<tr>
<th>Low Rating</th>
<th>VLBW</th>
<th>NON-LBW</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>police</td>
<td>55%</td>
<td>26%</td>
<td>3.2 (1.2-8.4)</td>
</tr>
<tr>
<td>property</td>
<td>43%</td>
<td>23%</td>
<td>1.9 (1.1-3.4)</td>
</tr>
<tr>
<td>safety</td>
<td>48%</td>
<td>25%</td>
<td>2.8 (1.0-7.4)</td>
</tr>
<tr>
<td>friendliness</td>
<td>39%</td>
<td>20%</td>
<td>2.2 (0.8-5.8)</td>
</tr>
<tr>
<td>services</td>
<td>29%</td>
<td>19%</td>
<td>1.7 (0.6-5.0)</td>
</tr>
<tr>
<td>cleanliness</td>
<td>50%</td>
<td>28%</td>
<td>2.5 (1.0-6.4)</td>
</tr>
<tr>
<td>quietness</td>
<td>61%</td>
<td>42%</td>
<td>2.1 (0.8-9.7)</td>
</tr>
<tr>
<td>schools</td>
<td>28%</td>
<td>15%</td>
<td>2.8 (0.8-9.7)</td>
</tr>
</tbody>
</table>
VLBW AND UNFAVORABLE RATING (OVERALL) OF RESIDENTIAL ENVIRONMENT

ODDS RATIO

VLBW: 3.2 (1.2-8.8)
NON-LBW: 20%

PERCENT
Race

“Race” is not a biological construct that reflects innate differences, but a social construct that precisely captures the impacts of racism.  
(Jones, AJPH, 2000)
MATERNAL LIFETIME EXPOSURE TO INTERPERSONAL RACISM AND INFANT BIRTH WEIGHT

(Collins et al, AJPH, 2004)
MATERNAL LIFETIME EXPOSURE TO INTERPERSONAL RACISM IN 1 OR MORE DOMAINS AND INFANT BIRTH WEIGHT

(Collins et al, AJPH, 2004)
MATERNAL LIFETIME EXPOSURE TO INTERPERSONAL RACISM IN 3 OR MORE DOMAINS AND INFANT BIRTH WEIGHT

(Collins et al, AJPH, 2004)

% exposed to racism

OR=2.7 (1.3-5.4)
LOGISTIC REGRESSION
(Collins et al, AJPH, 2004)

- Unadjusted and adjusted OR of VLBW for maternal lifetime exposure to interpersonal racial discrimination in 1 or more domains were 1.9 (1.2-3.1) and 2.3 (1.1-3.6), respectively.
- Unadjusted and adjusted OR of VLBW for maternal lifetime exposure to interpersonal racial discrimination in 3 or more domains were 2.7 (1.3-5.4) and 2.6 (1.2-5.3), respectively.
MATERNAL CHRONIC EXPOSURE TO INTERPERSONAL RACISM IN THE WORKPLACE AND INFANT BIRTH WEIGHT

• “You are watched more closely than others because of your race”. OR=2.3 (0.8-6.1)
• “Whites often assume that you work in a lower class job than you do and treat you as such”. OR=2.3 (1.0-5.1)
• “You are treated with less dignity and respect than you would be if you were white”. OR=2.0 (0.8-4.3)
MATERNAL CHRONIC EXPOSURE TO INTERPERSONAL RACISM IN THE WORKPLACE AND INFANT BIRTH WEIGHT

![Bar chart showing the percentage of women exposed to racism in the workplace by number of racist events and birth weight.]

- 1 or more* events: VLBW (dark blue) and non-LBW (red) bars.
- 3 or more* events: VLBW (dark blue) and non-LBW (red) bars.
- 7 or more events: VLBW (dark blue) and non-LBW (red) bars.
Self-Reported Experiences of Racial Discrimination and the Racial Disparity in Preterm Delivery: the CARDIA Study

(Mustillo et al, AJPH, 2004)
Racial Discrimination and the Racial Disparity in Low Birth Weight Delivery: the CARDIA Study (Mustillo et al, AJPH, 2004)

- Unadjusted OR of LBW delivery for African-American (compared to White) women was 4.2 (1.3-13.7).
- Adjusted (racial discrimination) OR of LBW delivery was 2.1 (0.8-5.9).
- Adjusted (racism, SES, depression, alcohol, and tobacco use) OR of LBW delivery was 2.4 (0.8-7.4).
Background

- Latinos quickly becoming the largest minority group in America
- According to the 2000 U.S. Census
  - 35.3 million Latinos in the U.S.
  - 20.6 million (58.5 percent) of Latinos are Mexican
  - Mexican population has increased by 52.9 percent between the 1990 and 2000 census
LBW RATES AMONG LATINOS IN CHICAGO

(Collins and Shay, AJE, 1994)

Puerto Ricans (N=3,582)
Other (N=6,455)
S. Americans (N=1,330)
Cubans (N=263)
Mexican-Americans (N=11,263)
LBW RATES AMONG PR AND MA
BY MATERNAL AGE
(Collins and Shay, AJE, 1994)

Puerto Ricans (N=3,582)  •  MA (N=11,263)
LBW RATES AMONG PR AND MA BY CENSUS TRACT INCOME
(Collins and Shay, AJE, 1994)

Puerto Ricans (N=3,582)  MA (N=11,263)
LBW RATES AMONG MEXICAN-AMERICANS
BY NATIVITY AND CENSUS TRACT INCOME
(Collins and Shay, AJE, 1994)

U.S.-BORN MA (N=2,300)  MEXICAN-BORN (N=8,963)
LBW RATES OF MEXICAN-AMERICANS BY MATERNAL GENERATIONAL RESIDENCE IN THE U.S.

Collins and David, Ethn Dis, 2004

Infant LBW Rates (per 100)

<table>
<thead>
<tr>
<th>Category</th>
<th>Number (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexican-Born</td>
<td>39,050</td>
</tr>
<tr>
<td>First Generation</td>
<td>2,203</td>
</tr>
</tbody>
</table>
VLBW RATES OF MEXICAN-AMERICANS BY MATERNAL GENERATIONAL RESIDENCE IN THE U.S.
Collins and David, Ethn Dis, 2004

Infant VLBW Rates (per 100)

Mexican-Born (N=39,050)  First Generation US-Born (N=2,203)
LBW RATES OF MEXICAN-AMERICANS BY MATERNAL NATIVITY AND EDUCATION
Study Objective

• To explore the extent to which lifelong exposure to neighborhood poverty affects infant LBW rates of first generation U.S.-born Mexican-American women
Methods

• Neighborhood poverty was defined as census tract median family income less than the 50th percentile
• Neighborhood socioeconomic status (SES) was determined at two points in woman’s life:
  – Time of her birth
  – Time of her pregnancy
• Maternal individual variables: age, education, parity, prenatal care, and cigarette smoking
• Rates of infant low birth weight (< 2500g, LBW) were calculated
Methods

• 1989-1991 Illinois computerized birth certificates of singleton infants born to first generation Mexican-American women

• Based on mother’s full maiden name and exact date of birth, linked 79% (N=1,511) of maternal birth records (1956-1975) to infant records (1989-1991)

• Appended 1990 US census income data to each infant record

• Appended 1960 US census income data to each maternal record
Distribution of Neighborhood SES

Maternal Neighborhood SES

Percent

Lifelong Poverty  Early NON-Poverty/Adult Poverty  Early Poverty/Adult NON-Poverty  Lifelong NON-Poverty  Missing
LBW Rates According to Neighborhood SES (unpublished)
Life Course Perspective

Reproductive Potential

Age

White

Lifelong Minority Status

Pregnancy
Adverse Environmental conditions
Social policy
Poverty
Limited Access to Care
Under-Education
Racism
Lack of access to good Nutrition
Weathering
Unemployment
Hopelessness
Stress
Disparities
Bad Housing
Bad Neighborhoods
Smoking
Family Support
Poor Working Conditions
Adverse Environmental conditions
Lack of access to good Nutrition
Adapted from A. R. James
A 12-Point Plan:
Lu and colleagues

1. Provide interconception care to women with prior adverse pregnancy outcomes
2. Increase access to preconception care for African American women
3. Improve the quality of prenatal care
4. Expand healthcare access over the life course
5. Strengthen father involvement in African American families
6. Enhance service coordination and systems integration
7. Create reproductive social capital in African American communities
8. Invest in community building and urban renewal
9. Close the education gap
10. Reduce poverty among African-Americans
11. Support working mothers
12. Undo racism: institutional, interpersonal
All of this will not be finished in the first 100 days. Nor will it be finished in the first 1,000 days, not in the life of your Administration, nor even perhaps in our lifetime on this planet. But let us begin.

John F Kennedy (1961)
I have a dream that my four little children will one day live in a nation where they will not be judged by the color of their skin, but by the content of their character.

Martin Luther King, Jr (1963)
Let America be America again. 
Let it be the dream it used to be—
O, let America be America again—
The land that never has been yet—
And yet must be——
the land where every man is free.

Langston Hughes