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Higher Mortality Rate Among Infants of US-Born Mothers Compared to Foreign-Born Mothers in New York City

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This study is to compare infant mortality rates (IMRs) between US- and foreign-born mothers in New York City. The linked live birth-infant death records from 1995 to 1998 were analyzed. Overall US-born mothers had a higher IMR than foreign-born mothers, though there were great variations in IMRs by country of maternal birth among foreign-born mothers. US-born mothers had higher IMRs compared to foreign-born mothers for several maternal/infant characteristics. Logistic regression analyses indicated that infants of foreign-born mothers were less likely to die from prematurity, Sudden Infant Death Syndrome and external causes, but were more likely to die of congenital anomalies than those of US-born mothers. Further analyses on the interactions of maternal race/ethnicity and country of birth showed variations in the IMRs of leading causes of death. Infant mortality reduction strategies should be differentially targeted to minority mothers of different countries of birth, particularly for potentially preventable causes of deaths.

KEY WORDS: infant mortality; country of birth; causes of death; race/ethnicity.

INTRODUCTION

Infant mortality is an important marker of a community's health and social well-being. Main risk factors associated with a high infant mortality rate include lower socio-economic status, lack of prenatal care, less education, tobacco and substance abuse during pregnancy, being a teenaged, black woman, and poor health of the mother (1–7). Several studies have shown that foreign-born women as a group have better pregnancy outcomes, such as lower rate of low birth weight infants, less preterm deliveries and lower infant mortality rate (IMR) compared to women who were born in the United States (US) (8–12). These better outcomes have been explained in part by the phenomenon of positive selectivity called healthy immigrant effect, whereby immigrants who were able to come to the US are healthier than their fellow countrymen who stayed in their country of birth (10). However, findings from several studies of perinatal and infant health among various immigrant groups display a far more complicated picture, as their health outcomes tend to vary when foreign-born groups are stratified by race/ethnicity and by specific country of maternal birth (13–17). For example, adverse pregnancy outcomes have been found to be more frequent among foreign-born black (African or Caribbean) women than among white women or US-born black women (18, 19).

New York City (NYC), where more than 200 languages are spoken, has been called the "Capital of the World" because of its diverse ethnic population. Immigration patterns have changed over the last century, with most immigrants coming from European countries in the early 1900s to mainly Latin America and Asia more recently. The diversity of NYC

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immigrant population provides a great source of information for immigrant health studies. However, to date, only a handful of studies have been published on the reproductive health outcomes of immigrant women and their children in NYC (19–23).

To better understand maternal and infant health among immigrants, this study used birth and infant death vital records to examine the association of infant mortality and area of maternal birth. The study objectives were to compare infant mortality rates for US- and foreign-born mothers stratified by selected maternal and infant characteristics, and to compare the rate of infant deaths for leading causes of death among various ethnic US- and foreign-born mothers, controlling for relevant maternal and infant characteristics.

METHODS

This study used live birth and linked birth-infant death files from 1995 to 1998, provided by the NYC Department of Health and Mental Hygiene Office of Vital Statistics. US- and foreign-born groups were based on area of maternal birth as stated on the infant birth certificate; US-born mothers included those who were born in the fifty states and US territories (e.g., Puerto Rico, Guam). The IMR is the number of infant deaths that occurred up to but not including one year of age in a specific year divided by the number of live births in the same year, expressed per 1000 live births.

All infant deaths with missing area of maternal birth were excluded in this study. The race/ethnicity in this study was classified into white (non-Hispanic), black (non-Hispanic), Hispanic, Asian (i.e., Asian and Pacific Islander, non-Hispanic), other (American Indian, Alaska Native, multiple races; non-Hispanic), and missing/unknown (excluded in all analyses). In all cases, the white category includes only white-non-Hispanics and the black group includes only the blacks-non-Hispanics. The timing of infant deaths was divided into two periods: neonatal (less than 28 days after birth) and postneonatal (from 28 through 364 days). The causes of infant death were categorized into eight groups based on a common etiologic mechanism and similar potential strategies for management (24); these categories are prematurity, congenital anomalies, Sudden Infant Death Syndrome (SIDS), external causes (including various injuries), obstetric conditions, non-perinatal infections, perinatal infections, and birth asphyxia. All other causes were grouped into an other/unspecified category.

The IMRs were stratified by maternal race/ethnicity, area of maternal birth, and selected maternal and infant characteristics. Maternal characteristics included borough of residence, marital status, educational level, age, Medicaid coverage, prenatal care utilization, and previous infant death. Infant characteristics included gestational age, birth weight, sex, whether the infant was a singleton or not, and birth order.

To control for the effect of maternal and infant characteristics on the relationship of birthplace of mother with infant deaths, a separate logistic regression model was applied for each leading cause of death. In each model, the outcome variable was a specific cause, compared to all other causes in the model, such as SIDS versus all other causes. The controlled variables were selected based on significant variables in the univariate analyses and published literature, including borough of residence (Manhattan, Bronx, Brooklyn, Queens, Staten Island), maternal education (<12 years vs. ≥ 12 years), maternal marital status (married vs. non-married), maternal age (<20 vs. ≥ 20 years), Medicaid (yes vs. no), prenatal care (yes vs. no), past infant death experience (yes vs. no), plurality (multiple vs. singleton birth), timing of death (neonatal vs. postneonatal), preterm birth (<37 vs. ≥ 37 weeks of gestation), and low birth weight (<2500 vs. ≥ 2500 g). Preterm birth and low birth weight were not controlled in the analyses of infant deaths due to prematurity. Two variable selection strategies were used in designing the models: Model A included area of maternal birth and race/ethnicity as separate variables and Model B included the interaction of area of maternal birth and race/ethnicity (e.g., US-born white, foreign-born black, US-born Hispanic). All p values in this study were two-sided.

SAS 8.0 (SAS Institute Inc., Cary, NC, 2001) and Epi-Info were used to calculate the stratified IMRs, and run Chi-square tests, Fisher Exact tests, and the logistic regression models.

RESULTS

There were 3,871 infant deaths between 1995 and 1998 in NYC. Of those, 3,457 had a known area of maternal birth, 2,028 (58.7%) of which were born to US-born mothers and 1,429 (41.3%) were to foreign-born mothers. US-born mothers had a

higher IMR (7.8 per 1000 live births) compared to foreign-born mothers (5.9) (US-born vs. foreign-born Rate Ratio (RR) = 1.3, $p < 0.001$), a difference observed for most racial/ethnic groups. Among US-born mothers, the IMR was 8.5 for NYC-born mothers, 7.9 for Puerto Rico-born mothers, and 6.5 for mothers born outside NYC (excluding Puerto Rico). US-born black mothers had the highest IMR (12.7), followed by foreign-born black (10.0), US-born Hispanic (7.5), US-born Asian (6.7), foreign-born Hispanic (5.4), US-born white (4.2), foreign-born white (4.1), and foreign-born Asian mothers (3.9). From 1995 to 1998, the IMR decreased for most racial/ethnic groups among US-born and foreign-born mothers, except for US-born and foreign-born white mothers who had low and stable IMRs. Even though US-born black and Hispanic mothers had significantly higher IMRs than their foreign-born counterparts, the IMR gaps between US-born and foreign-born mothers has been narrowing from 1995 to 1998.

The relationship between area of maternal birth and IMR varied by continents and by countries within each continent (Fig. 1). The IMR was 8.7 for women from Central America and the Caribbean, 8.6 for African women, 5.9 for South Americans, 4.2 for Europeans, and 4.0 for Asians. Among countries of birth of mother that contributed more than five hundred live births in NYC from 1995 to 1998, the countries with the highest IMR were exclusively in the Caribbean, Central America and Africa, namely St. Lucia (15.2), Gambia (14.9), Belize (14.1), Ghana (13.1), Haiti (11.9), Panama (11.7), Nigeria (11.5), Barbados (10.8), Nicaragua (10.8), Grenada (10.6), Ivory Coast (10.3), and St. Vincent (10.1). Interestingly, mothers from some African and Central American/ Caribbean countries had much lower IMR than the City's average foreign-born mothers; for example, women from Guinea (5.4), Senegal (2.9), Honduras (6.2), the Dominican Republic (5.3), Mexico (5.2), El Salvador (4.9), and Guatemala (3.9) had a lower IMR than their region-specific IMR or the overall NYC IMR.

The IMR was significantly higher for US-born mothers compared to foreign-born mothers in 4 of 5 NYC's boroughs and for unmarried mothers, women aged 18–35 years, women who had Medicaid coverage at delivery, infants born at normal birth weight and at normal gestational age, and singletons (Table I). Among residents of Staten Island, married women, women aged <18 years or >35 years, infants born low birth weight or premature and those from a multiple pregnancy, there was no significant difference in IMR between both groups. US-born women had higher IMR at all levels of education, and regardless of history of previous infant death, prenatal care initiation time, and infant's gender. Foreign-born women without Medicaid coverage had a higher IMR than US-born women without Medicaid.

The leading causes of infant death were prematurity (46.8%), congenital anomalies (19.4%), SIDS (6.0%), non-perinatal infections (3.7%), perinatal

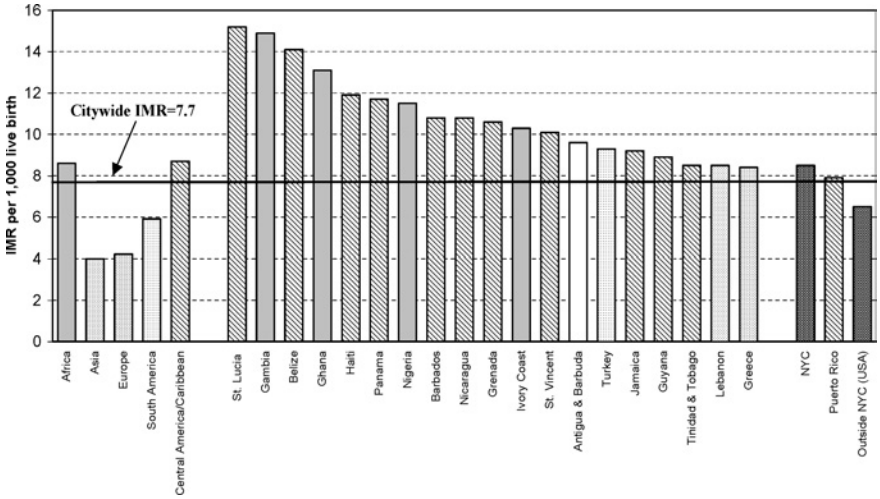

Fig. 1. Infant mortality rate (IMR) by area of maternal birth, New York City, 1995–1998. *Note*: The countries of maternal birth were restricted to countries with more than 500 live births in NYC in 1995–1998.

Table I. Infant Mortality Rates (IMRs) per 100,000 Live Births and IMR Ratios, by Area of Maternal Birth and Maternal/Infant Characteristics, New York City, 1995–1998

	US-born IMR	Foreign-born IMR	Unadjusted IMR ratio[a] (95% confidence interval)
Maternal residence			
Manhattan	6.65	4.33	1.54 (1.26–1.87)***
Bronx	9.01	6.70	1.34 (1.15–1.57)***
Brooklyn	9.12	7.26	1.26 (1.13–1.40)***
Queens	7.97	5.08	1.57 (1.35–1.82)***
Staten Island	5.02	4.62	1.09 (0.69–1.71)
Outside NYC	4.52	6.14	0.74 (0.54–1.00)
Maternal marital status			
Married	4.51	4.92	0.92 (0.82–1.03)
Unmarried	11.02	7.22	1.53 (1.40–1.66)***
Maternal education			
Less than high school	10.76	5.55	1.94 (1.70–2.21)***
High school graduate or more	6.53	5.77	1.13 (1.04–1.23)**
Maternal age at infant birth			
<18	11.19	8.29	1.35 (0.97–1.89)
18–35	7.57	5.37	1.41 (1.30–1.52)***
>35	7.54	8.44	0.89 (0.77–1.04)
Medicaid coverage at infant birth			
Yes	10.40	5.47	1.90 (1.74–2.08)***
No	5.68	6.41	0.89 (0.80–0.99)*
Starting time of prenatal care			
None	29.67	12.83	2.31 (1.72–3.11)***
First trimester	5.98	5.30	1.13 (1.02–1.25)*
Second trimester	6.89	4.75	1.45 (1.25–1.69)***
Third trimester	7.16	3.24	2.21 (1.56–3.12)***
Previous infant death experience			
Yes	27.68	18.30	1.51 (1.14–2.01)**
No	7.27	5.59	1.30 (1.21–1.40)***
Sex of infant			
Male	8.46	6.26	1.35 (1.23–1.48)***
Female	7.02	5.63	1.25 (1.13–1.38)***
Birthweight (grams)			
<1500	226.84	237.90	0.95 (0.88–1.03)
1500–2499	13.49	13.15	1.03 (0.85–1.23)
≥2500	2.40	1.72	1.39 (1.22–1.58)***
Gestational age (weeks)			
<37	38.00	35.08	1.08 (0.99–1.18)
≥37	2.69	1.99	1.35 (1.19–1.53)***
Multiple birth			
Singleton	6.96	5.36	1.30 (1.21–1.40)***
Multiple	27.84	29.93	0.93 (0.77–1.12)

[a]Unadjusted IMR ratios were based on US-born versus foreign-born.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

infections (3.6%), external causes (3.2%), obstetric conditions (2.1%), and birth asphyxia (1.5%) (Table II). The three leading causes of deaths for infants were the same for US-born and foreign-born mothers: prematurity, congenital anomalies and SIDS. Infants of US-born mothers were more likely to die of external causes, SIDS, and nonperinatal infections, but were less likely to die of congenital anomalies compared to infants of foreign-born mothers. Among neonatal deaths, there were

Table II. Causes of Infant Deaths, by Timing of Death and Area of Maternal Birth, New York City, 1995–1998

	Area of maternal birth		Neonatal deaths			Postneonatal deaths			
	US-born	Foreign-born	US-born	Foreign-born	All	US-born	Foreign-born	All	Total
Prematurity & related conditions	964 (47.5%)	654 (45.8%)	62.5%	57.5%	1451* (60.3%)	16.2%	15.4%	167 (15.9%)	1618 (46.8%)
Congenital anomalies	336 (16.6%)	333* (23.3%)	16.2%	20.9%	438** (18.2%)	17.4%	29.5%	231*** (22.0%)	669 (19.4%)
Sudden infant death syndrome (SIDS)	145 (7.2%)	63* (4.4%)	1.0%	0.6%	20 (0.8%)	20.0%	14.4%	188* (17.9%)	208 (6.0%)
Non-perinatal infections	88 (4.3%)	41* (2.9%)	0.3%	0.3%	7 (0.3%)	12.8%	9.6%	122 (11.6%)	129 (3.7%)
Perinatal infections	65 (3.2%)	58 (4.1%)	3.3%	4.2%	88 (3.7%)	3.1%	3.8%	35 (3.3%)	123 (3.6%)
External causes/ injuries	90 (4.4%)	21* (1.5%)	0.7%	0.1%	10* (0.4%)	12.4%	5.0%	101*** (9.6%)	111 (3.2%)
Obstetric conditions	45 (2.2%)	28 (2.0%)	3.0%	2.6%	68 (2.8%)	0.6%	0.3%	5 (0.5%)	73 (2.1%)
Birth asphyxia	28 (1.4%)	25 (1.7%)	1.6%	1.9%	42 (1.8%)	0.9%	1.3%	11 (1.1%)	53 (1.5%)
Others	267 (13.2%)	206 (14.4%)	11.5%	11.9%	281 (11.7%)	16.6%	20.9%	192 (18.3%)	473 (13.7%)
Total	2028	1429	1373	1032	2405	655	397	1052	3457

Note. 1. This analysis excluded infant deaths with missing information on area of maternal birth.

2. Within each cause of death, $\chi 2$ or Fisher exact test for the difference in causes of death between foreign-born and US-born groups:
$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

significant differences in the proportions of prematurity, congenital anomalies and external causes between US-born and foreign-born mothers. Among postneonatal deaths, a significantly higher proportion of US-born mothers had infants who died of SIDS and external causes compared to foreign-born mothers. A significantly higher proportion of foreign-born mothers had infants who died of congenital anomalies in the postneonatal period than US-born mothers.

Model A, controlling for several variables, showed that infants of foreign-born mothers were less likely to die from prematurity, SIDS and external causes, but were more likely to die of congenital anomalies than those of US-born mothers (Table III). Compared to white infants, black infants were more likely to die of prematurity-related conditions, SIDS and external causes, Hispanic infants were more likely to die of prematurity, and Asian infants were more likely to die of SIDS. On the other hand, black infants were less likely to die of congenital anomalies than white infants.

Model B showed significant interactions between area of maternal birth and race/ethnicity for selected causes of death. Compared to infants of US-born white mothers, infants of US-born black mothers were more likely to die of SIDS and external causes. Infants born to US-born black, foreign-born black mothers, US-born Hispanic, and US-born Asian were more likely to die of prematurity related conditions. On the other hand, infants of US-born black and foreign-born black mothers were less likely to die of congenital anomalies compared to those of US-born white mothers.

DISCUSSION

This study showed that foreign-born mothers had an overall lower IMR than US-born mothers, similar to previously published studies (1, 10). However, we found that the IMR varied by continent and area of maternal birth; for example, immigrant mothers from several countries of Central America, the Caribbean and Africa had higher IMR compared to that of women from Asia, Europe and South America. A study of perinatal health in London comparing women from various countries showed that women from Africa and West Indies experienced more intrauterine and neonatal deaths than white

Table III. Risks of Infant Deaths (Odds Ratios and 95% Confidence Intervals), Race/Ethnicity and Area of Maternal Birth, New York City, 1995–1998

	Prematurity ($N = 3{,}004$)	Congenital anomalies ($N = 2{,}711$)	SIDS ($N = 2{,}711$)	External causes ($N = 2{,}711$)
Model A				
Foreign-born vs. US-born	0.82* (0.69–0.98)	1.45** (1.17–1.80)	0.65* (0.42–0.98)	0.35** (0.18–0.64)
White (non-Hispanic)	Referent	Referent	Referent	Referent
Black (non-Hispanic)	2.27** (1.76–2.93)	0.44** (0.32–0.59)	2.64** (1.38–5.35)	2.55* (1.14–6.23)
Hispanic	1.43* (1.09–1.88)	0.78 (0.57–1.06)	1.93 (0.96–4.04)	1.76 (0.73–4.52)
Asian	1.29 (0.85–1.95)	0.77 (0.48–1.21)	4.03** (1.54–10.44)	1.11 (0.15–5.11)
	Prematurity ($N = 3{,}085$)	Congenital anomalies ($N = 2{,}783$)	SIDS ($N = 2{,}783$)	External causes ($N = 2{,}783$)
Model B				
US-born white	Referent	Referent	Referent	Referent
Foreign-born white	0.92 (0.60–1.40)	1.16 (0.72–1.84)	N/A	0.33 (0.02–1.89)
US-born black	2.03** (1.56–2.66)	0.39** (0.27–0.54)	2.36* (1.24–4.72)	2.61* (1.17–6.37)
Foreign-born black	1.89** (1.41–2.53)	0.70* (0.49–0.99)	1.42 (0.66–3.09)	0.60 (0.17–1.88)
US-born Hispanic	1.42* (1.05–1.93)	0.80 (0.56–1.14)	1.45 (0.70–3.09)	1.52 (0.61–4.01)
Foreign-born Hispanic	1.02 (0.75–1.38)	1.02 (0.73–1.44)	1.44 (0.67–3.16)	0.85 (0.28–2.50)
US-born Asian	4.11* (1.08–18.32)	N/A	8.03 (0.70–67.26)	N/A
Foreign-born Asian	0.92 (0.60–1.40)	1.19 (0.75–1.87)	2.07 (0.78–5.27)	0.48 (0.07–2.07)

Note. 1. Each logistic regression model was adjusted for other race/ethnicity, borough of maternal residence, maternal education/marital status, teenage mothers, Medicaid, prenatal care, multiple birth, infant birth order, timing of death, preterm birth (except in the prematurity category), and low birth weight (except in the prematurity category).
2. N/A: Sample size was too small to calculate the odds ratio and 95% of CI.
*$P < 0.05$; **$P < 0.01$.

women (25). The so-called healthy immigrant effect or positive selectivity of immigrants is thought to account for better outcomes seen for many immigrants to the United States in several health areas. However, this effect was not found for immigrants from several countries of Africa, Central America and the Caribbean. The variation in infant mortality among women from Central America and the Caribbean has been demonstrated since the 1980s in the United States when it was shown that Cuban and Mexican women had much lower IMR than women from other countries of Central America or the Caribbean (26).

In our study, US-born black women were found to experience more infant deaths compared to foreign-born black women or other US-born ethnic groups in NYC. The weathering hypothesis provides some insight on possible reasons for the poor pregnancy outcomes of US-born blacks (27). According to this hypothesis, socioeconomic inequality, daily stress and racial discrimination, particularly in health care access, and more intense exposure to health risks may significantly affect the health of women of childbearing age, particularly black women born and raised in the United States. Thus, socio-economically disadvantaged women, especially blacks because of the added effect of racism, may be subject to higher health risks and limited access or lower quality of health care, with the health consequences of inequality accumulating with age. The negative effects of low socio-economic status suffered from early childhood could be lasting, and even those who escape poverty in adulthood are likely to have a greater reproductive disadvantage. This complicated interaction of social, environmental, and biological factors experienced by black mothers in the United States might account for a higher infant mortality in this group (4).

Additional factors were proposed to explain the infant mortality differences between US- and foreign-born minority mothers, such as maternal nutrition (e.g., US-born black mothers eat more fat in their diet) and stress (e.g., foreign-born black mothers might not have similar long-time experiences to socioeconomic discriminations as the US-born black mothers) (1, 19). For black mothers, especially US-born, a "Life-Course Perspective" also suggests that different risk behaviors, stressors, prenatal care, gene-environment interactions, and racial discrimination over their life courses might explain the racial disparities in birth outcome (7).

We found that the IMR varied among US- and foreign-born mothers according to maternal and infant characteristics. For many analyzed factors, US-born mothers of different ethnic backgrounds had higher IMR than foreign-born mothers. One study shows that foreign-born mothers were more likely to be older, have a better education, or receive more prenatal care visits than US-born mothers (13), which, if true in NYC, might explain partly the better outcomes of foreign-born women. Being unmarried has been shown to be a significant risk factor for infant mortality in several studies (28, 29) Compared to married women, unmarried mothers are likely to experience more difficult socioeconomic conditions and stresses, such as problems with housing arrangement, exposure to environmental hazards and crime, limited access to health care, and lower income and social supports. Although we found that unmarried women in general had higher IMR than married women, we also found that US-born unmarried mothers had a higher IMR than foreign-born unmarried mothers.

The logistic regression models demonstrated that infants of US-born black mothers were more likely to die of SIDS, external causes, and prematurity, but less likely to die of congenital anomalies compared to their white counterparts. Analysis of the 1998 US-linked live birth-infant death analysis showed that IMR due to short gestational age or low birth weight was higher for all minorities compared to whites, but the maternal places of birth were not specified for non-Hispanic minorities (30). However, the mothers from Mexico and Central/South America had a lower prematurity related IMR than that of non-Hispanic white mothers in that report.

One study has also shown that black mothers experience more infant deaths from SIDS than non-black mothers in the United States (31). Similarly, a British study found that the proportion of infant deaths from SIDS was higher among Caribbean-born mothers compared to British-born mothers (32). SIDS was significantly higher in infants born to Asian mothers than those of white mothers, but the difference was not significant for US-born or foreign-born Asian mothers separately. The reason for non-significant results might be small numbers of infants who died of SIDS in these two Asian groups. One study showed that Asian mothers in California (82% of them were immigrants) were less likely to use the back sleeping position that could possibly cause SIDS (33). Two Australian studies have shown that Thai mothers raised their infants according to

their original cultural beliefs and practices which might have affected the sleeping position and overheating of infants (34, 35), Varied child-rearing cultures might affect the risks of SIDS among ethnicity groups, therefore specific qualitative research is needed to understand cultural factors affecting SIDS.

Others also found that infant deaths due to external causes were higher for black mothers in the United States, especially postneonatal deaths due to homicide and suffocation (36, 37). Congenital anomalies contributed less infant deaths among black than among white infants, supporting our findings (38, 39). Another British study showed that congenital anomalies are low among British mothers born in Western Africa and the Caribbean relative to those born in other regions of the world (40). The 1998 National Vital Statistical Report also showed that congenital anomalies were not the leading cause of deaths for black infants in the US (30). Another possible explanation was competing causes of infant death (i.e., prematurity, SIDS or external causes) among infants of black mothers, compared to their white counterparts who were less likely to die of these causes.

Certain limitations of this study should be considered. As this analysis is based on vital record data, missing or incomplete information on maternal and infant characteristics on birth and death certificates could lead to an underestimate of the association of certain maternal/infant characteristics with infant mortality. Data accuracy and completeness are important to perinatal research based on birth and death records. Substance abuse, for example, is known to be unreliable on infant birth certificates due to underreporting, therefore we were not able to examine possible effects of maternal substance abuse on infant mortality. Due to lack of information on the length of maternal residence in the United States for foreign-born mothers, we could not distinguish between newly arrived and long-time foreign-born residents, a factor that could affect the relationship between area of maternal birth and health outcomes. Relatively small number of infant deaths in some groups (e.g., foreign-born white, US-born Asian) could explain the wider confidence intervals for the adjusted odds ratios in logistic regression models and possibly lack of significant results in some comparisons.

In summary, this study showed that the IMR was higher among US-born black and foreign-born black mothers (those from Africa, the Caribbean and some Central American countries) compared to the city average and to white women. This study is also one of the few comparing infant mortality between US- and Foreign-born mothers, stratified by leading causes of infant death. We also found that main causes of infant deaths among black women (i.e., prematurity, SIDS, external causes) were potentially preventable. These potentially preventable causes us to believe that better pre-pregnancy health, reduction of unintended pregnancy, consultation on infant care and safety need to be specifically addressed in black women. In addition, culturally sensitive training for health care providers and customized pre-conception and maternal-infant health programs may be helpful to improve access and quality of reproductive and perinatal health care for disadvantaged mothers (41–43). By targeting marginalized racial minorities and immigrant women, infant mortality in NYC could be more efficiently and effectively reduced. More research should focus on interventions to reduce the health gap between disadvantaged populations and those more fortunate, as well as on studies of cultural and behavioral variations among specific racial/ethnic groups with different immigration experiences.

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