Generations of Loss: Contemporary Perspectives on Black Infant Mortality

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The U.S. black infant mortality rate (IMR) remains a significant public health concern. Although improved during the last four decades, the U.S. IMR remains within the lowest tier of IMRs for all industrialized countries, and black American infants remain disproportionately represented in low birthweight (LBW) and infant death statistics.

Numerous risk factors have been analyzed for their relative contributions to the U.S. IMR and black–white infant survival health disparities. Those factors include prenatal care quality and access, maternal socioeconomic status (SES), HIV/AIDS status, infections, intrapartum risk factors, existing comorbidities, social support, and nutritional status. However, the role of these and other factors have not fully explained the higher infant mortality risks for black infants.

This review will discuss a variety of risk factors that contribute to infant mortality disparities between non-Hispanic black and white infants. Among those factors, the goal will be to review selected topics pertaining to maternal SES, LBW, preterm birth, perinatology advances, birth record data quality, maternal stress, prenatal care adequacy, and physical and substance abuse, and the relationships of those topics to black–white IMR health disparities.

Key words: black infant mortality ■ health disparities

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INTRODUCTION

The U.S. infant mortality (infant deaths within the first year of life) remains a significant public health concern.[1-4] Recent statistics indicate that the U.S. infant mortality rate (IMR) is 6.9 deaths per 1,000 live births (2000).[1] Although improved, the U.S. IMR places it within the lowest tier of IMRs for all industrialized countries.[2,5] For example, recent statistics indicate that the USIMR ranks below IMRs for the Czech Republic (5.2 deaths per 1,000 live births), Greece (5.7 deaths per 1,000 live births), and Panama (5.9 deaths per 1,000 live births).[5]

Steady improvements in the U.S. IMR have been attributed to advances in prenatal care and perinatology and improvements in ante- and perinatal care for high-risk infants. For example, in 1950, the black American IMR was 43.9 deaths per 1,000 live births; for white Americans, the IMR was 29.2 deaths per 1,000 live births.[6] By 1970, the black IMR was 32.6 deaths per 1,000 live births; for whites, the IMR was 17.8 deaths per 1,000 live births.[6] Additionally, in 1970, the overall U.S. IMR was approximately 20 deaths per 1,000 live births.[5] By 1998, the U.S. IMR had declined to 7.2 deaths per 1,000 live births.[5] However, despite medical advances and general improvements in U.S. IMRs, black–white American IMR disparities have not been eliminated, and black infants remain disproportionately represented in low birthweight (LBW) and infant death statistics.[4] As a result, significant black–white disparities exist in infant survival within the first year of life (with the majority of infant deaths within the neonatal period or first 28 days of life), which have adversely affected the overall U.S. IMR.

This paper will review a variety of risk factors that contribute to the disparities in infant mortality among non-Hispanic black and white children. Among those factors, the goal will be to review selected topics pertaining to maternal SES, LBW, preterm birth, perinatology advances, birth record data quality, maternal stress, and prenatal care adequacy, and the relationships of those topics to black–white IMR health disparities.

IMR Variations

During the past several years, national data indicated that the black IMR, although generally showing some improvement, has inter-state variations. For example, of 27 states reviewed, the black IMR ranged from 8.8 deaths (Massachusetts) to 19.2 deaths (Nebraska) per 1,000 live births (1997).[2] By 2000, black IMR rates spanned from 5.0 deaths (Massachusetts) to 13.5 deaths (District of Columbia) per 1,000 live births.[1] More recent data (2001) indicate state black IMRs have ranged from 9.6 deaths (Massachusetts) to 22.8 deaths (Arizona) per 1,000 live births; in comparison, for white infants, mortality rates (2001) ranged from 3.8 deaths (New Hampshire) to 8.0 deaths (Delaware) per 1,000 live births.[7]

Causes

Birth defects, LBW, prematurity, sudden infant death syndrome (SIDS) and respiratory distress syndrome (RDS) are major risk factors affecting infant mortality. Health disparities are evident when the causes of infant death are examined. Black American infants remain overrepresented in all major categories contributing to U.S. infant deaths.[1]

For example, in terms of infant deaths per 100,000 live births, most recent statistics indicate that congenital malformations (138.5 deaths per 100,000 live births), disorders relating to short gestation and LBW not otherwise classified (74.7 deaths per 100,000 live births) and SIDS (51.8 deaths per 100,000 live births) account for the primary causes of death for white infants. For black infants, disorders relating to short gestation and LBW not otherwise classified (293.6 deaths per 100,000 live births), congenital malformations (167.0 deaths per 100,000 live births) and SIDS (122.1 deaths per 100,000 live births) account for the majority of infant deaths.[1] For those categories, the number of affected black infants supersedes the number for white infants.

Contributing Factors

Previous work indicates that the offspring of women who have not had prenatal care were teenagers, had nine- to 11 years of education, were unmarried, or were cigarette smokers during pregnancy had higher risks of mortality.[1] Prenatal care quality and access, maternal socioeconomic indicators (including parity, marital status, education, employment, and median census tract income/area of residence), maternal hematocrit levels, AIDS/HIV, pregnancy complications, prenatal care problems, infections, intrapartum risk factors, number of spontaneous and elective abortions, existing comorbidities (including diabetes mellitus during pregnancy), substance abuse, social support, and nutritional status have also been examined.[4,8-10] Fetal variables that have been studied for potential contributions to infant mortality disparities include fetal gender and gestational age at birth. However, the role of these and other indicators have not fully explained the higher infant mortality risks for black infants.[4] Additionally, the relative contributions of such variables to IMR disparities remain controversial.[4,11,12]

Maternal SES

Compounding the difficulty with analyzing the role of maternal SES upon IMR disparities is a lack of consensus on which variables should be used to determine individual SES.[13,14] However, using "traditional" SES indicators (e.g., education, income), some studies have linked inversely low maternal SES with infant mortality risk. Namely, as maternal SES levels climb, IMRs decrease.

Other studies challenge that assertion concluding even positive SES attributes, such as higher level of maternal education, is not protective for black infants and that African-Americans remain at higher risk for infant mortality at every socioeconomic level.[2,15] Disturbingly, previous work indicates that black–white IMR disparities increase on a multiplicative scale as black prenatal patients' educational and income levels increase and that postsecondary education fails to reduce infant deaths for black Americans to the same extent as it does for white Americans (Table 1).[16] Using national data, disparities in infant survival between black and white Americans have been shown to increase with maternal educational level (Table 2).[16,17] Maternal postsecondary education does not appear to reduce infant deaths for black women to the same extent as it does for whites.[16,17]

The lack of infant survival benefits accrued to the offspring of black American women, regardless of maternal SES, has prompted examination of whether more pervasive and indigenous black maternal risk factors exist. For example, the weathering conceptual framework proposes that black American women's relatively poor health status, as demonstrated by their high levels of chronic morbidity and disability, is a function of early health deterioration. That deterioration is considered a result of their extensive and collective experiences with entrenched social, economic, or political barriers.[18] Due to suboptimal black American maternal health, it can be inferred that their offspring remain at disproportionately higher risk of poor reproductive outcomes.

Despite the considerable implications of the weathering conceptual framework,[18] controversy persists regarding the role played by black American maternal SES on black IMRs. For example, a recent study of college-educated black and white women failed to identify black race as a key predictor of infant mortality.[19] Rather, preterm birth (below the 28th week of gestational age) was found to be a far more significant predictor of infant death.[19] A generational study (Meharry Cohort Study) also suggests that offspring of black American families of sustained and high socioeconomic status (SES) are no less likely than their white counterparts to be of LBW or at higher risk of infant mortality due to LBW.[9] A key conclusion was that, for sustained and high-SES black and white families, the offspring of black families did not demonstrate any significant differences in birthweight distributions as compared to their white counterparts.[9]

Role of Preterm Birth

Normal human gestation is 40 weeks, and full-term pregnancies are gestations greater than 37 weeks. Preterm infants are born before 37 completed weeks of gestational age.[20]

Preterm birth occurs in approximately 11% of all U.S. pregnancies and is the leading cause of perinatal and neonatal morbidity and mortality nationally. It is also considered to be the primary cause of U.S. infant mortality.[9,21-24] After having steadily increased during the past 20 to 30 years, only during the past 10 years has the preterm birth rate declined (from 11.8% to 11.6%), but the incidence of preterm birth remains higher for black infants and is approximately twice the preterm birth rate of white infants.[1]

However, neither LBW nor preterm delivery fully explains higher rates of black infant mortality for all gestational age categories. Previous studies have indicated that 60% of the neonatal mortality difference can be accounted for by the births of black infants that are less than 2,500 grams and 34 completed weeks of gestational age.[25] Approximately 25% of the racial disparities in neonatal mortality are attributed to the loss of black infants who are of term gestational age and normal birthweight.[25] Causative reasons for a persistent 2:1 black to white neonatal IMR for infants of normal birthweight who have completed 36–39 weeks of gestation are unknown and, overall, black infants remain twice as likely as white infants to die within the first year of life.[2,25-27]

Role of Low Birthweight

Normal birthweight is greater than 2,500 grams. The term "low birthweight" is ascribed to infants who are less than 2,500 grams at birth. Very-LBW infants are less than 1,500 grams at birth.[20]

Most recent national data indicate a LBW rate of 7.6% of all births, and LBW is a significant contributor to neonatal and IMRs.[1,28] LBW continues to compromise infant health, since approximately 75% of neonatal deaths and 60% of all infant deaths affect LBW infants.[30,73] LBW black infants appear disproportionately at risk of death since, for some birthweight categories, those infants are approximately four times likelier to die than white infants.[1]

LBW suggests a history of fetal intrauterine stress. Fetuses experiencing intrauterine stress may manifest intrauterine growth restriction (IUGR), which is frequently associated with advanced maternal age (greater than 35 years), and/or maternal constitutional factors, cigarette smoking, hypertensive disorders, low prepregnancy weight, low SES, and other morbidities.[31-40]

A category of LBW infants are those that are small for dates or small for gestational age (SGA). SGA infants have birthweights that are at least two standard deviations below the median birthweight of infants of the same gestational age and SGA infants have reached less than the 10th percentile for birthweight for their gestational age. Since SGA infants are more common among preterm rather than term births, SGA risk factors are closely linked to prematurity risks. National data also suggests that black infants are at highest risk of being LBW, SGA, and/or premature at delivery. Although at any gestational age, preterm and SGA infants have high mortality rates, among preterm and SGA infants, black infants have the highest mortality rates.[31]

Higher SES factors do not have the expected and inverse effects upon the incidence of LBW among black Americans. For example, LBW remains a significant risk for even the offspring of college-educated black American women.[15,41] In a study of almost 866,000 infants born to college educated women, offspring of black American women were more likely to be of very low or LBW at delivery and were at disproportionate risk of death within the first year of life.[15] Another study of nearly 3,000 black and 7,000 white American women concluded that offspring of college-educated black women were nearly three times as likely to be SGA at birth than were offspring of college-educated white women.[41]

However, offspring of other black women do not demonstrate comparably LBW rates.[8,42] For example, Illinois Department of Public Health birth certificates (1980–1995) were reviewed for 90,000 infants of U.S.-born and African-born black women and U.S.-born white women. A review of matched cases demonstrated that the average birthweight for white infants was 3,475 grams. For African-born black women, the average birthweight of their offspring was 3,341 grams. But for U.S.-born black women, average birthweight for their offspring was significantly lower at 3,195 grams.[43]

Additionally, U.S.-born white women had the lowest percentage of LBW deliveries (3.6%), and African-born black women had the next highest percentage (6.9%) of such deliveries. But U.S.-born black women had the highest percentage of LBW infant deliveries (8.5%).[43]

Perinatology Advances

Perinatology advances must be credited for aiding the survival of premature/LBW/SGA infants. In the late 1980s, advances in neonatal mechanical ventilation allowed improved care of high risk neonates. During the 1990s, surfactant (to speed neonatal pulmonary maturation) was made commercially available for neonatal intensive care, and the National Institutes of Health 1994 Consensus Conference advocated the use of antenatal steroids (also used to speed fetal pulmonary maturation) in cases where preterm delivery would be likely.[44]

Several studies indicate that selection and application of neonatal support technologies, including surfactant, have benefited preterm or premature white infants to a greater extent than premature black infants.

Previously, premature black infants were considered to have had a survival advantage over their white counterparts.[25] However, perinatal advances have led to elimination of any significant racial disparities in preterm infant survival. The end result has been a decrease in the survival advantage of premature black infants and an increased overall survival advantage for premature white infants.

For example, from 1987–1992 in St. Louis, introduction of surfactant led to decreased neonatal mortality rates for premature white infants only. Their mortality rate dropped from 261.5 to 155.5 deaths per 1,000 live births. However, no comparable changes were seen in the survival of very LBW and premature black infants, since, during the same period, the premature black IMR increased from 195.6 to 196.8 deaths per 1,000 live births. Differences in tertiary-level medical center access to surfactant or corticosteroid use did not explain black–white survival differences among premature neonates. Therefore, although premature black infants may have been delivered at major medical centers where surfactant and other neonatal support technologies were available, those neonates' survival rates lagged behind those of premature white infants within the same birthweight categories.[45,46]

Several authors have commented on whether racial differences in health outcomes may have a genetic component.[9,47,48] However, given the unknown interactions between genetics and environment in triggering preterm birth and data, including the St. Louis surfactant studies, it is unlikely that only differential organ system maturation rates are the cause of such significant racial disparities in preterm infant survival. There is currently little support for a genetic model for LBW and infant death disparities because normal interethnic group genetic variation has not been proved sufficient to explain such large racial disparities in infant birthweight and mortality rates.[47]

Prenatal Care Adequacy

Prenatal care involves health promotion, risk assessment, and interventions linked to the risks and conditions discovered.[49-51] The universal goal of prenatal care is to encourage good maternal health for favorable maternal and infant outcomes.

Prenatal care adequacy has been measured using the Kessner and Kotelchuk indices.[29,52] More recently, the Kotelchuk index has been used as a more comprehensive evaluator of prenatal care adequacy based on vital record data. The Kotelchuk index assesses whether any prenatal care was received, whether prenatal care was initiated during the first trimester of pregnancy, the average number of prenatal visits, and components of initiation and receipt of prenatal care services to determine if prenatal care was "adequate". Nonetheless, "adequate" prenatal care does not translate automatically into improved birth outcome.[52,53]

Large scale studies have analyzed the effects of prenatal care upon birth outcome. For example, the federally funded Healthy Start project did have some

Table 1. Adjusted Odds Ratios (ORs) for Infant Death, Comparing African Americans and Whites across Educational Levels; North Carolina Birth and Infant Death Linked File, 1988–1993

Education,y	Adjusted OR (95%CI) Reduced model[a]	Model 1[b]	Model 2[c]
<12	1.5 (1.4,1.7)[d]	1.4 (1.3,1.6)	1.8 (1.6,2.0)
12	1.9 (1.8,2.1)	1.8 (1.7,2.0)	2.0 (1.9,2.2)
>12	2.5 (2.3,2.8)	2.2 (2.0,2.5)	2.5 (2.3,2.8)

[a] The reduced model is a multiple logistic regression that includes maternal race, maternal education, and the interaction term race by education; [b] Model 1 is the same as the reduced model and also adjusts for maternal age, smoking, high parity, Kotelchuk prenatal care utilization indices, and rural residence; [c] Model 2 is the same as Model 1 with additional adjustments for percentiles of gestational age at birth; [d] P values for homogeneity across levels of education were <0.001 in all models

Source: Din-Dzietham R, Hertz Picciotto I. Infant mortality differences between whites and African Americans: the effect of maternal education.[16]

success in improving birth outcome using a structured, community-based approach to prenatal care.[54-56] The $345.5-million program was started in response to the high U.S. IMR and was a five-year program begun in 1991 by the Health Resources and Services Administration (HRSA) of the U.S. Public Health Service. Healthy Start patients were more likely to be below the age of 20 years, African-American, to have less than a secondary school education, to have unintended pregnancies, to be from lower socioeconomic groups, and to be single mothers. Patients were more likely not to have received prenatal care from private clinicians.[54-56]

Healthy Start program areas had comparable declines in the IMR as did the United States as a whole. But only two of 15 sites—New Orleans and Pittsburgh—had more significant declines in IMRs. Between 1989 and 1991, New Orleans and Pittsburgh both had an IMR of approximately 17 per 1,000 live births. At the New Orleans site, black infants accounted for 95% of all births; in Pittsburgh, 62.8%. By 1996, the regression-adjusted black IMR declined from 18.3 to 11.3 per 1,000 live births in New Orleans. In the same year, the regression-adjusted black IMR had declined from 17.5 to 8.6 per 1,000 live births in Pittsburgh. Successes in Pittsburgh and New Orleans were attributed to strong community involvement, effective outreach programs, good organizational leadership, improved primary care access, and higher utilization of tertiary-care hospitals by at risk prenatal populations.[54-56]

Birth Record Data Quality

Despite the importance of monitoring health disparities in IMRs, birth record data quality is not assured. Infants' gestational age and birthweight data are important, because the information is used to monitor the incidence of preterm deliveries, SGA infants, maternal and infant risk factors, and evaluating prenatal care adequacy (using the Kotelchuk and/or Kessner indices).[57-59] However, racial disparities in the reporting of birth record data (e.g., reported month, day, and year of last maternal menstrual period, and infants' gestational ages and birthweights) have been identified.[60] Conservative estimates place under-reporting of gestational age intervals as involving approximately 20% of the nation's birth certificates.

Less-complete reporting of pregnancy data affects nonwhite patients in disproportionate numbers.[61,62] For example, several studies have identified more missing data among patients and infants from minority and lower socioeconomic groups. For example, a study of Connecticut vital records showed slightly lower birthweight distribution among births with missing gestational ages that was consistent with an increase in low SES factors, including being unmarried, black, and teenaged. At least one Connecticut birth record study identified 0.6% of births that were less than 1,500 grams and had no recorded gestational ages. If infants of LBW had more missing gestational ages and higher incidence of prematurity, data results for early gestational-aged infants could be biased.[63]

Unlikely combinations of gestational age and birthweight were more likely to be recorded for infants of younger gestational ages. Since black women from low SES groups are at risk of adverse

Table 2. U.S. Infant Mortality Rates per 1,000 Live Births by Maternal Education and Race, 1964 through 1966 and 1987

Maternal Education, y	White	Black	Black–White Ratio
1964–1966[a]			
0 to 8	32	45.9	1.4
9 to 11	24.6	41.7	1.7
12	18	34.5	1.9
13 to 15	15	32.1	2.1
16+	19.6	N/A	N/A
All levels	20.8	39.5	1.9
1987[b]			
0 to 8	12.5	21.6	1.7
9 to 11	12.4	20	1.6
12	8.1	16.6	2
13 to 15	6.4	14.7	2.3
16+	5.8	13.3	2.3
All levels	8.3	17.8	2.1

[a] Data from National Natality Survey and National Infant Mortality Survey, 1964–1966; [b] Data from National Linked Birth and Infant Death data set, 1987 birth cohort

Source: Singh GK, Yu SM. Infant mortality in the United States: trends, differentials, and projections, 1950 through 2010.[17]

birth outcomes, including preterm birth, missing data could affect overall data analysis in their high-risk categories.[63]

Other studies have found that women who had a missing date of the last menstrual period (DLMP) information (used for calculating infants' gestational age at birth) tended to be from lower socioeconomic groups and had higher medical risks for adverse birth outcomes than women whose DLMP was completed on birth records. Deletion of patients with missing DLMP might underestimate percentages of preterm births or SGA infants.[63] By extension, information on the incidence of IUGR would be inaccurate, since SGA status is so closely linked to IUGR.[61,62,64]

Maternal Stress

Available data supports unknown interactions between maternal health behaviors, social influences, and living environment as having a significant role on IMRs.[65] For example, the Perceived Stress Scale is a reliable and proven 14-item inventory that evaluates the degree to which individuals find their lives to be unpredictable, uncontrollable, and overloaded.[66]

An eight-item abridged version of the PSS was used to assess pregnant patients' chronic stress and coping abilities in a prospective survey of 1,071 low-income, primiparous black American and Mexican-origin, recent-immigrant women in Los Angeles County. The PSS was used to compare respondents' psychosocial risk factors and to see whether their PSS scores could be linked to infant problems during the neonatal period. Specifically, differences in prenatal behaviors and psychosocial risk factors were analyzed to see if there were connections to the incidence of LBW infant deliveries among respondents. Findings included that black American women who were more likely to have earlier deliveries experienced greater levels of prenatal stress. Overall, individual women who reported higher levels of perceived stress were more likely to deliver infants prematurely. Black American women remained at higher risk of delivering LBW infants. In fact, non-Hispanic black women were 2.39 times more likely to give birth to a preterm infant and nearly three times more likely to deliver a LBW infant. Prenatal stress was demonstrated to lead to a higher incidence of LBW, premature infants due to an association with unhealthy pregnancy behaviors (such as smoking or substance abuse) and negative attitudes towards pregnancy.[67,68]

Due to such data analyses, poverty alone has been discounted as the sole reason for racial disparities in birth outcome. Although poverty is a source of economic and psychosocial stress, it cannot explain alone the presence of racial disparities in birth outcome and why the offspring of impoverished black American women fare worse than the offspring of Mexican, recent-immigrant women of comparably low SES.[67-69]

Previous work has supported that positive maternal attitudes towards pregnancy are more predictive of the likelihood of preterm delivery and LBW than maternal ethnicity or SES. Recent-immigrant ethnic women with favorable attitudes toward motherhood appear more likely to engage in self-care behaviors (i.e., healthy diets, medical/prenatal care help-seeking, and substance abuse abstinence) and experienced better perinatal outcomes. For babies born prematurely, their mothers were likely to have experienced higher levels of perceived stress and substance abuse. Similar results were seen for women who delivered LBW infants. Additionally, women who delivered LBW infants had decreased social support and were less likely to be cohabiting with the baby's father, had more negative attitudes about pregnancy, and were more likely to be smokers or substance abusers.[67-68]

Other studies have reviewed whether links exist between maternal physiology in response to stress and birth outcome. Previous investigations have involved data collection involving plasma corticotrophin releasing hormone (CRH), adrenocorticotrophic hormone (ACTH), beta-endorphins, and cortisol levels from 90 women with gestations of 30–32 weeks. Women were also queried regarding their psychosocial stresses. Interestingly, each unit increase in third-trimester maternal life-event stress led to an average 55-gram decrease in expected birthweight. Also, regardless of obstetrical risk factors, offspring of women with high life-event stress and pregnancy anxiety scores fared less well in terms of birthweight and weeks of gestational age at delivery, compromising the likelihood of infant survival during the first year of life.[70]

SUMMARY

This article has reviewed selected topics pertaining to maternal SES, LBW, preterm birth, perinatology advances, birth record data quality, maternal stress, prenatal care adequacy, and physical and substance abuse, and the relationships of those topics to black–white American infant health disparities.

Relatively excessive black American preterm births, LBW infant rates, and IMRs have engendered significant social, public health, and financial costs; community stress and sense of loss are known results of such disproportionate black, adverse reproductive outcomes.[2] Beginning with affected families, many parents experience compensated or uncompensated loss of workdays and income during infants' periods of hospitalization, interruptions in normal familial routines caused by traveling to and from regional medical centers, personal stress, and financial exigencies incurred by arranging babysitting and other care for siblings or parental accommodations during their infants' hospitalizations.[71,72] Previous studies have attempted to quantify potential national financial expenditures of caring for high-risk infants. Net healthcare costs for intensive care treatment of preterm and/or LBW infants that do not survive infancy are in the range of tens of millions of dollars.[71,73,74] Emotional costs are certainly incalculable.

To decrease black IMRs, numerous federal-, state, and community-based programs have been attempted and/or implemented. Results of such programs are variable. However, it appears as if statewide, customized community-based prenatal care programs offering effective outreach programs, good organizational leadership, improved primary care access, and higher utilization of tertiary-care hospitals by at-risk prenatal populations are most likely to have a positive impact on decreasing black IMRs.[54-56,75,76]

But more than four decades of research has not yet found a clear solution to resolving black–white IMR disparities. Perinatal technologies have not yet closed that disparities' gap for infants at risk nor do term births and normal birthweights assure decreased black American IMRs.[2,25-27,45,46]

Intriguingly, offspring of recent-immigrant ethnic women have more favorable outcomes than those of offspring of black American women whose families have resided in the United States for generations. Psychosocial factors, such as the role of extended families, partner cohabitation, and maternal and familial attitudes towards pregnancy, prenatal care, early childhood, and nutrition, are of acknowledged importance.[67,68,77] Although speculative, the concept that "It takes a village to raise a child" may be more pertinent to the discussion of infant health outcomes than has thus far been addressed. More should be learned about how recent-immigrant ethnic communities experience lower IMRs than black Americans and how that knowledge can be applied to develop innovative programs for elimination of IMR disparities.

From the perspectives of decreasing national healthcare costs and improving public health, there appears to be little choice but to evaluate successful IMR reduction models and to refine and customize those models for implementation in at-risk communities nationwide. Rather than being of elective consideration, developing unique and community-based solutions for eliminating IMR disparities will be required to improve national health.

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