Understanding Racial Disparities in Low Birth Weight

ABSTRACT

This paper summarizes the research on the epidemiology of low birth weight (LBW) births focusing on the evidence about disparities in low birth weight for Black infants in the US. Studies have continually shown that Black mothers and their infants are at higher risk for pregnancy-related complications such as LBW. LBW, a leading cause of infant death for this racial group, is associated with a multitude of risk factors, with the major two dimensions being *health status* and *health care*. Evidence suggests that the accumulation of chronic stress over a lifetime culminates in health problems for Black women, thus leading to the conditions for LBW to occur. There is growing acceptance of the context of societal and systemic racism that creates a toxic and harmful environment for Black mothers and how this results in physiological stress that directly causes infant and maternal mortality. Although racial disparities in low birth weight are widely known in the medical community, prevention requires addressing the harmful social conditions that underlie these inequitable outcomes. This paper focuses on the way in which Black women and infants are disproportionately burdened with the effects of LBW. It concludes by discussing how changes can, with careful consideration and implementation, drive efforts to protect the Black infants and mothers as part of a holistic, patient-centered approach.

Keywords: low birth weight; Black infants; racial disparities; physiological stress

PUBLIC HEALTH RELEVANCE

There is a long history of structural racism and racial health inequities for Black individuals in the United States. This history reveals that such inequities have not occurred by coincidence or chance, but by deliberate decisions designed to uphold power structures and racial hierarchies in this country. Racial attitudes dating from the time of slavery, Jim Crow, and extending into Civil Rights Era are embedded in the current health care system, exposing the racialization of health care delivery and the quality of care. Over the past decade, an expanding body of literature has sought to address the unequal and persistent disparities in health for Black communities. For example, the landmark report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* exposed how race and ethnicity remain significant predictors of quality of health care received.[1]

Even with more and more research and documentation of the problem and some changes in health insurance coverage and access to delivery of public health services, disparities persist. In the face of the COVID-19 pandemic, Black Americans are contracting COVID-19 and dying at higher rates,[2] demonstrating how racial identity still plays a significant role in health. The pervasive influence of historical and current systematic oppression of Black women has resulted in the high maternal mortality and adverse pregnancy outcomes that exist today.

This history provides clarity around the racialized idea that Black women did not have autonomy over their reproductive health. Jones (2020) asserts that one powerful example belonging to the slavery era was the act of slave breeding. Black women were forced into procreation in efforts to sustain the economy.[3] Jones (2020) also writes that as these women were already considered the economic property of these masters, so were their offspring.[3] Decisions regarding their reproductive experiences were subject to the needs of the white slave masters. Consequently, such experiences caused major physiological and psychological stress and trauma on the bodies of Black women. Growing research suggests that trauma can alter one's genetic makeup and can be passed intergenerationally. This profound discovery can provide insight on how Black infants may face health complications at birth and across their lifespan.

In addition, Black women's reproductive history has been influenced by discriminatory policies, practices, and structural racism. Jones (2020) states that racism against Black individuals led to the implementation of laws that intended to render them to second-class citizenship.[3] Jones (2020) highlights how policies such as de facto redlining impacted Black residents' ability to get mortgage loans, forcing them into neighborhoods of concentrated poverty, underfunded community resources, and generational

[1]Smedley BD, Stith AY, Nelson AR. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care (Full Printed Version). Washington, DC: National Academies Press; 2002.
[2]Seervai S. Why Are More Black Americans Dying of COVID-19? Accessed April 15, 2021. https://www.commonwealthfund.org/publications/podcast/2020/jun/why-are-more-black-americans-dying-covid-19
[3]Jones, K. (2020) America Is Failing Its Black Mothers: Reducing Racial Disparities in Maternal Mortality and Morbidity for Black Women [Unpublished manuscript]. Northwestern University.

wealth disadvantages.[3] As a result, Black women and their families had less access to prenatal and postpartum care, nutritious food, stable housing, and more, which are vital for preventing pregnancy-related deaths and complications.

Moreover, the legitimate fear and mistrust Black women have toward medicine is a direct result of a long legacy of mistreatment and abuse by white physicians in the medical system, often coined medical racism. One example of medical racism is the Mississippi Appendectomy cases, in which more than 8,000 unnecessary hysterectomies were performed on poor black women to stop them from reproducing between the 1920s and 1980s.[4] This procedure, a component of the eugenics movement, which was aimed at reducing the Black population by targeting the women who were responsible for its creation. Many in the medical system practiced *benevolent deception*, which is the act of withholding fundamental information from patients.[4] This form of deception highlights clear power dynamics in the medical system. Historical patterns can reveal that Black women have not been in control of their reproductive experiences, thus offering insight as to potential reasons why Black women and infants face higher rates of mortality and morbidity.

For Black mothers, pregnancy disproportionately leads to maternal and infant mortality and morbidity. Pregnancy-related mortality is defined as death of the mother during pregnancy, delivery, or within one year postpartum.[5] Black women are three to four times more likely to die from a pregnancy-related cause of death as compared with white women.[6] **Figure 1** demonstrates an international comparison of these deaths from 2018. Between 2007 and 2016, the Center of Disease Control and Prevention (CDC) confirmed significantly higher pregnancy-related mortality rates among Black and American Indian/Alaskan Native women did not change over the decade.[7] Black women have higher rates of hemorrhage and preeclampsia, even among women without preexisting conditions such as chronic hypertension, asthma, and infections.[2] This immense suffering

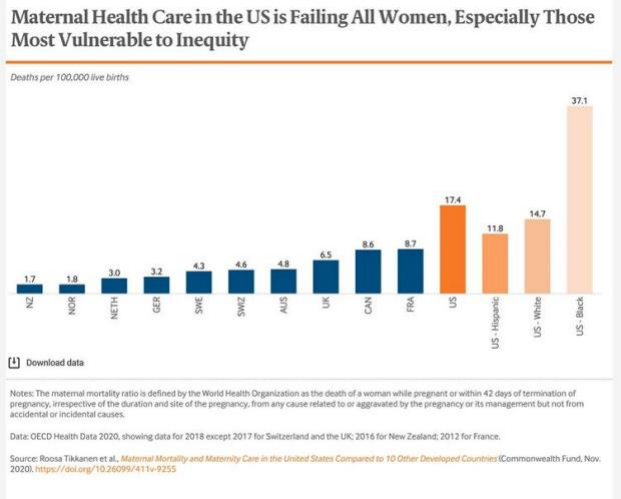

FIGURE 1

[4]Skloot, R. (2010). *The Immortal Life of Henrietta Lacks*.
[5] *Racial Disparities Persist in Maternal Morbidity, Mortality and Infant Health*. (n.d.). AJMC. Retrieved January 14, 2021, from https://www.ajmc.com/view/racial-disparities-persist-in-maternal-morbidity-mortality-and-infant-health
[6] Howell, E. A. (2018). Reducing Disparities in Severe Maternal Morbidity and Mortality. *Clinical Obstetrics and Gynecology*, *61*(2), 387–399. https://doi.org/10.1097/GRF.0000000000000349
[7] I*nfographic: Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016 | CDC*. (2020, February 4). https://www.cdc.gov/reproductivehealth/maternal-mortality/disparities-pregnancy-related-deaths/infographic.html

from Black women is intimately connected with another public health crisis, which is the tragedy of infant mortality and morbidity. Infant mortality is the death of an infant before his or her first birthday.[8]

Considering the public health relevance and urgency of LBW disparities, this literature review summarizes the research on the epidemiology of LBW births, focusing on the evidence about such disparities for Black infants in the US. Furthermore, the way Black infants experience LBW is radically different due to a multitude of sociopolitical factors, including childhood adversity, socioeconomic status, and access to health care coverage. Black mothers and infants face unique circumstances that are rooted in oppressive, racist, and discriminatory practices. This review describes the evidence linking structural racism to racial differences in LBW.

METHODS

This literature review was conducted using the six general steps involved in conducting a review article, as explained in Templier and Paré[9]. **Figure 2** outlines this general procedure. In searching the literature, I used keywords such as *low birth weight, racial disparities, physiological stress, Black mothers, Black infants.* Using databases such as PubMed (National Library of Medicine), Elsevier (ScienceDirect), ResearchGate, and journals such as American Journal of Public Health (AJPH), Pediatrics, Clinics in Perinatology, I searched these keywords and filtered through articles by relevance. The next steps included screening for inclusion and assessing quality, which involved evaluating the applicability of the studies and assessing its methodological quality. This criterion was determined by reviewing the contents, examining the presented evidence, addressing any present bias, and seeing its listed references. I prioritized literature that was published within the last 10-20 years. There are a few articles that fall outside the scope of this timeline that were included in this paper because of their historic relevance.

The review highlights how public health, local and federal officials, healthcare systems and individual providers can adopt the healthcare system and social services reforms in efforts to reduce disparities in LBW.

[8]*Infant Mortality | Maternal and Infant Health | Reproductive Health | CDC*. (2020, September 10). https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm

[9]Templier, M., & Paré, G. (2015). A Framework for Guiding and Evaluating Literature Reviews. Communications of the Association for Information Systems, 37, pp-pp. https://doi.org/10.17705/1CAIS.03706

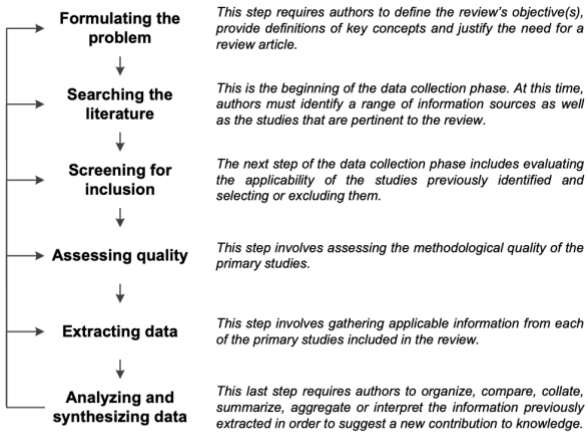

Figure 1. General Procedure for Conducting Literature Reviews

FIGURE 2

STRESS & PREGNANCY OUTCOMES

Many studies have found that the accumulation of chronic stress over a lifetime results in poorer physiological adaptation and a culmination of health problems for Black women, which leads to the conditions in which LBW can occur. Black women have a life expectancy that is 3 years shorter on average than Hispanic and non-Hispanic White women[10] and some of the root causes may be related to stress. Black women in the US face uniquely high levels of physiological and social stress that brings physical harm to their bodies and fetuses. Based on multiple studies that have examined the relationship between cortisol levels and stress, it is known that stress increases cortisol levels. Maternal stress has been identified as a potential explanatory factor for the disproportionate burden of preterm and LBW deliveries for Black women because of their exposure to racism-associated stress.[11] Hogue and Bremner (2005) document that compared with White women, Black women experience higher lifetime exposure to chronic and acute stressors, thus resulting in a higher stress age for Black women.[11] **Figure 3** demonstrates the mechanisms that produce this stress. Research shows that LBW and PTB are interconnected.[11,12] Additionally, when controlled for education and socioeconomic status Black women still face higher risk of pregnancy complications and maternal mortality. In their article, Hogue and Bremner (2005) also explain that because of the unexplained risk of preterm birth among well-educated Black women, their exposure to stress associated with racism sets them apart from similarly educated

[10] National Center for Health Statistics. Health, United States, 2016: With Chartbook on Long-term Trends in Health. Hyattsville, MD. 2017.
[11] Hogue, Carol & Bremner, James. (2005). Stress model for research into preterm delivery among black women. American journal of obstetrics and gynecology. 192. S47-55. 10.1016/j.ajog.2005.01.073.
[12] *WHO | Care of the preterm and low-birth-weight newborn*. (n.d.). WHO; World Health Organization. Retrieved May 9, 2021, from http://www.who.int/maternal_child_adolescent/newborns/prematurity/en/

white women.[11] Stress associated with racism and discrimination can hold lifelong consequences for the mother and child.

Unequal treatment causes the release of stress hormones, which over a lifetime of constant activation not only leads to erosion of the body's organs and systems, but can potentially initiate preterm labor.[13] Additionally, the stress that Black mothers experience has accumulated long before pregnancy, which is in itself a stressor. The way Black mothers and other marginalized communities experience the various stressors in their life are demonstrated by their poorer health outcomes. Cumulative exposure to social, economic, and political marginalization is a key factor. The weathering hypothesis, coined in 1992 by Dr. Arline T. Geronimus, posits that Black individuals' experience early health deterioration because of the cumulative impact of repeated exposure to social or economic stressors and political marginalization, known as the weathering hypothesis.[14] It is important to note that this hypothesis was developed within the context of women's fertility. In her groundbreaking paper on the health of Black women and infants, Geronimus defined the weathering hypothesis as the idea that the health of Black women may deteriorate towards the beginning of early adulthood as the consequence of cumulative socioeconomic disadvantage.[15] Consequently, such deterioration can lead to disparities in maternal and child health. Since the weathering hypothesis was a then-novel metaphor meant to depict the premature aging of the body caused by chronic stress, it has been used and cited by many authors since its origin in the 1992 paper.

In 2006, Geronimus et al. (2006) decided to extend the weathering hypothesis to Black adults in the US. While this article is not about LBW, it provides a solid foundation to understanding how racial inequalities lead to poor health deterioration. The article presents evidence how weathering affects age patterns of allostatic load scores among Black and White individuals in the US, hypothesizing that Black adults experienced early health resulting from repeated exposure to social adversity. Allostatic load refers to the cumulative burden of chronic stress and the "wear and tear" on the body, identified through biomarkers and a set clinical criterion.[14,16] A systematic review performed by Guidi et al. (2021) claim that allostatic load involves the interaction of different physiological systems at different degrees of activity.[17] Consequently, when present environmental challenges exceed the individual's ability to cope, the allostatic overload ensues.[17]

---

[13] Unnatural Causes : Is Inequality Making Us Sick? [San Francisco, Calif.] :California Newsreel, 2008.
[14] Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *Am J Public Health*. 2006;96(5):826-833. doi:10.2105/AJPH.2004.060749
[15] Geronimus A. T. (1992). The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethnicity & disease*, *2*(3), 207–221.
[16] McEwen B. S. (2005). Stressed or stressed out: what is the difference?. *Journal of psychiatry & neuroscience : JPN*, *30*(5), 315–318.
[17]Guidi, J., Lucente, M., Sonino, N., & Fava, G. A. (2021). Allostatic Load and Its Impact on Health: A Systematic Review. *Psychotherapy and Psychosomatics*, *90*(1), 11–27. https://doi.org/10.1159/000510696

The Geronimus study evaluated whether US Black individuals experience early health deterioration, as measured across biological indicators of repeated exposure and adaptation to stressors.[14] The results concluded that Black individuals had higher allostatic load scores than did Whites and had a greater probability of a high score at all ages, particularly at 35–64 years.[14] Poor and nonpoor Black women had the highest and second highest probability of high allostatic load scores, respectively, and the highest excess scores compared with their male or White counterparts.[14] These racial differences were not explained by poverty.

The impacts of racial hierarchies in the US have relegated Black women to one of the lowest social positions. They also bear much of the responsibility for the social and economic survival of Black families, kinship networks, and communities.[15,17,18]As a result, the effects of weathering on this group is framed within the context of their identity as a "double-minority." The intersection of race and gender experiences as a marginalized group is more likely to lead to physical deterioration. What Geronimus et al. demonstrate in this article is a precursor to understanding how chronic societal stressors have tangible, physical consequences that create the conditions in which LBW can occur. In other words, the social becomes the biological.

The layers of economic, social, political, and health-related issues compound, creating stressful situations for mothers and their infants. Several studies have sought to specify the biological mechanism behind weathering by examining biomarkers (e.g. cortisol level, allostatic load, telomere length).[19,20,21] Biomarkers provide an objective, measurable way to characterize pre-clinical disease progression.[21] Collins et al. (2004) highlight that psychophysiological stress is likely to accelerate the release of corticotropin-releasing hormone (CRH), which initiates a cascade of events leading to preterm delivery.[22] CRH impacts one's response to stress, addiction, depression, and more. Clinically, if high CRH levels can cause nervous and inflammatory issues. This finding is consistent with larger literature on stress. Geronimus et al. (2010) hypothesized that Black women experience accelerated biological aging in response to repeated or prolonged adaptation to subjective and objective stressors, performing a population-based test to examine telomere length.[19] This article provides evidence that by middle age,

[18]Geronimus AT. Understanding and eliminating racial inequalities in women's health in the United States: the role of the weathering conceptual framework. J Am Med Womens Assoc. 2001;56:133–136, 149–150

[19]Geronimus, A. T., Hicken, M. T., Pearson, J. A., Seashols, S. J., Brown, K. L., & Cruz, T. D. (2010). Do US Black Women Experience Stress-Related Accelerated Biological Aging?: A Novel Theory and First Population-Based Test of Black-White Differences in Telomere Length. *Human nature (Hawthorne, N.Y.)*, *21*(1), 19–38. https://doi.org/10.1007/s12110-010-9078-0

[20]Woods-Giscombé C. L. (2010). Superwoman schema: African American women's views on stress, strength, and health. *Qualitative health research*, *20*(5), 668–683. https://doi.org/10.1177/1049732310361892

[21]Pierce, Janet D. DSN, APRN, CCRN; McCabe, Shannon BS; White, Nicole BSN, RN, CCRN; Clancy, Richard L. PhD Biomarkers, AJN, American Journal of Nursing: September 2012 - Volume 112 - Issue 9 - p 52-58 doi: 10.1097/01.NAJ.0000418926.83718.28

[22] Collins, J. W., Jr, David, R. J., Handler, A., Wall, S., & Andes, S. (2004). Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *American journal of public health*, *94*(12), 2132–2138. https://doi.org/10.2105/ajph.94.12.2132

Black women have shorter telomeres than White women, suggesting that Black women experience accelerated biological aging. Geronimus et al. (2010) also found that stressors associated with perceived stress, poverty, and waist-to-hip ratio (WHR) contributed to black-white differences in telomere length.[16] Djuric et al. (2008) writes that psychological stress leads to cascade of physiological events including activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. The consequence of such activation can trigger physical effects (e.g. increased blood pressure) leading to infant consequences of LBW. In support of Geronimus et al. (2006), Djuric et al. (2008) also elaborate that while recurrent activation of the stress response is normal, the cost of chronic, repeated stress hormone elevation is the damage on physiological processes and organ systems.[23] A study by Suglia et al. (2010) addressed the cumulative stress and cortisol disruption among Black and Hispanic pregnant women. **Figure 4** shows the percentage of cumulative stress for Black and Hispanic pregnant women. Many of the Black women who participated in this study had medium to high cumulative stress exposure.

Chronic maternal exposure to stress can have profound impacts on infants' birth weight. A key takeaway from the literature is that high chronic stress hormones are associated with an increased risk of LBW.

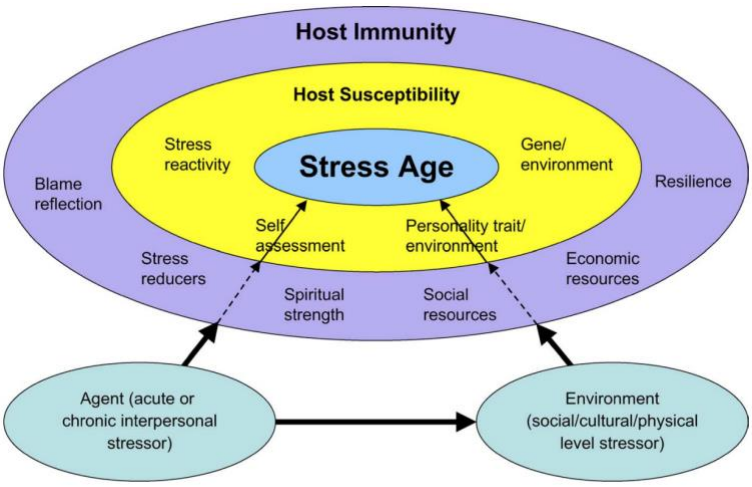

Figure Hypothesized effect of stress on stress-aging, with the use of the agent/host/environment model.

FIGURE 3

[23] Djuric, Z., Bird, C. E., Furumoto-Dawson, A., Rauscher, G. H., Ruffin, M. T., 4th, Stowe, R. P., Tucker, K. L., & Masi, C. M. (2008). Biomarkers of Psychological Stress in Health Disparities Research. *The open biomarkers journal*, *1*, 7–19. https://doi.org/10.2174/1875318300801010007

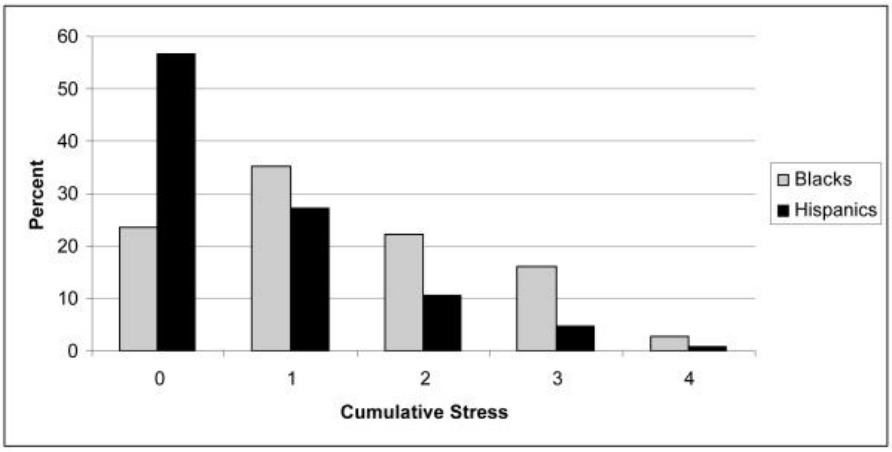

FIGURE 4

ETIOLOGY OF RISK FACTORS

LBW is a potentially preventable public health issue that can be best addressed through understanding and reducing the micro- and macro-level barriers facing pregnant mothers. The weight of the infant at birth is one of many key indicators that the infant is healthy. Thus, when an infant is born with LBW, there is an increase in the risk for future health and developmental issues. Birthweight can be categorized into three major categories: extremely low birth weight (ELBW), very low birth weight (VLBW), and low birth weight (LBW). LBW is defined as weight at birth less than 2500 g (5.5 lb).[24] Research shows that LBW rates are increasing over time, especially for Black infants.[25,27] It is important to note the distinction between the risk factors that can lead to LBW and the mechanisms. LBW can arise through two major mechanisms: the duration of gestation (also known as preterm birth, *PTB*) and fetal growth restriction (FGR). LBW is not limited to either or, as both mechanisms can occur while the fetus is in utero.

Preterm Birth

According to the World Health Organization (WHO), PTB is defined as when a baby is born too early before 37 weeks of pregnancy has been completed.[26] An infant that spends less time inside of the mother's uterus has less time to grow and gain additional weight. This is important considering that fetal weight gain is greatest toward the third trimester of pregnancy. The impact of PTB disproportionately impacts Black mothers and their infants. Most evidence suggests that the majority of the racial disparities

[24]*WHO | Global Nutrition Targets 2025: Low birth weight policy brief*. (n.d.). WHO; World Health Organization. Retrieved May 10, 2021, from http://www.who.int/nutrition/publications/globaltargets2025_policybrief_lbw/en/
[25]National Vital Statistics Reports, *CDC*, Volume 70, Number 2, March 23 Births: Final Data for 2019. (2019). 51.
[26]*Preterm birth*. (19, February 2018). World Health Organization. Retrieved May 10, 2021, from https://www.who.int/news-room/fact-sheets/detail/preterm-birth

that exist for LBW is driven by differences in PTB.[27] In 2019, the CDC released research on this disparity, showing that the rate of PTB among African-American women (14.4%) was about 50 percent higher than the rate of preterm birth among white or Hispanic women (9.3% and 10% respectively).[28] This supports findings from Burris et al. (2019) that claimed the PTB rate is 52% higher for Black than White women (13.8% and 9.0%, respectively).[29] Having higher PTB risk increases the likelihood of having an infant with LBW. Based on trends illustrated in **Figure 5**, it can be concluded that Black women are disproportionately more likely to experience a PTB, and thus, and LBW. Burris et al. (2019) provide an expanded framework[26], which demonstrates micro- and macro-environmental risks for PTB, which shed insight into the racial disparities surrounding this mechanism. **Figure 6** illustrates this framework. For example, one major risk factor associated with PTB is neighborhood and housing. Consequently, the longstanding implications of de facto redlining and residential segregation are connected to outcomes in PTB and LBW.[30,25] Historically, Black residents have been concentrated in communities without adequate health care resources, educational opportunities, and opportunities for upward social mobility. Ellen (2000), in a sample of Black mothers, determined that the probability of LBW for Black mothers was significantly higher in segregated, metropolitan areas.[25] Lack of access to pre- and post-natal care, proper nutrition, and other resources are key factors why Black women are more likely to experience PTB. Since PTB is closely linked to LBW, public health policy must seek to provide solutions for both.

[27]Ellen, I.G. (2000). Is Segregation Bad for Your Health? The Case of Low Birth Weight. *Brookings-Wharton Papers on Urban Affairs 2000*, 203-229. doi:10.1353/urb.2000.0002

[28]*Preterm Birth | Maternal and Infant Health | Reproductive Health | CDC*. (2020, October 30). https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

[29]Burris HH, Lorch SA, Kirpalani H, Pursley DM, Elovitz MA, Clougherty JE. Racial disparities in preterm birth in USA: a biosensor of physical and social environmental exposures. Arch Dis Child. 2019 Oct;104(10):931-935. doi: 10.1136/archdischild-2018-316486. Epub 2019 Mar 8. PMID: 30850379; PMCID: PMC6732250.

[30]Bell, J. F., Zimmerman, F. J., Almgren, G. R., Mayer, J. D., & Huebner, C. E. (2006). Birth outcomes among urban African-American women: A multilevel analysis of the role of racial residential segregation. *Social Science & Medicine*, *63*(12), 3030–3045. https://doi.org/10.1016/j.socscimed.2006.08.011

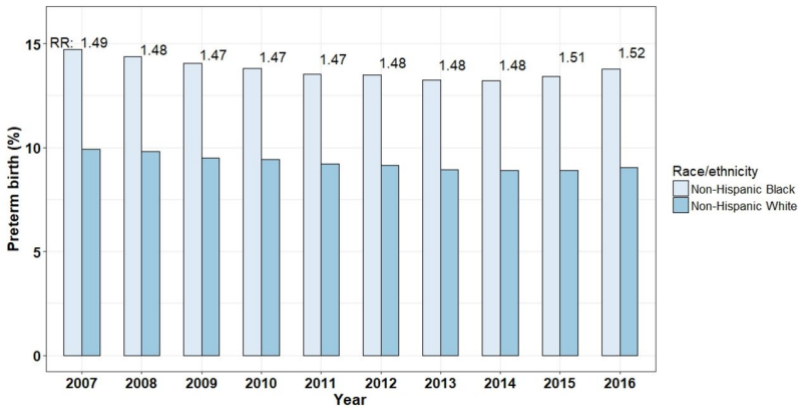

FIGURE 5

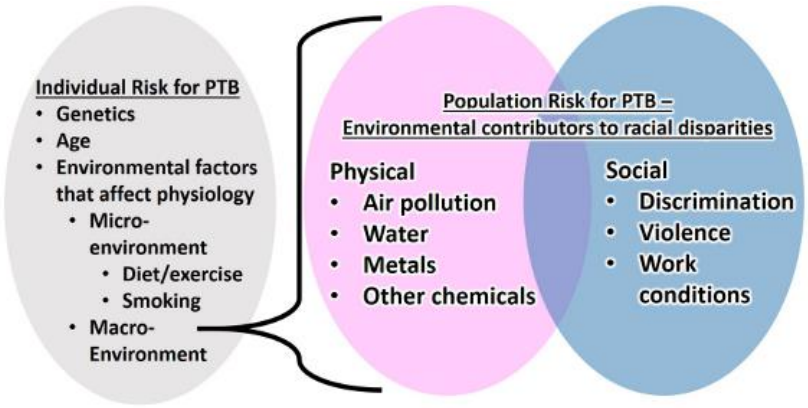

FIGURE 6

Fetal Growth Restriction (FGR)

Often a comorbidity of preterm birth, FGR (formally known as intrauterine growth restriction IUGR) is defined as the diagnosis for infants with an estimated fetal weight below the 10th percentile for the estimated gestational age.[31] FGR can lead to significant neonatal mortality or morbidity if disrupted. Certain pregnancies are at higher risk for FGR. Considering the **Figure 7** below, FGR is directly connected to various possible disorders, prompting the increased risk. One article by Kramer et al. (2006) highlights that Black infants within the US have had consistently lower birth weight for their gestational age than White infants for decades.[30] Research demonstrates that the factors surrounding FGR may

[31] Vladislava Zohdi, Megan R. Sutherland, Kyungjoon Lim, Lina Gubhaju, Monika A. Zimanyi, M. Jane Black, "Low Birth Weight due to Intrauterine Growth Restriction and/or Preterm Birth: Effects on Nephron Number and Long-Term Renal Health", *International Journal of Nephrology*, vol. 2012, Article ID 136942, 13 pages, 2012. https://doi.org/10.1155/2012/136942

produce disparities within racial and ethnic groups, thus influencing outcomes in LBW.[31,32,33] One factor associated with FGR is hypertensive disorders of pregnancy.[33] A study conducted by Ghosh et al. (2014) reported the non-Hispanic Black women had higher odds of entering pregnancy with chronic hypertension and had higher odds of developing mild, severe, or superimposed preeclampsia, compared with non-Hispanic White women.[31] With these data, it can be determined that Black women are statistically more likely to give birth to a LBW infant. In addition to this risk factor, other factors such as substance abuse and diabetes, have a higher incidence in Black women (and men). Overall, considering the maternal, placental, and fetal factors, it can be concluded that Black infants are more likely to experience FGR. Like PTB, the conditions that surround FGR are tied to structural inequalities that disproportionately impact Black mothers.

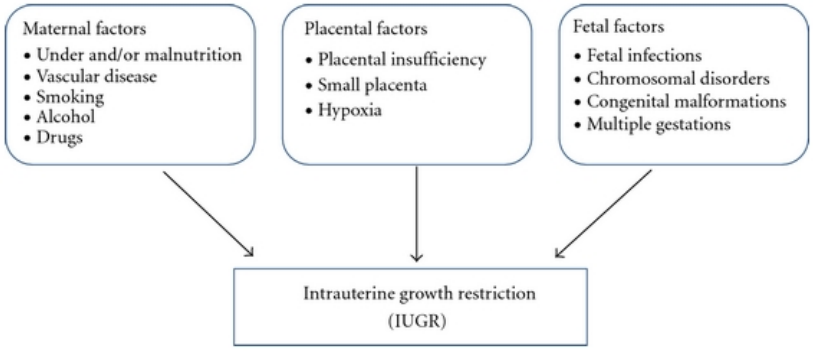

FIGURE 7

International Epidemiology of LBW

It has been estimated that 15% to 20% of all births worldwide are low birth weight, which represents more than 20 million births per year.[24] WHO global nutrition targets introduced at the World Health Assembly in 2012 sought to reduce LBW prevalence by 30% between 2012 and 2025, although studies currently show that countries will need to double their progress in order to reach the target.[34,24] Consequently, in 2019, the LBW rate in the United States (8.3%) had not met the Healthy People 2020 objective of no more than 7.8% of live births, set by the U.S. Department of Health and Human

[32] Michael S Kramer, Cande V Ananth, Robert W Platt, KS Joseph, US Black vs White disparities in foetal growth: physiological or pathological?, *International Journal of Epidemiology*, Volume 35, Issue 5, October 2006, Pages 1187–1195, https://doi.org/10.1093/ije/dyl125

[33]Ghosh, G., Grewal, J., Männistö, T., Mendola, P., Chen, Z., Xie, Y., & Laughon, S. K. (2014). Racial/ethnic differences in pregnancy-related hypertensive disease in nulliparous women. *Ethnicity & disease*, *24*(3), 283–289.

[34]Blencowe, H., Krasevec, J., De Onis, M., Black, R.E., An, X., Stevens, G.A., Borghi, E., Hayashi, C., Estevez, D., Cegolon, L., Shiekh, S., Ponce Hardy, V., Lawn, J.E., Cousens, S., 2019. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. The Lancet Global Health 7, e849–e860.. doi:10.1016/s2214-109x(18)30565-5

Services.[35] The slow progress of reducing LBW globally has allowed disparities in prevalence, especially between Black and White women, to persist. Another important distinction is between offspring born to foreign-born versus US-born mothers. A study by Kuzawa & Sweet (2009) documents that between the two groups, infants born to US-born mothers are more likely to experience LBW.[36] Despite extensive research, the practice of clinical and public health, and policies devoted to reducing the number of LBW infants, the prevalence of LBW has remained unacceptably and consistently high.[37] LBW infants, born after a preterm birth or secondary to fetal growth restriction, account for high rates of morbidity, mortality and cost for various regions across the globe.[38] Based on UNICEF data from 2014, there is a higher percentage of infants with LBW across the 6 regions of Africa, which further supports the notion that racial disparities in LBW persist.[22,39] Moreover, LBW is an important cause of perinatal, infant, and childhood morbidity, with infants dying at rates of up to 40 times of non-LBW infants.[40] The morbidity effects can lead to long-term disability and chronic conditions.

Epidemiology of LBW in the US

In the United States, the average newborn weighs around 8 pounds, with the normal range being between 5.5 and 10 pounds (lbs). There are large disparities in LBW that exist within the U.S. and have been documented over time. The CDC cite that in 2019, 8.31% of infants born in the US were born LBW, which is an increase from the most recent low in 2014 (8.00%).[23] Again, many of the infants born with LBW were often Black. Data records spanning across decades have been able to track this startling trend. For example, in examining data health records in Illinois from 1980 through 1995, David and Collins (1997) reported that of 43,322 infants born to U.S.-born black women, the incidence of low birth weight was 13.2 percent, in comparison to 4.3 percent among infants of U.S.-born white women.[41] Moving toward the West, we can follow this trend as well. Ratnasiri et al. (2018) conducted a retrospective study

[35]*Birthweight United States | PeriStats | March of Dimes*. (n.d.). Retrieved May 25, 2021, from https://www.marchofdimes.org/peristats/ViewTopic.aspx?reg=99&top=4&lev=0&slev=1

[36]Kuzawa, C. W., & Sweet, E. (2009). Epigenetics and the embodiment of race: developmental origins of US racial disparities in cardiovascular health. *American journal of human biology : the official journal of the Human Biology Council*, *21*(1), 2–15. https://doi.org/10.1002/ajhb.20822

[37]Ratnasiri, A.W.G., Parry, S.S., Arief, V.N. *et al.* Recent trends, risk factors, and disparities in low birth weight in California, 2005–2014: a retrospective study. *matern health, neonatol and perinatol* 4, 15 (2018). https://doi.org/10.1186/s40748-018-0084-2

[38]Robert L Goldenberg, Jennifer F Culhane, Low birth weight in the United States, *The American Journal of Clinical Nutrition*, Volume 85, Issue 2, February 2007, Pages 584S–590S, https://doi.org/10.1093/ajcn/85.2.584S

[39]Undernourishment in the womb can lead to diminished potential and predisposes infants to early death. New York: United Nations Children's Fund; 2014 (http://data.unicef.org/nutrition/low-birthweight, accessed 13 October 2014).

[40]Ghojazadeh, M., Velayati, A., Mallah, F., Azami-Aghdash, S., Mirnia, K., Piri, R., & Naghavi-Behzad, M. (2014). Contributing death factors in very low-birth-weight infants by path method analysis. *Nigerian medical journal : journal of the Nigeria Medical Association*, *55*(5), 389–393. https://doi.org/10.4103/0300-1652.140378

[41]David, R. J., & Collins, J. W., Jr (1997). Differing birth weight among infants of U.S.-born blacks, African-born blacks, and U.S.-born whites. *The New England journal of medicine*, *337*(17), 1209–1214. https://doi.org/10.1056/NEJM199710233371706

in California to show that the overall prevalence of LBW was only 6.7%.[42] However, 11.8% of infants born to Black women were LBW compared to 5.7% and 6.3% of those born to White and Hispanic women, respectively.[31]Research has also attempted this geographic difference. Research from the CDC for 2019 shows that 8.4% of infants were born LBW in Illinois compared to the 7.1% of infants in California.[43] Disparities in LBW persist but vary over time and geographic location.

Maternal Mortality & Morbidity

In parallel with worse LBW and other infant outcomes, Black women have higher maternal mortality and morbidity. Among 11 developed countries, the U.S. has the highest maternal mortality rate, with mothers being the most likely to die from complications related to pregnancy or childbirth.[44,45] A pregnancy-related death is defined as death during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.[44]This definition is only used in the United States. An estimated 700 pregnancy-related deaths occur each year in the US, and 2/3 of these deaths are considered to be preventable.[46] Howell (2018) documents that maternal death disproportionately burdens Black mothers, as they are three to four times more likely to die a , pregnancy-related death as compared with white women.[47] The CDC cites that there are 42.2 per 100,000 deaths for Black women as compared to 14.1, 30.4, and 13.0 for Asian, Indigenous, and white women, respectively. Moreover, Black women have higher rates of certain types of hemorrhage and preeclampsia, even among women without preexisting conditions such as chronic hypertension, asthma, and infections.[33,47] This issue is endemic among Black mothers in the United States, who face high levels of maternal stress. This stress, combined with the pervasive influence of historical and current systematic oppression of Black women, has caused the high racial disparity of maternal mortality rate. Furthermore, embedded within the doctor-patient relationship between Black women and white doctors is an inherent level of distrust based on past and current experiences.

---

[42]Ratnasiri, A., Parry, S. S., Arief, V. N., DeLacy, I. H., Halliday, L. A., DiLibero, R. J., & Basford, K. E. (2018). Recent trends, risk factors, and disparities in low birth weight in California, 2005-2014: a retrospective study. *Maternal health, neonatology and perinatology*, *4*, 15. https://doi.org/10.1186/s40748-018-0084-2

[43]*Stats of the States—Low Birthweight Births*. (2021, February 9). https://www.cdc.gov/nchs/pressroom/sosmap/lbw_births/lbw.htm

[44]Tikkanen, R.; Gunja, M. Z.; FitzGerald, M.; Zephyrin, L. (2020) Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries. *The Commonwealth Fund.* Retrieved March 11, 2021, from https://www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries

[45]*What Is Status of Women's Health? U.S. vs. 10 Other Countries | Commonwealth Fund*. (19, December 2018.). https://doi.org/10.26099/WY8A-7W13

[46]Melillo, G. (2020) Racial Disparities Persist in Maternal Morbidity, Mortality and Infant Health. *AJMC*. Retrieved March 11, 2021, from https://www.ajmc.com/view/racial-disparities-persist-in-maternal-morbidity-mortality-and-infant-health

[47]Howell, E. A. (2018). Reducing Disparities in Severe Maternal Morbidity and Mortality. *Clinical Obstetrics and Gynecology*, *61*(2), 387–399. https://doi.org/10.1097/GRF.0000000000000349

LBW EFFECTS ACROSS THE LIFESPAN

LBW is a major predictor of infant and child survival and development and has major lifelong consequences. Rosenthal and Lobel (2011) write that LBW infants experience greater problems in infancy, childhood, and adulthood, including higher rates of respiratory illness and impaired growth; cognitive, emotional, and neurodevelopmental deficits, and more.[48] Collins and David (2009) write that college-graduated Black women who receive adequate prenatal care still have more than a twofold greater LBW rate than college-educated white women who receive adequate prenatal care. Black mothers are more likely to be uninsured prior to pregnancy, face greater financial barriers to care when they need it, and are less likely to access pre-and postpartum care, which increases the risk of medical complications before, during, and after pregnancy.

Childhood Health Outcomes & Adverse Childhood Experiences (ACEs)

Not all of the effects from LBW manifest immediately. Delayed effects can appear during infancy and childhood in the form of physical, cognitive, and emotional impairments. Data on neurodevelopment impairment from developed countries show that infants born with LBW have a higher risk of cognitive function, score lower on academic achievement tests, and have a higher prevalence of mental disorders, behavioral problems, and developmental delays.[49] Studies conducted by Orchinik et al. (2011), Whitaker et al. (2006), and Arpi & Ferrari (2013), all reach similar conclusions that LBW serves as a risk factor for cognitive, motor, and emotional delays.[50,51,52] The delays can begin to appear as young as 12 months of age.[52] Such delays include hyperactivity, sensory problems, depression, and more.[52] These three studies also support additional literature that have studied LBW as a risk factor as well. In analyzing the results from these studies in tandem with the existing aforementioned racial disparities in LBW, it is clear that Black infants and children are disproportionately impacted. Since they are more likely to born with LBW, this directly correlates to the increased risk in developmental impairments.

Research on this subject has also shown that infants born with a LBW are more likely than infants born above LBW to have adverse childhood experiences (ACEs). ACEs are traumatic childhood events

[48] Rosenthal, L., & Lobel, M. (2011). Explaining racial disparities in adverse birth outcomes: Unique sources of stress for Black American women. *Social Science & Medicine, 72*(6), 977–983. https://doi.org/10.1016/j.socscimed.2011.01.013

[49] Upadhyay, R.P., Naik, G., Choudhary, T.S. *et al.* Cognitive and motor outcomes in children born low birth weight: a systematic review and meta-analysis of studies from South Asia. *BMC Pediatr* 19, 35 (2019). https://doi.org/10.1186/s12887-019-1408-8

[50] Orchinik, L., Taylor, H., Espy, K., Minich, N., Klein, N., Sheffield, T., & Hack, M. (2011). Cognitive Outcomes for Extremely Preterm/Extremely Low Birth Weight Children in Kindergarten. *Journal of the International Neuropsychological Society, 17*(6), 1067-1079. doi:10.1017/S135561771100107X

[51] Whitaker AH, Feldman JF, Lorenz JM, et al. Motor and Cognitive Outcomes in Nondisabled Low-Birth-Weight Adolescents: Early Determinants. *Arch Pediatr Adolesc Med.* 2006;160(10):1040–1046. doi:10.1001/archpedi.160.10.1040

[52] Arpi, E. and Ferrari, F. (2013), Preterm birth and behaviour problems in infants and preschool-age children: a review of the recent literature. Dev Med Child Neurol, 55: 788-796. https://doi.org/10.1111/dmcn.12142

that affect the biopsychosocial health of an individual across the lifespan.[53] Unsurprisingly, related research highlights how Black children are more likely to experience poverty, academic challenges, and disrupted physiological functioning, which can lead to ACEs. This is clearly demonstrated in the Hall et al. (2020) article, which claims that disparities in ACEs is a direct result from systemic differences in risk exposure, opportunity access, and on resources.[54] Consequently, ACEs can exacerbate health issues and further disrupt adulthood and lead to further disparities. ACEs are linked to chronic health problems, mental illness, and even substance abuse in adulthood.[55] According to the CDC, 61% of adults in the US had at least one ACE and 16% had 4 or more types of ACEs, with female and racial minority groups being at greater risk for experiencing these events.[55] One of the most devastating consequences of ACEs is that it creates a cyclical relationship with LBW. One study conducted by Mersky and Lee (2019) demonstrated that each additional ACE belonging to low-income women is associated with a 12% increase in the odds of pregnancy loss, a 7% increase in the odds of preterm birth, and 8% increase in the odds of LBW.[56] Such results only reinforce the importance of reducing and eliminating disparities in LBW. In addition, this data also points to much larger, systemic disparities that must be addressed through legislative and policy changes.

Cardiovascular Health

Additional consequences of being born with LBW are the impacts on cardiovascular health. Cardiovascular disease (CVD) is one of the leading causes of death worldwide and rates for Black Americans remain almost 20% higher than those for White Americans.[57,58] There are many risk factors that can influence an individual's risk of developing CVD, mainly environmental, psychosocial, and genetic factors. One important hypothesis posed by David Barker proposes that fetal origins (e.g., LBW, FGR, PTB) have a causal relationship to adult diseases, such as CVD.[54,59] A key component of this hypothesis centers on undernutrition, which is important to highlight because of the disparities in

[53]Bryan, R. H. (2019). Getting to Why: Adverse Childhood Experiences' Impact on Adult Health. *The Journal for Nurse Practitioners*, *15*(2), 153-157.e1. https://doi.org/10.1016/j.nurpra.2018.09.012

[54] Hall T, Rooks R, Kaufman C. Intersections of Adverse Childhood Experiences, Race and Ethnicity and Asthma Outcomes: Findings from the Behavioral Risk Factor Surveillance System. Int J Environ Res Public Health. 2020 Nov 7;17(21):8236. doi: 10.3390/ijerph17218236. PMID: 33171864; PMCID: PMC7664623.

[55]*Adverse Childhood Experiences (ACEs) | VitalSigns | CDC*. (n.d.). Retrieved May 13, 2021, from https://www.cdc.gov/vitalsigns/aces/index.html

[56]Mersky, J.P., Lee, C.P. Adverse childhood experiences and poor birth outcomes in a diverse, low-income sample. *BMC Pregnancy Childbirth* 19, 387 (2019). https://doi.org/10.1186/s12884-019-2560-8

[57]Smith, C. J., Ryckman, K. K., Barnabei, V. M., Howard, B. V., Isasi, C. R., Sarto, G. E., Tom, S. E., Van Horn, L. V., Wallace, R. B., & Robinson, J. G. (2016). The impact of birth weight on cardiovascular disease risk in the Women's Health Initiative. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, *26*(3), 239–245. https://doi.org/10.1016/j.numecd.2015.10.015

[58]Mensah G. A. (2018). Cardiovascular Diseases in African Americans: Fostering Community Partnerships to Stem the Tide. *American journal of kidney diseases : the official journal of the National Kidney Foundation*, *72*(5 Suppl 1), S37–S42. https://doi.org/10.1053/j.ajkd.2018.06.026

[59]Barker D. J. (2006). Adult consequences of fetal growth restriction. *Clinical obstetrics and gynecology*, *49*(2), 270–283. https://doi.org/10.1097/00003081-200606000-00009

nutritional status and behaviors of pregnant women in the US. Barker (2006) highlights the importance of nutrition, claiming that its role during development is to increase the allocation of energy.[57] In smaller babies, who experience a lesser allocation of energy, they incur higher health costs, which leads to disease later in life.[57] For low-income Black women, about 40% of these women enter pregnancy with normal BMI but less than 30% reach the ideal weight gain during pregnancy.[60] Moreover, low-income Black women are more likely to live in food deserts and consume a calorie and carbohydrate-dense diet. Research has clearly demonstrated a direct link between diet and mechanisms behind LBW (e.g., PTB and FGR).

LEGISLATIVE & POLICY PROPOSALS

While there has been an uptick in public health interventions seeking to globally reduce disparities in birth outcomes, the US has experienced an increase in disparities, such as maternal mortality, over the last few years. There must be a shift in policy to protect the livelihood of Black infants and their mothers. It is important to note that care begins with the mother, long before pregnancy. Bills must pass that not only reduce disparities and prioritize the health of Black mothers, but that extend protections both before *and* after pregnancy. There were several policies introduced in previous Congressional terms that sought to reduce disparities in maternal and infant mortality and morbidity.

One bill that has been passed into law is the Prematurity Research Expansion and Education for Mothers who deliver Infants Early (PREEMIE) Reauthorization Act of 2018. Originally introduced in 2006, the PREEMIE Reauthorization Act aimed to prevent premature birth and its consequences by supporting federal research and supporting interventions and initiatives.[61] Between 2006 and 2014, the nation's preterm birth rate steadily decreased, although the rate began to rise again in 2015.[61] Moreover, the key provisions of the bill include renewing research on PTB, infant mortality, and adverse pregnancy outcomes, with an increased focus on health equity.[59] Preventing PTB is key in addressing disparities in LBW. This act was reintroduced and passed twice since its inception, demonstrating Congress' commitment to addressing PTB and its consequences. However, the challenge remains to ensure long-term protection of Black mothers and infants. Another recent bill that has been introduced in the US senate is the Black Maternal Health Momnibus Act of 2021. The act seeks to end preventable maternal mortality and morbidity and close disparities in maternal health outcomes.[62] The act also builds on existing legislation to ensure that every dimension of the maternal health crisis in the US is addressed.[62]

---

[60] Lu, M. C., & Lu, J. S. (2007). *MATERNAL NUTRITION AND INFANT MORTALITY IN THE CONTEXT OF RELATIONALITY*. 89.

[61] *PREEMIE Act 2018*. (n.d.). Retrieved May 14, 2021, from https://www.marchofdimes.org/advocacy/preemie-act-2018.aspx

[62] Booker, C. A. (2021, February 22). *Text - S.346 - 117th Congress (2021-2022): Black Maternal Health Momnibus Act of 2021* (2021/2022) [Legislation]. https://www.congress.gov/bill/117th-congress/senate-bill/346/text

Although the outcomes have yet to be seen, it has the potential to make meaningful change. By making investments in the social determinants of health, the perinatal workforce, and supporting pregnant persons and their infants, the Momnibus Act can have a direct impact on Black maternal health outcomes.[63] One key addition to Momnibus bill centers on the relationship between pregnancy and COVID-19, which is important in considering the increased risk of maternal mortality and morbidity.[64] The addition calls for prioritization of pregnant women in receiving the COVID-19 vaccine. Moreover, another key addition addresses the association of heat and air pollution with PTB, LBW, and stillbirth, through the investment in community-based programs to eliminate environmental threats.[64]

Another related bill that passed was The Preventing Maternal Deaths Act of 2018. This act would establish and support state Maternal Mortality Review Committees (MMRC) to review every pregnancy-related or pregnancy-associated death, and based on those findings, develop recommendations for how to prevent future mothers' deaths. This legislation sets up a federal infrastructure and allocates resources to collect and analyze data on every maternal death, in every state in the nation.[65] Although this is a monumental piece of legislation, there is concern regarding the implementation and financing of the act. Considering that funding has not been secured in each state, the act has the potential to fail. For example, the CDC forecasted a potential state-based grant opportunity in December 2018.[65] However, this grant provides funding only to states with existing MMRCs that have been meeting for at least 12 months and are currently reviewing maternal deaths, which many states have not completed.[65] This may disqualify some of the 11 states that established MMRCs under the 12 month period from receiving federal funding and additional benefits. Although this policy does not address LBW directly, it is still a key policy because it aims to address disparities in maternal health.

An additional bill that has been introduced in the US Senate is The Maternal Care Access and Reducing Emergencies (CARE) Act. Introduced by Senator Kamala Harris, the act's main goal is to end maternal health disparities using evidence-based quality improvement measures to protect the health of mothers during pregnancy, childbirth, and postpartum period.[66] This act is very important because it addresses the inequities that place Black mothers at a greater risk than their counterparts. It seeks to uncover the historical and current biases that very clearly indicate that Black women's reproductive health and lives are in great danger. I believe that this bill should be passed in the Senate as soon as possible.

---

[63]*NACPM is proud to endorse the Black Maternal Health Momnibus Act of 2021 | National Association of Certified Professional Midwives (NACPM)*. (n.d.). Retrieved May 15, 2021, from https://nacpm.org/nacpm-is-proud-to-endorse-the-black-maternal-health-momnibus-act-of-2021/

[64]Spencer, E. (n.d.). *'Momnibus' Bill Takes Aim At Reducing Black Maternal Deaths*. Forbes. Retrieved May 25, 2021, from https://www.forbes.com/sites/erinspencer1/2021/02/10/momnibus-bill-takes-aim-at-reducing-black-maternal-deaths/

[65]*Beyond The Preventing Maternal Deaths Act: Implementation And Further Policy Change | Health Affairs Blog*. (2019, February 4.). Retrieved May 14, 2021, from https://www.healthaffairs.org/do/10.1377/hblog20190130.914004/full/

[66]Harris, K. D. (2019, May 22). *Text - S.1600 - 116th Congress (2019-2020): Maternal CARE Act* (2019/2020) [Legislation]. https://www.congress.gov/bill/116th-congress/senate-bill/1600/text

However, with every policy, it is not perfect and needs support, funding, and enforcement in order to enact meaningful change.

Recommendations

After this extensive review of the literature, I believe that there are many recommendations that can be driving forces to decrease disparities in LBW and improve pregnancy outcomes for Black mothers and infants.

1) *Understanding racism as a root cause rather than a risk factor*

The interpersonal, systemic, and structural forms of racism have shaped patterns of access, quality, and overall health outcomes. It is necessary to understand that racism is a root cause, rather than 'race' being a risk factor. Malawa et al. (2021) discuss this framework,[67] stating that because racism is an intractable problem, public health solutions must seek to dismantle long standing inequities deeply ingrained in our society. In treating racism as a root cause, practitioners and policy makers can directly address and eliminate structural inequities within social determinants of maternal health. This includes economic factors (e.g. poverty, employment), neighborhood (e.g. quality of housing, crime), social and community factors (e.g. systemic racism, gender discrimination), education, and health care access (e.g. universal insurance, health literacy)

2) *Addressing medical practitioner bias and racial discrimination*

Understanding the systemic harm and exploitation that Black mothers and infants have faced for decades in key in enacting sustainable change. Historical context can help frame the reproductive and general health experiences of Black women, thus offering some insight into the persistent disparities. Moreover, health care providers and policy makers must include the lived experiences of Black, low-income, and marginalized women into clinical research to further understand how bias and discrimination impact maternal mortality. Their voices must be prioritized in developing interventions, policy, and research. Moreover, care must be provided on a case-by-case basis and generalizations should not be made.

[67]Malawa Z, Gaarde J, Spellen S. Racism as a Root Cause Approach: A New Framework. Pediatrics. 2021;147(1):e2020015602

3) *Provide accessible and effective preconception and postpartum care to Black women*

Given the elevated rates of illnesses, such as hypertension and diabetes among Black women and the strong link between these comorbidities and adverse maternal outcomes, a focus on preconception care is key. Jones (2020) states that early and high-quality prenatal care is thought to promote healthy pregnancies through screening and management of a woman's risk factors and health conditions and to promote health behaviors during pregnancy.[3] Nearly one-half of pregnancies are unintended, underscoring the need for a strong focus on accessible and effective contraception, when desired. Unintended pregnancies have been linked to multiple adverse perinatal outcomes and significant racial/ethnic disparities exist in unintended pregnancies rates with Black and Hispanic women having higher unintended pregnancy rates as compared with white women.[47]

4) *Improvement of wealth, employment, and education gaps*

Improving the wealth, employment, and education gap must be a priority for local, state, and federal levels of government because of their connection to health outcomes. Wealth inequality can directly lead to an education gap. In turn, this creates an employment gap, thus leading to lower earnings and a potentially poorer quality of life. COVID-19 serves as a major example, which revealed the staggering inequalities in wealth between White and Black household. This gap led to Black households having fewer resources to protect themselves against the virus and higher rates of COVID-19 related deaths.[68] These key factors can reshape patterns of access to care, encourage the use of primary and prenatal care, and reduce health disparities for Black mothers and infants.

CONCLUSION

For a developed nation priding itself on reaching specific health and development goals, the United States has the responsibility to address and mitigate the adverse pregnancy outcome of low birth weight. Recognizing the disparity uncovers both the irony and tragedy that policymakers and government officials must confront. While it is easier to consider disparities in LBW because of individual differences, it is a direct reflection of systemic and structural inequities that disproportionately burden

[68]Logan, B. H. and T. D. (2020, August 13). Racial economic inequality amid the COVID-19 crisis. *Brookings*. https://www.brookings.edu/research/racial-economic-inequality-amid-the-covid-19-crisis/

Black women and infants. There must be a focus on eliminating social inequality and social structures that continue to perpetuate such disparities. Moreover, because preventing low birth weight starts with a healthy pregnancy, the health care sector must reinforce care with Life Course Theory principles, provide accessible and effective preconception and postpartum care to Black women and their children, and emphasize patient-centered care that focuses on Black women and infant's needs.

References:

- Smedley BD, Stith AY, Nelson AR. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care (Full Printed Version). Washington, DC: National Academies Press; 2002.
- Seervai S. Why Are More Black Americans Dying of COVID-19? Accessed April 15, 2021. https://www.commonwealthfund.org/publications/podcast/2020/jun/why-are-more-black-americans-dying-covid-19
- Jones, K. (2020) America Is Failing Its Black Mothers: Reducing Racial Disparities in Maternal Mortality and Morbidity for Black Women [Unpublished manuscript]. Northwestern University.
- Skloot, R. (2010). *The Immortal Life of Henrietta Lacks*.
- *Racial Disparities Persist in Maternal Morbidity, Mortality and Infant Health*. (n.d.). AJMC. Retrieved January 14, 2021, from https://www.ajmc.com/view/racial-disparities-persist-in-maternal-morbidity-mortality-and-infant-health
- Howell, E. A. (2018). Reducing Disparities in Severe Maternal Morbidity and Mortality. *Clinical Obstetrics and Gynecology*, *61*(2), 387–399. https://doi.org/10.1097/GRF.0000000000000349
- I*nfographic: Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016 | CDC*. (2020, February 4). https://www.cdc.gov/reproductivehealth/maternal-mortality/disparities-pregnancy-related-deaths/infographic.html
- *Infant Mortality | Maternal and Infant Health | Reproductive Health | CDC*. (2020, September 10). https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm
- Templier, M., & Paré, G. (2015). A Framework for Guiding and Evaluating Literature Reviews. Communications of the Association for Information Systems, 37, pp-pp. https://doi.org/10.17705/1CAIS.03706
- National Center for Health Statistics. Health, United States, 2016: With Chartbook on Long-term Trends in Health. Hyattsville, MD. 2017.
- Hogue, Carol & Bremner, James. (2005). Stress model for research into preterm delivery among black women. American journal of obstetrics and gynecology. 192. S47-55. 10.1016/j.ajog.2005.01.073.
- *WHO | Care of the preterm and low-birth-weight newborn*. (n.d.). WHO; World Health Organization. Retrieved May 9, 2021, from http://www.who.int/maternal_child_adolescent/newborns/prematurity/en/
- Unnatural Causes : Is Inequality Making Us Sick? [San Francisco, Calif.] :California Newsreel, 2008.
- Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *Am J Public Health*. 2006;96(5):826-833. doi:10.2105/AJPH.2004.060749
- Geronimus A. T. (1992). The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethnicity & disease*, *2*(3), 207–221.
- McEwen B. S. (2005). Stressed or stressed out: what is the difference?. *Journal of psychiatry & neuroscience : JPN*, *30*(5), 315–318.
- Guidi, J., Lucente, M., Sonino, N., & Fava, G. A. (2021). Allostatic Load and Its Impact on Health: A Systematic Review. *Psychotherapy and Psychosomatics*, *90*(1), 11–27. https://doi.org/10.1159/000510696
- Geronimus AT. Understanding and eliminating racial inequalities in women's health in the United States: the role of the weathering conceptual framework. J Am Med Womens Assoc. 2001;56:133–136, 149–150
- Geronimus, A. T., Hicken, M. T., Pearson, J. A., Seashols, S. J., Brown, K. L., & Cruz, T. D. (2010). Do US Black Women Experience Stress-Related Accelerated Biological Aging?: A Novel Theory and First Population-Based Test of Black-White Differences in Telomere Length. *Human nature (Hawthorne, N.Y.)*, *21*(1), 19–38. https://doi.org/10.1007/s12110-010-9078-0
- Woods-Giscombé C. L. (2010). Superwoman schema: African American women's views on stress, strength, and health. *Qualitative health research*, *20*(5), 668–683. https://doi.org/10.1177/1049732310361892
- Pierce, Janet D. DSN, APRN, CCRN; McCabe, Shannon BS; White, Nicole BSN, RN, CCRN; Clancy, Richard L. PhD Biomarkers, AJN, American Journal of Nursing: September 2012 - Volume 112 - Issue 9 - p 52-58 doi: 10.1097/01.NAJ.0000418926.83718.28
- Collins, J. W., Jr, David, R. J., Handler, A., Wall, S., & Andes, S. (2004). Very low birthweight in African American infants: the role of maternal exposure to interpersonal racial discrimination. *American journal of public health*, *94*(12), 2132–2138. https://doi.org/10.2105/ajph.94.12.2132
- Djuric, Z., Bird, C. E., Furumoto-Dawson, A., Rauscher, G. H., Ruffin, M. T., 4th, Stowe, R. P., Tucker, K. L., & Masi, C. M. (2008). Biomarkers of Psychological Stress in Health Disparities Research. *The open biomarkers journal*, *1*, 7–19. https://doi.org/10.2174/1875318300801010007
- *WHO | Global Nutrition Targets 2025: Low birth weight policy brief*. (n.d.). WHO; World Health Organization. Retrieved May 10, 2021, from http://www.who.int/nutrition/publications/globaltargets2025_policybrief_lbw/en/
- National Vital Statistics Reports, *CDC*, Volume 70, Number 2, March 23 Births: Final Data for 2019. (2019). 51.
- *Preterm birth*. (19, February 2018). World Health Organization. Retrieved May 10, 2021, from https://www.who.int/news-room/fact-sheets/detail/preterm-birth

- Ellen, I.G. (2000). Is Segregation Bad for Your Health? The Case of Low Birth Weight. *Brookings-Wharton Papers on Urban Affairs 2000*, 203-229. doi:10.1353/urb.2000.0002
- *Preterm Birth | Maternal and Infant Health | Reproductive Health | CDC*. (2020, October 30). https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm
- Burris HH, Lorch SA, Kirpalani H, Pursley DM, Elovitz MA, Clougherty JE. Racial disparities in preterm birth in USA: a biosensor of physical and social environmental exposures. Arch Dis Child. 2019 Oct;104(10):931-935. doi: 10.1136/archdischild-2018-316486. Epub 2019 Mar 8. PMID: 30850379; PMCID: PMC6732250.
- Bell, J. F., Zimmerman, F. J., Almgren, G. R., Mayer, J. D., & Huebner, C. E. (2006). Birth outcomes among urban African-American women: A multilevel analysis of the role of racial residential segregation. *Social Science & Medicine*, *63*(12), 3030–3045. https://doi.org/10.1016/j.socscimed.2006.08.011
- Vladislava Zohdi, Megan R. Sutherland, Kyungjoon Lim, Lina Gubhaju, Monika A. Zimanyi, M. Jane Black, "Low Birth Weight due to Intrauterine Growth Restriction and/or Preterm Birth: Effects on Nephron Number and Long-Term Renal Health", *International Journal of Nephrology*, vol. 2012, Article ID 136942, 13 pages, 2012. https://doi.org/10.1155/2012/136942
- Michael S Kramer, Cande V Ananth, Robert W Platt, KS Joseph, US Black vs White disparities in foetal growth: physiological or pathological?, *International Journal of Epidemiology*, Volume 35, Issue 5, October 2006, Pages 1187–1195, https://doi.org/10.1093/ije/dyl125
- Ghosh, G., Grewal, J., Männistö, T., Mendola, P., Chen, Z., Xie, Y., & Laughon, S. K. (2014). Racial/ethnic differences in pregnancy-related hypertensive disease in nulliparous women. *Ethnicity & disease*, *24*(3), 283–289.
- Blencowe, H., Krasevec, J., De Onis, M., Black, R.E., An, X., Stevens, G.A., Borghi, E., Hayashi, C., Estevez, D., Cegolon, L., Shiekh, S., Ponce Hardy, V., Lawn, J.E., Cousens, S., 2019. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. The Lancet Global Health 7, e849–e860.. doi:10.1016/s2214-109x(18)30565-5
- *Birthweight United States | PeriStats | March of Dimes*. (n.d.). Retrieved May 25, 2021, from https://www.marchofdimes.org/peristats/ViewTopic.aspx?reg=99&top=4&lev=0&slev=1
- Kuzawa, C. W., & Sweet, E. (2009). Epigenetics and the embodiment of race: developmental origins of US racial disparities in cardiovascular health. *American journal of human biology : the official journal of the Human Biology Council*, *21*(1), 2–15. https://doi.org/10.1002/ajhb.20822
- Ratnasiri, A.W.G., Parry, S.S., Arief, V.N. *et al.* Recent trends, risk factors, and disparities in low birth weight in California, 2005–2014: a retrospective study. *matern health, neonatol and perinatol* 4, 15 (2018). https://doi.org/10.1186/s40748-018-0084-2
- Robert L Goldenberg, Jennifer F Culhane, Low birth weight in the United States, *The American Journal of Clinical Nutrition*, Volume 85, Issue 2, February 2007, Pages 584S–590S, https://doi.org/10.1093/ajcn/85.2.584S
- Undernourishment in the womb can lead to diminished potential and predisposes infants to early death. New York: United Nations Children's Fund; 2014 (http://data.unicef.org/nutrition/low-birthweight, accessed 13 October 2014).
- Ghojazadeh, M., Velayati, A., Mallah, F., Azami-Aghdash, S., Mirnia, K., Piri, R., & Naghavi-Behzad, M. (2014). Contributing death factors in very low-birth-weight infants by path method analysis. *Nigerian medical journal : journal of the Nigeria Medical Association*, *55*(5), 389–393. https://doi.org/10.4103/0300-1652.140378
- David, R. J., & Collins, J. W., Jr (1997). Differing birth weight among infants of U.S.-born blacks, African-born blacks, and U.S.-born whites. *The New England journal of medicine*, *337*(17), 1209–1214. https://doi.org/10.1056/NEJM199710233371706
- Ratnasiri, A., Parry, S. S., Arief, V. N., DeLacy, I. H., Halliday, L. A., DiLibero, R. J., & Basford, K. E. (2018). Recent trends, risk factors, and disparities in low birth weight in California, 2005-2014: a retrospective study. *Maternal health, neonatology and perinatology*, *4*, 15. https://doi.org/10.1186/s40748-018-0084-2
- *Stats of the States—Low Birthweight Births*. (2021, February 9). https://www.cdc.gov/nchs/pressroom/sosmap/lbw_births/lbw.htm
- Tikkanen, R.; Gunja, M. Z.; FitzGerald, M.; Zephyrin, L. (2020) Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries. *The Commonwealth Fund.* Retrieved March 11, 2021, from https://www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries
- *What Is Status of Women's Health? U.S. vs. 10 Other Countries | Commonwealth Fund*. (19, December 2018.). https://doi.org/10.26099/WY8A-7W13
- Melillo, G. (2020) Racial Disparities Persist in Maternal Morbidity, Mortality and Infant Health. *AJMC*. Retrieved March 11, 2021, from https://www.ajmc.com/view/racial-disparities-persist-in-maternal-morbidity-mortality-and-infant-health
- Howell, E. A. (2018). Reducing Disparities in Severe Maternal Morbidity and Mortality. *Clinical Obstetrics and Gynecology*, *61*(2), 387–399. https://doi.org/10.1097/GRF.0000000000000349
- Rosenthal, L., & Lobel, M. (2011). Explaining racial disparities in adverse birth outcomes: Unique sources of stress for Black American women. *Social Science & Medicine*, *72*(6), 977–983. https://doi.org/10.1016/j.socscimed.2011.01.013

- Upadhyay, R.P., Naik, G., Choudhary, T.S. *et al.* Cognitive and motor outcomes in children born low birth weight: a systematic review and meta-analysis of studies from South Asia. *BMC Pediatr* 19, 35 (2019). https://doi.org/10.1186/s12887-019-1408-8
- Orchinik, L., Taylor, H., Espy, K., Minich, N., Klein, N., Sheffield, T., & Hack, M. (2011). Cognitive Outcomes for Extremely Preterm/Extremely Low Birth Weight Children in Kindergarten. *Journal of the International Neuropsychological Society, 17*(6), 1067-1079. doi:10.1017/S135561771100107X
- Whitaker AH, Feldman JF, Lorenz JM, et al. Motor and Cognitive Outcomes in Nondisabled Low-Birth-Weight Adolescents: Early Determinants. *Arch Pediatr Adolesc Med.* 2006;160(10):1040–1046. doi:10.1001/archpedi.160.10.1040
- Arpi, E. and Ferrari, F. (2013), Preterm birth and behaviour problems in infants and preschool-age children: a review of the recent literature. Dev Med Child Neurol, 55: 788-796. https://doi.org/10.1111/dmcn.12142
- Bryan, R. H. (2019). Getting to Why: Adverse Childhood Experiences' Impact on Adult Health. *The Journal for Nurse Practitioners*, *15*(2), 153-157.e1. https://doi.org/10.1016/j.nurpra.2018.09.012
- Hall T, Rooks R, Kaufman C. Intersections of Adverse Childhood Experiences, Race and Ethnicity and Asthma Outcomes: Findings from the Behavioral Risk Factor Surveillance System. Int J Environ Res Public Health. 2020 Nov 7;17(21):8236. doi: 10.3390/ijerph17218236. PMID: 33171864; PMCID: PMC7664623.
- *Adverse Childhood Experiences (ACEs) | VitalSigns | CDC*. (n.d.). Retrieved May 13, 2021, from https://www.cdc.gov/vitalsigns/aces/index.html
- Mersky, J.P., Lee, C.P. Adverse childhood experiences and poor birth outcomes in a diverse, low-income sample. *BMC Pregnancy Childbirth* 19, 387 (2019). https://doi.org/10.1186/s12884-019-2560-8
- Smith, C. J., Ryckman, K. K., Barnabei, V. M., Howard, B. V., Isasi, C. R., Sarto, G. E., Tom, S. E., Van Horn, L. V., Wallace, R. B., & Robinson, J. G. (2016). The impact of birth weight on cardiovascular disease risk in the Women's Health Initiative. *Nutrition, metabolism, and cardiovascular diseases : NMCD*, *26*(3), 239–245. https://doi.org/10.1016/j.numecd.2015.10.015
- Mensah G. A. (2018). Cardiovascular Diseases in African Americans: Fostering Community Partnerships to Stem the Tide. *American journal of kidney diseases : the official journal of the National Kidney Foundation*, *72*(5 Suppl 1), S37–S42. https://doi.org/10.1053/j.ajkd.2018.06.026
- Barker D. J. (2006). Adult consequences of fetal growth restriction. *Clinical obstetrics and gynecology*, *49*(2), 270–283. https://doi.org/10.1097/00003081-200606000-00009
- Lu, M. C., & Lu, J. S. (2007). *MATERNAL NUTRITION AND INFANT MORTALITY IN THE CONTEXT OF RELATIONALITY*. 89.
- *PREEMIE Act 2018*. (n.d.). Retrieved May 14, 2021, from https://www.marchofdimes.org/advocacy/preemie-act-2018.aspx
- Booker, C. A. (2021, February 22). *Text - S.346 - 117th Congress (2021-2022): Black Maternal Health Momnibus Act of 2021* (2021/2022) [Legislation]. https://www.congress.gov/bill/117th-congress/senate-bill/346/text
- *NACPM is proud to endorse the Black Maternal Health Momnibus Act of 2021 | National Association of Certified Professional Midwives (NACPM)*. (n.d.). Retrieved May 15, 2021, from https://nacpm.org/nacpm-is-proud-to-endorse-the-black-maternal-health-momnibus-act-of-2021/
- Spencer, E. (n.d.). *'Momnibus' Bill Takes Aim At Reducing Black Maternal Deaths*. Forbes. Retrieved May 25, 2021, from https://www.forbes.com/sites/erinspencer1/2021/02/10/momnibus-bill-takes-aim-at-reducing-black-maternal-deaths/
- *Beyond The Preventing Maternal Deaths Act: Implementation And Further Policy Change | Health Affairs Blog*. (2019, February 4.). Retrieved May 14, 2021, from https://www.healthaffairs.org/do/10.1377/hblog20190130.914004/full/
- Harris, K. D. (2019, May 22). *Text - S.1600 - 116th Congress (2019-2020): Maternal CARE Act* (2019/2020) [Legislation]. https://www.congress.gov/bill/116th-congress/senate-bill/1600/text
- Malawa Z, Gaarde J, Spellen S. Racism as a Root Cause Approach: A New Framework. Pediatrics. 2021;147(1):e2020015602
- Logan, B. H. and T. D. (2020, August 13). Racial economic inequality amid the COVID-19 crisis. *Brookings*. https://www.brookings.edu/research/racial-economic-inequality-amid-the-covid-19-crisis/