Sudden Infant Death Syndrome Evaluated as Epigenetically Maintained Historical Trauma

Alankrit Shatadal

Acknowledgements

Writing an honors thesis during a pandemic would not have been possible without my readers in the Sociology and Anthropology department. Dr. Markowitz and Dr. Goluboff, thank you so much for seeing my project through!

My time at W&L has been enriched by wonderful classes in the Poverty Studies department, and I want to thank the professors I've had in that department over the past few years for sharing their knowledge with so much enthusiasm: Dr. Taylor, Dr. Perez, Dr. Eastwood, and Dr. Sanchez.

To Dr. Kyle Friend, Ana Noel, and my amazing parents: I can never thank you enough for your unwavering support throughout my four years here, and especially this year. You all are the best.

I am grateful to have had the opportunity to share this work with my defense committee members, and I am honored to be able to submit this work to the digital archives.

Table of Contents

Is not kindness more powerful than arrogance; and truth more powerful than the sword?
-Standingbear, 1997

Introduction

The questions leading to this thesis began during a completely unrelated project. In the summer after my freshman year at Washington and Lee University, I received Leyburn funding for a project centering on close observation of relationships between members of Indian households and the domestic workers employed in those households. Being Indian myself, the cultural paradigm was not new to me, but the intricacies of the power dynamics were revealed during interviews I held with domestic workers and their employers. A common theme which emerged from interviews with female employers was the need for domestic help after childbirth. In the description of these situations, some parenting choices were also revealed, including parent/child co-sleeping. What was interesting to me was that when I returned to the U.S. and Googled co-sleeping for more information, the results which came up were entirely different from what they had been when I searched the same thing in India.

While the majority of results about co-sleeping on the Indian server were positive in nature, the U.S. results showed an overwhelmingly negative outlook on the practice. This was essentially the first domino falling in what would begin my investigation that has ultimately led to this thesis. Indian parenting practice highly values co-sleeping. The idea of a crib is something that my parents and members of my extended family told me they heard about only via Western media or if they moved to the U.S., and I wanted to know why Western culture has disfavored co-sleeping. The most highly cited reason I found was the possibility of accidental suffocation or injury. I worked to find out whether that was a genuine problem in places where co-sleeping is the norm. Looking at patterns of co-sleeping across countries, I found that where co-sleeping is practiced, accidental injury or suffocation were not listed as common causes of infant mortality. Additionally, I discovered that most of the world (save Europe, North America, and a few other

Westernized countries) practice parent/child co-sleeping, with 80% of countries sharing a room and almost 50% overall sharing a bed (McKenna et al., 2010).

My most shocking discovery was that some societies not advocating co-sleeping have infant mortality rates much higher than their economic development would predict. For low-GDP developing countries, common causes of infant mortality include water-borne disease and malnutrition, but in the higher-GDP countries which have eliminated these causes, infant mortality still remained inexplicably above predicted rates. For the U.S., an immediately noticeable number of infant mortality cases are filed under a term which essentially means "unknown cause of death." Sudden Unexplained Infant Death (SUID) encompasses accidental injury, asphyxiation, and congenital disease (CDC, 2017). The more specific term Sudden Infant Death Syndrome (SIDS), however, indicates that no cause of death could be determined from autopsy or death scene analysis.

Among the causes of infant mortality, SIDS remains one of the least explained and most prevalent in high-income countries. As of 2010, the National Vital Statistics Report from the CDC reports that the rate of infant mortality for the United States is higher than all other countries within a cohort of similarly economically-developed countries (Fig 1), and by a wide margin. Furthermore, the rate of decrease in SIDS deaths over time for the U.S. (although decreasing) has been the slowest when compared with the same countries (Oldenburg et al., 1997). It is the leading cause of death for infants in the U.S. after one month of age (Fig 1) and claims approximately 2,000 children every year (CDC, 2017). For a death to be ruled as sudden infant death syndrome (SIDS) by a coroner, the victim must be a child younger than 1 year old and no explanation for cause of death found during survey of the death scene, clinical history,

and autopsy report (ibid.). This definition, then, excludes cases of accidental suffocation, injury, and infectious disease.

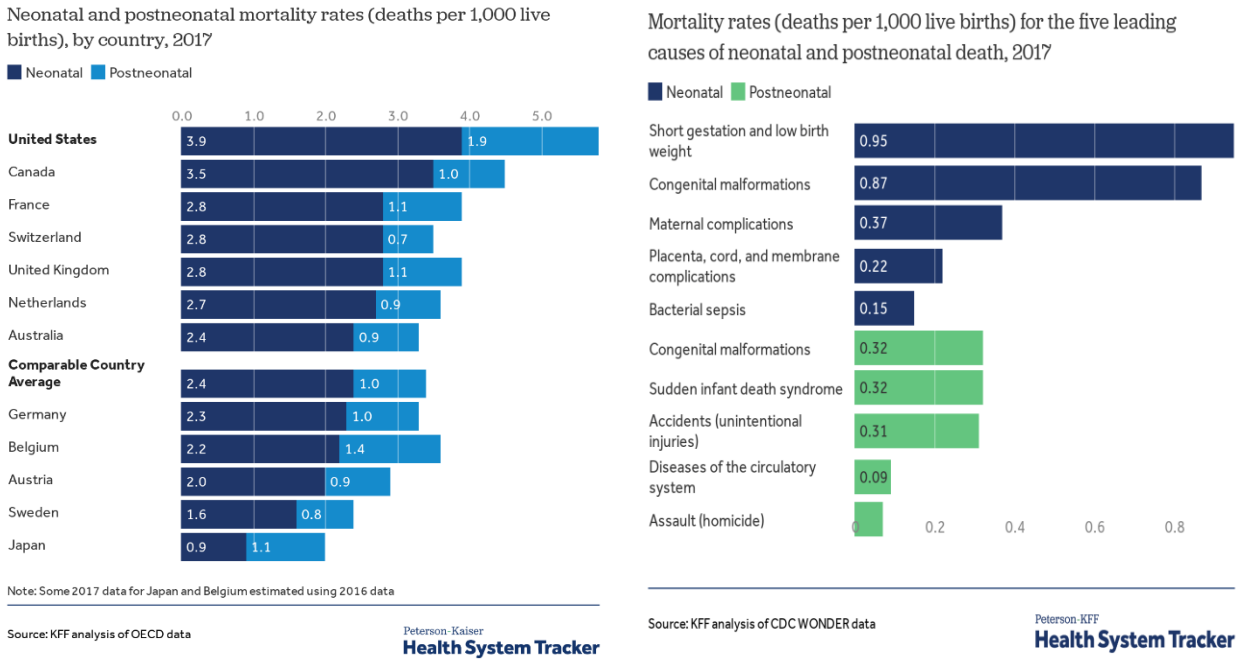


Fig. 1: (Left) Comparison of infant mortality rates for countries with similar economic profiles (Right) Causes of infant mortality by frequency in the U.S. in 2017 (Kaiser Family Foundation, 2017)

The mystery and devastation of losing a child like this has led to SIDS being widely studied, through lenses of both human biology and human behavior. This thesis will contribute to this work through two goals: First, I would like to propose a new model for understanding variation in SIDS rates. The proposed scaffolded model combines two established explanations for health disparities, (1) biological legacies of trauma and (2) the impact of inequality on health with understandings of subjugation of certain U.S. racial minorities. These factors have to date never been considered as a synergistic explanation for SIDS. To build my argument for this model, in the coming chapter, I will explain what is known about SIDS from biological studies,

as well as the risk factors and insufficient hypotheses which tried to explain SIDS pathology. From that point, I will introduce biological anthropology's take on the relationship between trauma environments and their encoding into one's health, which is crucial to understanding the rest of my argument. The final step in my argument will be explaining SIDS risk as a function of racial trauma, both past and present, which presents itself in a myriad of health determinants, both social and biological. This thesis will also provide clarity about SIDS and its risk factors, as the field has had many contradictory and sometimes spurious results. I will explain misinterpretations about the risk factors associated with SIDS to advocate the clarity of my model and the subject in general, which will entail a deeper dive into untangling variables often misconstrued with socioeconomic status (SES) and racial influences upon those factors.

Chapter 1: Sleep Studies and SIDS

Experts in human biology and behavior suggest that parent/child co-sleeping makes sense from an evolutionary standpoint. As humans became bipedal, the accompanying narrow pelvis limited the extent to which the brain could develop in utero. One consequence of this is that babies are born not knowing how to regulate their breathing in the same way that adults can, but learn this skill quickly as their brains mature after birth. Of course, they are learning from their parents, and proximity has been shown to drastically improve that process (McKenna et al., 2010). Animal biology supports this finding, as no other animal separates children to sleep, and when forced into separation, suffer more health problems, some strikingly similar to SIDS (Moise et al., 1997).

Historical Context for Separated Sleep

Although it is very difficult to pin down a specific cause, historians have found what may have been the beginning of a movement to stop parent/child co-sleeping. In large European cities, impoverished women with no access to means of contraception may have felt forced to sacrifice a child so that the others might live given their limited resources. Accounts from priests hearing confessionals from women who had deliberately overlain their infants led to a church-enforced “ban” on co-sleeping. These accounts are the first piece of evidence we have for how separate sleeping came into the Western mindset (McKenna et al., 2010). This also explains why most countries practicing separate sleep in the modern day are of European descent.

Priests responded to these confessions with threats of imprisonment, fines, and excommunication, preaching that children would not be banned from sleeping in the same bed with their parents. Around this time in history, social norms and values were beginning to shift

towards privacy and individualism, which helped to further the notion that separation of children and parents at night is beneficial. The separation also spurred the concepts of self-sufficiency for children and romantic love between parents (Flandrin, 1979).

Concurrently, the field of psychology was popularizing Freud's notion that infants can become developmentally impaired if they witness anything sexual (Kellum, 1974). Additionally, behaviorism made it increasingly acceptable to be strict with children. This encouraged regimented feeding and sleep schedules as well as limiting affection to encourage discipline (Watson, 1928). These ideas were taken up by pediatricians, who were at the time frequently asked questions about how to make babies sleep "through the night". Great importance began to be placed on a baby's ability to sleep through the night, the general belief being that in order to raise independent children, they need to be taught independence as early as possible. In addition to giving parents advice to wad carpets under the child's door to allow them to "cry it out" without feeling guilt, it also became commonplace for doctors to advise formula-feeding infants so they would not wake up at night (Hardyment, 1983).

Infant Sleep Patterns

Sleeping through an entire night, however, is not normal for an infant. A starting point for much of SIDS research is that SIDS deaths always occur while an infant is asleep, so SIDS must involve a failure in the brain and/or cardiopulmonary system renders the infant unable to rouse. Despite our reputation for intelligence, humans are the most neurologically immature of all mammals at time of birth. As mentioned previously, this adaptation is an evolutionary response to bipedalism and the need for a narrower pelvis, as well as the need for bigger brains due to increasingly social behaviors. This means that a remarkable amount, close to 75 percent, of brain

growth occurs postnatally (Huelke, 1998). When children are born, they do not inherently know sleeping patterns. Around the age of 3 months, infants' sleep patterns begin to transition in a process that accompanies maturation of the nervous system (Cornwall, 2006). This is a critical time window in SIDS studies, as the incidence of SIDS is highest between the ages of 2 and 4 months (ibid.), and research on sleep patterns has suggested a probable pathogenesis.

Infant sleep patterns are not completely understood, but in comparison to the adult sleep cycle, infant sleep is less regimented. The adult sleep cycle is divided into 4 stages, beginning with the lightest sleep, progressing gradually into deep sleep, then returning to a lighter sleep distinct from the starting point termed Rapid Eye Movement (REM) sleep. The stages follow the order 1 → 2 →3 →4 →3 →2 →REM, following the pattern of an incomplete wave. One complete cycle will last approximately 90 minutes. Electroencephalograms (EEGs) reveal a person's stage of consciousness based on the pattern of brainwaves. Alertness and calm waking stages appear as beta and alpha waves on an EEG, respectively. Stages 3 and 4 (deep sleep) are characterized by delta waves (Fig 2), which appear more slowly than the theta waves which precede them in stages 1 and 2. REM sleep appears unlike any other stage of sleep on an EEG, resembling waves present while awake. REM sleep is known to be a critical stage of sleep important for memory consolidation (Boyce, 2017). Early in the night, we have traditional complete sleep cycles, and as the night progresses, we spend more time in REM sleep.

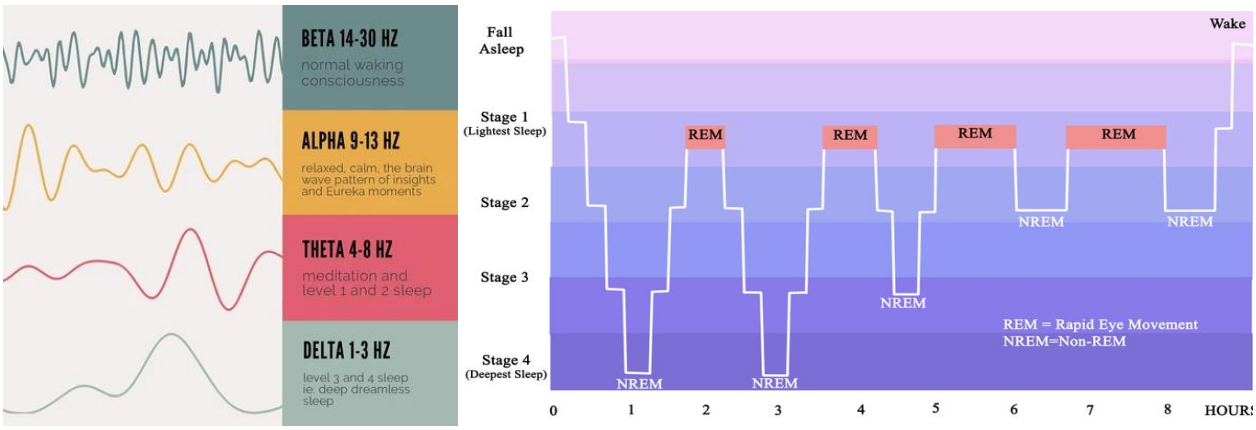


Fig. 2: (Left) Characteristic EEG waves, from waking (top) to deep sleep (bottom) (Right) Adult sleep cycles over the course of one night (McGill, 2017)

From what is known about the sleep cycle of infants, it differs from that of adults in several key ways. The duration of one sleep cycle is shorter, lasting just under an hour, and its stages are not as clearly defined (Kato, 2003). Thus, infant sleep is divided into the categories of active, transitional, and quiet sleep. Active sleep is analogous to REM sleep in the adult sleep cycle. However, just like adults, a night's sleep follows an oscillation in which light sleep progresses to deep sleep, and then the process reverses (Fig 2). Around 3 months of age, the sleep patterns of an infant will begin matching with circadian rhythms of their caretakers (McKenna et al., 2007). The amount of active sleep in a cycle decreases and is replaced by more time spent in quiet sleep. Additionally, sleep cycles begin to lengthen. This change, as mentioned previously, is both a sign of and a factor involved in maturation of the brain.

Interestingly, infants who fell into the high-risk category for SIDS tended to show nervous system immaturity (meaning their sleep cycles remained consistent with those of younger children) (Kato et al., 2003). These high-risk infants were observed to spend more time in deep sleep than their lower-risk counterparts, indicating difficulties in consolidating their

periods of sleep and wake. These differences were most significant in the early morning hours, between 2 and 5 A.M. (Cornwall et al., 1998), which is also when a majority of SIDS deaths occur. In the control group, infants spent increasing amounts of each sleep cycle in deep sleep in early morning hours, while the high-risk infants spent more time in light, active sleep. Additionally, another study showed that infants who later died of SIDS tended to wake less than healthy infants during morning hours (despite being in light sleep) (Schechtman et al., 1992). This has led to the general understanding of SIDS being rooted in an inability to rouse from sleep.

A natural question follows from this: What is so dangerous about sleeping that makes it lethal for some babies? Sleep does present risks we typically do not notice. Throat muscles, which intermittently relax, can inadvertently cause a blocked airway. Apneas, as these are called, are often a result of the brain not sending proper signals to the muscles controlling breathing (Sleep Foundation, 2016). These are also known to occur more often during REM sleep (ibid.). However, suffocation and SIDS are not synonymous, although they are often confused with each other. An important thing to remember, though, is that SIDS occurs in male babies 30-50% more often than their female counterparts (Safe to Sleep Statistics, 2010); if SIDS were simply asphyxiation, there would be no sex bias.[1] Adults have a well-developed ventilatory response when low oxygen or high carbon dioxide levels are sensed; we are instantly sent into an involuntary reflex to up the heart rate and move to clear any possible obstruction. Infants,

[1] Being male is a risk factor for SIDS. While there is speculation that this may come from the social stigma of men going to therapy and processing their emotions, it could also have a genetic component. Women receive two X chromosomes, and groups of cells randomly choose one copy to silence (epigenetically deactivate) in order to not have too much expression of any X-chromosome gene. Probabilistically, this means females only have a 50% chance of having active X-chromosome gene from one parent in a group of cells, while males have a 100% chance of having an active maternal X-chromosome.

however, have an immature version of this response and are therefore much more sensitive to collapses in breathing (Horne et al., 2005), whereby they are unable to quickly trigger brain functions necessary to wake up, which can become fatal.

Known Factors of SIDS

Infant wake/sleep patterns are also highly subject to influence from outside factors. Much of the research effort surrounding SIDS has been on the topic of reducing harmful inputs from babies' environments. Well-established risk factors for SIDS include drug, alcohol, and smoke exposure. The chances of sudden death increased by 2-5 times if exposed to opiates, 6-8 times in cases of 1st trimester maternal alcohol consumption, and between 2-4 times if exposed to smoke (depending on the number of cigarettes (Blair et al., 2006)). These odds are staggering, yet unsurprising, because all three substances are known to retard brain development and have been shown to affect the breathing centers of the brain (Ekblad et al., 2015). Smoke, additionally, impacts the immune system and renders it less capable of preventing infection (Dwivedi, 2014), which is itself also a risk factor for SIDS (this is the same reasoning for why immunizations are a protective factor). Smoke exposure also harms the infant's lungs, and exposure increases the odds ratio associated with bedsharing risks.

Risk factors	Protective factors
-Tobacco, alcohol, or drug exposure -Male -Sibling SIDS victim status -Low SES -Unsafe sleep practices -African American/ Indigenous American	-Coparenting -Breastfeeding -Supine sleep position -Prenatal care -Room sharing -Immunizations

Table 1: Separation of factors which show statistically significant increased chance of SIDS (left) and factors which have been found in associative or correlational studies (right)

Unsafe sleeping practices are also a major risk factor for SIDS. The co-sleeping debate has one irrefutable argument: A parent who is not sober (by alcohol or drug use) poses a risk if sleeping in the same bed as an infant (Mitchell, 1992). However, this correlation loses its statistical significance when considering sober parents. This makes sense in a global context, seeing as countries with some of the lowest SIDS rates practice co-sleeping regularly (Japan and Sweden, for example (Bartick et al., 2018)). In the absence of any hazards, the risk associated with bedsharing was found to be insignificant for infants under 3 months, and for older infants, the effects of bedsharing were protective (Blair et al., 2014). Additionally, bedsharing among lower-SES parents and children does not increase the chances of SIDS (Young, 1999).

The term “unsafe sleeping practices” also includes overly soft bedding, heavy blankets, as well as sleeping position. The logic behind supine positioning (laying a baby on their back) is that infants would not be “re-breathing” the air they exhale. Constantly taking in an elevated level of carbon dioxide over a prolonged period can prove fatal (Chong, 1999). A key study in the 1980s led to the establishment of supine sleeping as a major protective factor against SIDS.

This began the Back to Sleep campaign, which was highly effective in several parts of the world, some seeing up to an 83% reduction in average annual infant mortality rates (Trachtenberg et al., 2012). It is important to note here, that this reduction also includes deaths due to suffocation, which is also more common for babies laid in the prone position. Facing down during sleep reduced circulatory control, higher temperatures, and CO_2 buildup (Chong et al., 1999).[2] In the U.S., the number of infants found in the prone position at the time of death decreased by 50% after the introduction of Back to Sleep (Goldstein et al., 2016). However, since 2006, the incidence of SIDS has decreased at a very low rate, which strongly indicates that there must be other risk factors not being addressed.

Coparenting is labeled here as a protective factor because infants who do not live with their father were found to be 50% more sensitive to sudden death (Mathews, 2004). However, this was only a correlation; there may be several confounding variables. Yet it is known that babies learn how to breathe at night from their parents: The trace amounts of CO_2 which reach the baby if they are in the same room stimulate their breathing and promote stability of breath cycles (Mosko et al., 1998) so having both parents present is helpful. Another noted protective factor is breastfeeding. Babies who are breastfed wake more easily and more often than their formula-fed counterparts (McKenna et al., 1997). This goes back to why doctors began advising formula-feeding to help babies sleep through the night. Human milk has a much lower fat and protein content compared to that of other mammals. It is rich in carbohydrates, which are quickly

[2] In the body, carbon dioxide is quickly converted to carbonic acid for solubility purposes. This lowers the pH of blood. Re-inhalation of exhaled carbon dioxide will therefore lower the blood pH: SIDS cases show this sign of acidosis, with average pHs of 6.15 compared with an average of 6.65 among children who died of other respiratory causes (six times more acidic): for more, see: http://njms2.umdnj.edu/biochweb/education/bioweb/NewsandViews/SIDS_and_respiratory_acidosis.html

burned for energy (ibid.). Formula-fed babies receive long-lasting forms of energy and can sleep longer without feeling hungry. However, this means that in the early hours of the morning when SIDS risk is highest, breastfed babies have a higher chance of waking up, thus reducing their risk.

Genetics: An Incomplete Explanation

One of the most alarming risk factors, confirmed in multiple studies, is being Indigenous American or African American. Findings like these have reopened conversations about the construct of race, and its implications on health. Recent research on SIDS has turned to genetics in an attempt to explain race as a risk factor, under the logic that mutations can be inherited for several generations and be more prevalent within a group. Compromised connections anywhere in the circuit between the heart, lungs, and brain provide plausible pathologies for SIDS deaths (Hunt et al., 1992). Some genetic inquiries have produced results which indicate mutations of important cardiac proteins occur in some cases of SIDS (Schwartz, 1998). Similarly, genes relevant to the immune system have also been investigated since SIDS victims often pass away after mild infections (Odpal et al., 1999). These studies have shown associations, but they do not address the wide disparity in SIDS incidence by race or socioeconomic status. Studies which did find racial differences focused on metabolic syndrome (Chitrala et al., 2020), thermoregulation (Farnell et al., 2001), and serotonin receptors (Weese-Mayer et al., 2003).

The serotonin receptor study is of particular interest because serotonin is a neurotransmitter which plays a large role in regulating consciousness. In SIDS victims, serotonin binding to corresponding receptors was decreased in parts of the brainstem, which is responsible for managing all autonomic behaviors. Genes for serotonin transporting proteins were found to

have a slightly different DNA sequence in SIDS victims (Paterson et al., 2006). Furthermore, this was found to be more prevalent in African Americans (ibid.). However, it is largely recognized that the strength of the genetic component's influence is unknown, and that these genetic differences are unlikely to be singularly predisposing factors for SIDS. Therefore, more information is needed on the impact of race on health before progress can be made.

Chapter 2: The Role of Race in SIDS Statistics

As explained in the last chapter, sudden infant death syndrome has been researched by many scientists, recently focusing on biology and biochemistry. The puzzle of this disease includes a very striking and disturbing sociological feature: SIDS rates vary widely based on race and socioeconomic status. This extent of variation does not replicate itself in other countries. The effect of race on SIDS deaths is so radical that it is included in lists of risk factors. Research has repeatedly shown that SIDS rates in the U.S. are significantly higher for African American and Indigenous American babies (Fig 3).[3] The rates are lowest for Asian Americans, followed closely by White and then Hispanic Americans.

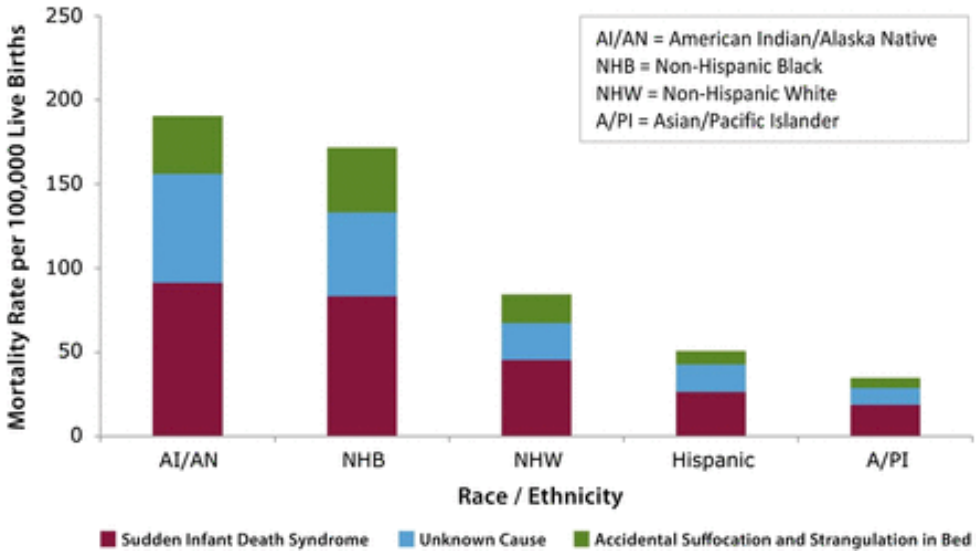


Fig. 3: Breakdown of infant mortality in the U.S. by race (bottommost section of the bars represent SIDS cases) (NHS, 2017)

[3] The term African American is used in this thesis when conveying ancestry from enslaved Africans brought to the U.S., recognizing that the category of black Americans also includes many immigrants and would not represent the demographic accurately.

Many survey studies have tackled this by trying to find parenting behavioral factors that differ by race. Some of the offered rationales that will be discussed in later chapters include health literacy and compliance with guidelines, such as breastfeeding, sleep environment, appointment attendance, and neighborhood location. However, individual "choices" are at times outcomes of socioeconomic factors. That is why I suggest that current research at the intersection of anthropology and biology can best explain the interplay between sociological conditions and its impact on the body when it comes to SIDS. The truth of the matter is that race impacts one's resources in life, which in turn influence one's health, and potentially the health of their progeny. Looking at either biochemical causes or behavioral causes leading to SIDS, therefore, may not take into account the variation in risk for babies of different races when considered alone. To explain the interplay between sociological conditions and its impact on the body, current research is investigating the intersection of anthropology and biology.

Definitions of Race

To do this, researchers have been reconsidering what race means, since history has provided numerous ideas ranging in accuracy. The notion that races represent separate forms and levels of humans emerged in 17th century Europe, when the transatlantic slave trade was underway. The slave trade and institution of slavery existed for more than 350 years. In its most dehumanizing form, chattel slavery (the treatment of people as moveable, personal property) was ruled as a crime against humanity by the United Nations (DeGruy, 2017). America was culpable based on this ruling because its enslavement of Africans was more brutal there than anywhere else in the world (ibid.). Those who survived the passage to the U.S. were forced to work until the point of exhaustion regularly on very little food and water, and were often beaten, raped, or

whipped. Families were often separated, and children suffered frequent maladies from poor nutrition (ibid.).

Seeking justification for such cruelty, white European scholars began to classify people in a hierarchy based on closeness to God (Mukhopadyay, 2007). These rankings were based on an incorrect assumption that there existed significant biological differences between races beyond skin color. The hierarchical classifications of biologically distinct races unsurprisingly placed white Europeans in a position of superiority. The supposed evidence for such a claim came from the discovery of bones on Mount Caucasus (the location of the biblical ark and first home of mankind) which were white in color (ibid.). Other so-called proof included skull size and supposed behavioral predispositions, all of which are now known to be completely false.

Race is a man-made idea; something that is imaginary and therefore unstable in its definition, but how we experience the world has come to be influenced by race. In turn, biological differences between races, beyond skin color, have been brought into existence. For the purpose of this thesis, race is recognized to be a sociological assignment of privilege (largely based on differences in physical appearance and country of origin) which has, as a consequence, created a cline of biological differences in modern people. Along with this, race also creates differences in the ways people are treated, and by extension, differences in access to resources. The disadvantages and discrimination faced by racial minorities, which are written into the structure of institutions or systems of multiple institutions, is referred to as structural racism (Sondlik et al., 2010). This theme will present itself several times in this thesis because it is key to understanding factors which increase SIDS risk.

Structural Racism in the United States

The U.S. Census is an example of the way institutions (in this case, the government) have utilized race as a social category. Categorizations of racial groups by the census have been inconsistent through time, with notable manipulations made for political suppression. In 1890, the Census divided races as mulatto, quadroon, octoroon, or black to indicate what 'fraction' of a mixed-race person's ancestry was African (Mukhopadyay, 2007). After the Civil War, this attention to bloodline indicated a growing interest in 'purity.' With growing rights for free African Americans, land ownership became a front for litigation, since white landowners often had both mixed-race and white children who could stand to potentially inherit their estate (Schor, 2017). Beginnings of the Civil Rights Movement alerted southern states' congressmen that voting rights would soon be at its forefront. By the time of the 1930 Census, those congressmen had exerted enough pressure upon the Census Bureau to informally adopt their ideology of the 'one-drop rule,' signifying that any African ancestry would preclude a person from having equal rights (ibid.).

Race has also been used in manipulating neighborhood segregation. In the 1930s, U.S. government surveyors coded the neighborhoods of 239 cities for the purpose of mortgage loan determination. In their assessments, green and blue ranked neighborhoods indicated the most desirable places to live, yellow warned of declining quality, and red stood for hazardous. The problem with this system was that in addition to checking local amenities and standard home prices, surveyors determined neighborhoods' ranks based on the amount of people of color who lived in the area. Loans for green and blue neighborhoods were often set to be very expensive or entirely unavailable to people of color. This made it a struggle for low-SES minorities to settle anywhere besides yellow and red neighborhoods. This pattern is still present today. The majority

of redlined neighborhoods are more likely to house low-SES minorities. 3 of every 4 redlined neighborhoods struggle financially to this day due to scarce employment opportunities and underdeveloped infrastructure such as banks, healthcare, and groceries (Gaspaire, 2012). Crime is also higher in these areas, which makes it less likely for investors to take interest in repairing the residences or businesses. A study of Sacramento County, California found that neighborhoods with high crime rates tended to be hotspots for SIDS deaths (Ciaola, 2016).

Social Determinants of Health

To discuss the ways race, which began as only a concept, has created inequalities in the U.S., we will explore the social determinants of health (SDHs) (U.S. Department of Health, 2020). These are, as the name suggests, everything in the external world that could impact a person's ability to heal or fight disease. The CDC explains SDHs as falling into 5 overarching domains: economic stability, education access and quality, neighborhood and built environment, social and community context, and health care access and quality. Each one is important, and each has been clearly shown to affect personal health. They also impact one another: Unemployment, a situation falling into the economic stability domain, has the potential to lower health care accessibility through loss of health insurance. Another example is unsafe or unreliable public transportation services making it difficult to attend classes in order to advance one's education and consequent income potential. Many of the problems structural racism causes present themselves as factors blocking access to the SDHs.

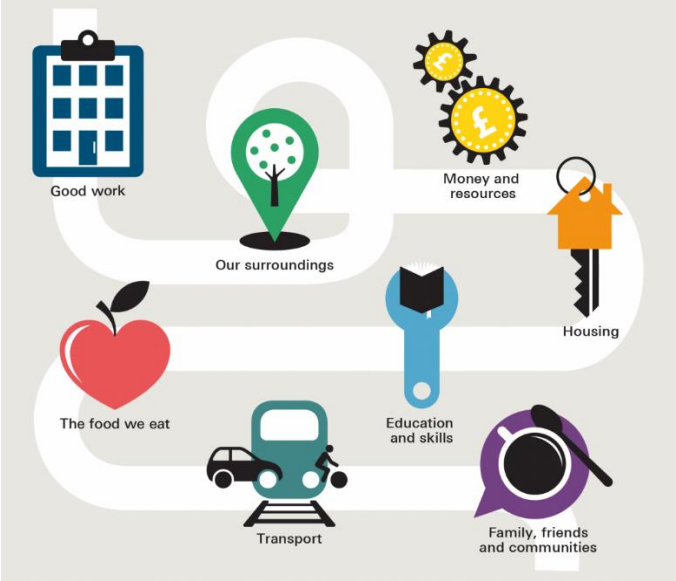


Fig. 4: Social determinants of health (Health Foundation U.K., 2017)

Structural racism represents a complex interplay between policy and practice. Undeniably, though, the effects of structural racism are "pronounced, persistent, and pervasive (Sondlik et al., 2010)" in society today.[4] Every person above the age 50 was alive during the Jim Crow Era, so its effects are almost unescapable. Many scholars argue that the echoes of Jim Crow are still present today in the prison system (DeGruy, 2017). While African Americans make up 12% of the general population, they constitute half of the imprisoned population (ibid.). With an incarceration rate 7 times that of whites (even higher for young men), African Americans also experience longer sentences, higher conviction rates, and higher bail amounts. In the same vein, fatal police shootings are disproportionately high when victims are African American. Recent data shows that as of June this year, the rate of fatal shootings is more than

[4] Consider, for example, the Flint water crisis. The complaints of unsafe water began in 2014, but were largely ignored. The city, primarily made up of lower-SES minorities, repeatedly asked for water to be tested, but they were not heeded for almost a year. The test "dropped" two samples so the water could be cleared as safe to use. It was not. The state of emergency was called much too late and the issue taken much too lightly by media considering the gravity of the problem.

double for African Americans when compared to whites (Bureau of Justice Statistics, 2020).[5] Unemployment and wage gaps present further evidence of structural racism. African Americans men earn only ¾ of what their white peers do, and this pattern stands when comparing PhDs or high school graduates (ibid.). "Equal opportunity employers" were also found to discriminate in the hiring process, adding an extra hurdle in the quest to accumulate wealth.

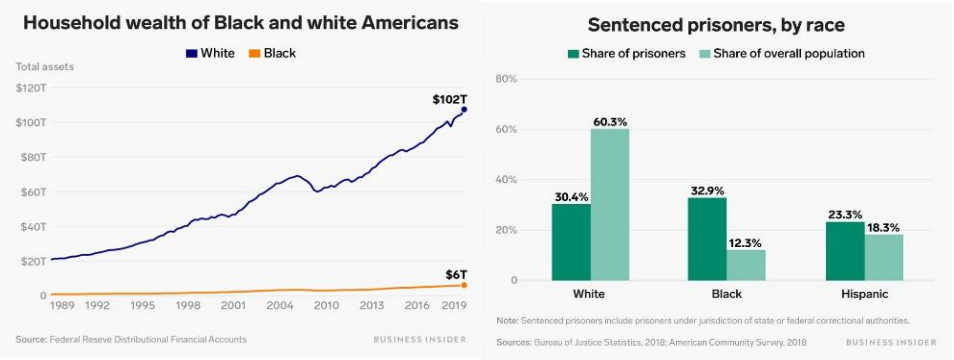


Fig. 5: (Left) Comparison of household accumulated wealth between African Americans and White Americans from 1989-2019 (Federal Reserve Distributional Financial Accounts, 2019) (Right) Comparison of imprisoned Americans by race ratios (Bureau of Justice Statistics, 2018)

Through pathways such as the aforementioned, lower socioeconomic status is encapsulated within the social determinants of health and serves to exacerbate SIDS risk (Bartick, 2018). This has prompted many researchers to tie the two demographic features

[5] Repeated exposure to violence against one's racial group results in what therapists call racial trauma. For a full explanation of the term, see: https://www.huffpost.com/entry/racial-trauma-therapist-whats-happening_l_5edfc1b9c5b6e1150820743c. Note that the term will only be used when conveying physical violence specifically, with structural racism serving as a term to encapsulate this as well as institutional violence.

together, and explain the variation in SIDS deaths as a direct effect of being of a lower socioeconomic class. The conclusion does seem to fit the circumstances at first glance, and because there is hesitancy to acknowledge the impact of racial discrimination and structural racism on health, has led to more available work on the impact of SES on SIDS. The average accumulated wealth of African Americans and Indigenous Americans is lower than Asian American and White Americans (Federal Reserve Distributional Financial Accounts, 2019), which follows the same pattern as SIDS rates. However, Hispanic Americans' average wealth resembles that of African and Indigenous Americans more closely than Asian or white Americans, while their SIDS rates are only slightly higher than that of white Americans. This makes it difficult to construe income as a direct cause of racial disparities in SIDS rates. In this examination of SIDS rates, I will not attempt to separate SES and race because there exists an interplay between the two. In the model I will propose for SIDS evaluation, race integrates itself as a source of biologically inherited health disadvantage, and being of lower SES compounds those effects.

Evaluating SIDS with the Triple Risk Model

Recall that the genetic findings from previous SIDS studies are unlikely to be singularly predisposing factors for SIDS; this means there must be environmental factors which trigger problems in the infant before these genetic differences play any harmful role (Odpal, 2004), which is where SDHs fit into this puzzle. Consideration of multiple factors when assessing SIDS risk like we have done so far is what led to the most common model for the cause of SIDS. Termed the "Triple Risk Model," this theory proposes that SIDS must arise from an intersection of multiple risk factors, some of which are intrinsic and others exogenous (Fig. 6). The creators

of this model posited that a simultaneous occurrence of the critical developmental period (defined as age 0-1 year) and exposure to a stressor, combined with a biological vulnerability, creates the highest risk of SIDS (Filiano et al., 1994).

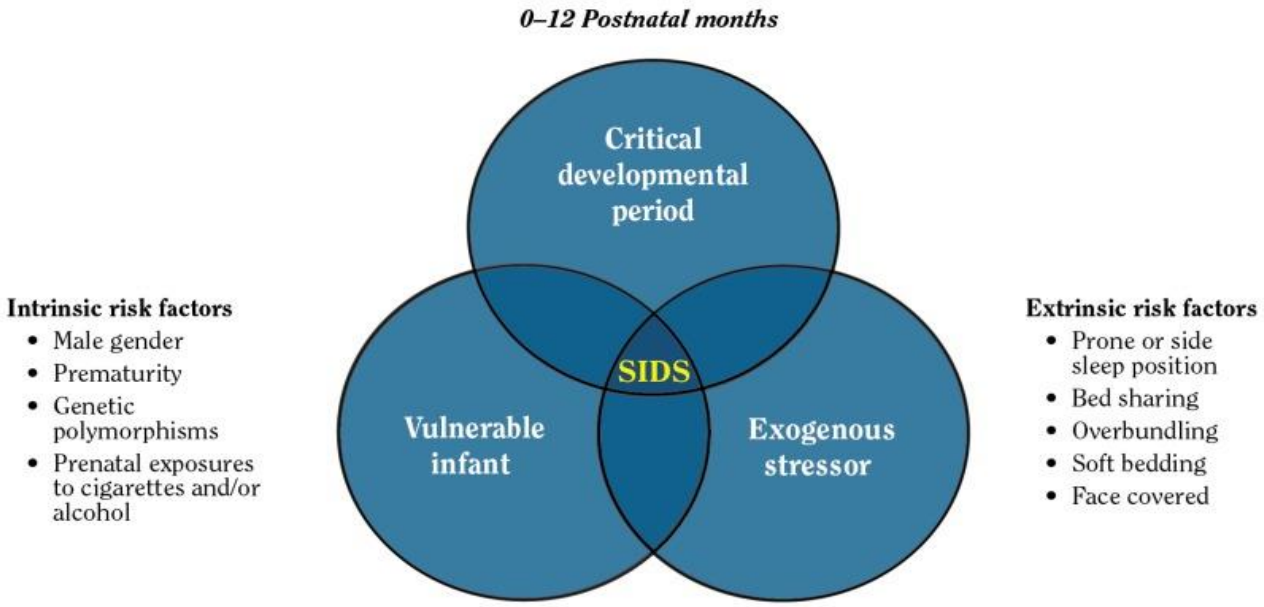


Fig. 6: Overlapping of potential SIDS risk factors as explained in the Triple Risk Model (Trachtenberg et al., 2012)

Prone sleep was included in this model as a potential stressor. Mutations in genes could be factored in under the category of biological vulnerability. Also consider that exogenous risk factors can create biological vulnerability through SDHs; neighborhood pollution leading to respiratory illness, for example. I suggest that we label race as a potential exogenous stressor, allowing us to see the overlap between that and biological risk as facilitated by social determinants of health. It is important to mention, though, that a study applying this model to a database of SIDS cases retrospectively found that SIDS does not occur exclusively in children with risk factors, although it is true that at least one risk factor is present in almost 90% of SIDS

deaths (Duncan and Byard, 2018). It is possible, though, that the risk factors characterized in the retroactive study were limited in scope; recent work evaluating race's impact on health has led to an enhanced understanding of what it means for a racial group to bear a legacy, and the embodiment of the cyclical structural racism compounding their trauma. In other words, Indigenous Americans and African Americans experience race as embodied trauma, which I am suggesting becomes both exogenous and intrinsic factors for SIDS. We will explore this in the next chapter.

Chapter 3: Historical Trauma and Embodiment Theory

In the history of the U.S., both Indigenous and African Americans bear a legacy of traumas subjected onto them. Research primarily in the realm of mental health has crafted the idea of this legacy into the term historical trauma. The working definition refers not only to the impact of atrocities of a racial or ethnic group's past upon subsequent generations, but also to the compounding/ cumulative nature of what those same groups endure as a result of their previous subjugation (Brave Heart et al., 2004).

African Americans and Their Legacy of Historical Trauma

Recently, researchers have investigated the connection between quality of care after birth and infant health to determine if poor infant health outcomes for African American infants is due to post- or pre-natal factors. In one study, which evaluated 9 measures of neonatal care (timeliness of eye checkups, mortality during NICU hospitalization), white infants fared better than their African American counterparts. A separate study found that standard medical practices in prenatal care differed based on race as well: while 89% and 88% of white and Asian infants received steroids before birth to promote lung maturation,[6] while this was only provided to 85% of African American infants (Profit et al., 2017). Black mothers were also nine times more likely to be given formula in the hospital when compared with white mothers. This was the biggest predictor of continuing to formula-feed after discharge from the hospital (Hahn-Holbrook et al., 2016). Mothers who participated in a survey asking about their choice to breastfeed cited

[6] For an explanation on why Asian Americans do not face the same *structural* racism, despite facing discrimination and racism interpersonally, the model minority myth can be overviewed here: https://depts.washington.edu/sibl/Publications/Model%20Minority%20Section%20(2011).pdf

familiarity with the concept through their families (McKinney, 2016), when the suggestion should have been provided in prenatal as well as post-delivery appointments by clinicians.

This inequal dissemination of information also plays into the disparity between racial groups' outcomes after the Back to Sleep program (Pickett, 2005). The accusation originally fell upon African American mothers' "health literacy" because they display the highest rate of placing their babies prone. Realistically, though, there must be a problem with communication between patients and healthcare providers. African American mothers are more likely to receive a recommendation from a healthcare provider to lay their baby prone (Oden et al., 2005). Additionally, surveys have found inconsistencies with how SIDS is explained to parents, often resulting in confusion between SIDS and SUID. This has, in several instances, led to the belief that SIDS is synonymous with choking, for which the solution is to lay babies facedown (Hauck et al., 2011). SES complicates the issue of communication further; according to an analysis of private practice clinic (primarily serving white middle and upper-SES families) and inner-city clinics (mostly serving lower-SES African Americans), less than half of the inner-city clinic patients received advice on infant sleep positions. Compared to the 72% of city clinic patients who were given advice (Ray, 1997), this is majorly troubling. The lack of proper guidance seen here is an example of the way hurdles are still compounding the effects of historical trauma.

As we have seen through examples of redlining and preclusion of voting rights, African Americans were suppressed in the U.S. for years after emancipation. A great deal of African American reflections, displaying battles with historical trauma, can be found through written works. One of the most well-known is W.E.B. DuBois's idea of double consciousness. He explains that as a minority, one views the self through the eyes of others and constantly feels an internal struggle for belonging:

"It is a peculiar sensation…of measuring one's soul by the tape of a world that looks on in amused contempt and pity. One ever feels his two-ness,—an American, a Negro; two souls, two thoughts, two unreconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder. The history of the American Negro is the history of this strife—this longing to attain self-conscious manhood, to merge his double self into a better and truer self. In this merging he wishes neither of the older selves to be lost."

The concept of double consciousness shows the constant battle of identities in a person of color. We may not classify that alone as trauma, but consider that this rift in a person's sense of self could lead to symptoms of trauma such as trouble connecting to one's own culture and distorted self-image, both of which are themes exemplified in novels by Toni Morrison and Alice Walker (Craddock, 2014). These themes are seen through the characters in Morrison's "The Bluest Eye," a young girl synonymizes her blackness with ugliness. She idolizes white figures in mass media like Shirley Temple, and wishes that her own eyes were blue so that she, too, can be pretty. Nothing is ever said to her about the beauty of black skin and brown eyes. The girl's parents, living in a violent and impoverished neighborhood, suffer from their own traumas and do not notice their daughter slipping into a psychosis in which she believes she has finally gotten the blue eyes she craved so desperately. Most of the African Americans around the girl, including her family and neighbors, reinforce her beliefs on race and beauty because they, too, have been struggling with their situation (Morrison, 1970):

> *"It was their contempt for their own blackness that gave the first insult its teeth. They seemed to have taken all of their smoothly cultivated ignorance, their exquisitely learned*

self-hatred, their elaborately designed hopelessness and sucked it all up into a fiery cone of scorn that had burned for ages in the hollows of their minds – cooled – and spilled over lips of outrage, consuming whatever was in its path."

In this quote we see traces of dealing with the aftermath of trauma: The shame of feeling hopeless discharged through anger at weaker targets. Many of the characters feel powerless at the hands of a white-majority society. In "The Color Purple," one African American character explains the way this imbalance creates fear to a white character (Walker, 1982):

"'I just don't understand, say Miss Eleanor Jane. All the other colored women I know love children. The way you feel is something unnatural.'

'I love children, say Sofia. But all the colored women that say they love yours is lying… Some colored people so scared of whitefolks they claim to love the cotton gin.'"

African American authors also showcase the importance of acknowledging trauma as a first step towards healing. In one case, though, we see it without the authors' acknowledgement. Zora Neale Hurston denies historical trauma's effects on her, claiming she is too busy and otherwise unaffected by racism. There are many times, she asserts, that she has no race. But when she hears a jazz orchestra, sitting alongside a white friend, she feels as though she is miles away, experiencing "great blobs of emotion" and connection to her ancestry. When the song ends, she realizes her friend has only listened to a song; nothing more. "He is far away," she writes, "and I see him but dimly across the ocean and the continent that have fallen between us. He is so pale with his whiteness then and I am so colored."

The significance of connecting to one's roots and reclaiming one's culture are inherent through plays like Langston Hughes' 'Mulatto,' (written during the Harlem Renaissance) which was a clear denouncement of the hostility displayed by Southern Whites towards African Americans during the Jim Crow Era.[7] Reclaiming culture, in one sense, refers to educating others about what one's culture encompasses, but reclaiming can also mean unlearning certain survival tactics that were needed in the Jim Crow Era. Noted by studies in counseling, becoming silent and untrusting are two such examples of survival tactics that now hinder the healing process (Thompson-Miller, 2011). Consider this quote, which is the last line of "The Invisible Man," spoken by the African American narrator who falls through an open manhole as he runs from the police during a riot, becomes trapped there when the police replace the manhole cover: "I'm an invisible man and it placed me in a hole—or showed me the hole I was in, if you will—and I reluctantly accepted the fact (Ellison, 1952)."

Music also captures the traumas endured by African Americans. Work songs from enslaved Africans capture mere glimmers of what they endured, but the pain of the African American legacy is reflected in jazz and some gospel (Mathew, 2018). It is important to note here that the role of the church was critical, both during the Jim Crow Era as a place of organization for NAACP activity and in the present day as a source of social support (Wilson, 2019). The quote below describes the song "Feeling Good" from an African American vantage point, which provides clear depictions of historical trauma:[8]

---

[7] In a detailed analysis here: (https://zancojournals.su.edu.krd/index.php/JAHS/article/view/2474/1679), the main character of Langston Hughes' play "Mulatto" is said to have been murdered as a symbol of "the white races' proscription against blood-relations with African Americans and indicates collapse of all the bridges of communication and rapprochement between the two races."

[8] Lyrics:
And this old world, is a new world And a bold world for me

> *"I think one of the gripping aspects of the song is the dichotomy of the lyrics that are so happy, hopeful and positive set against a background of music that is somewhat dark, projects sadness, hopelessness and fear, probably associated with the plight of most Black folk at the time (1960s). Not to mention [Nina Simone's] subtle yet powerful voice that presents the lyrics almost as a plea. Her plea is filled with determination to have what is in those happy lyrics regardless of the grim reality that is in the music—likewise, the reality of unemployment, homelessness, police brutality, disenfranchisement from society and possibly any number of addictions all around her."* (Singleton, 2011)

Specifically African American trauma responses have been referred to as post-traumatic slave syndrome by scholars who corroborate the ideas encapsulated by historical trauma (DeGruy, 2017). Unlike the term "racial trauma," which hinges on current events, this term emphasizes the deliberate and repeated exploitation of African Americans in the past. Between 1932 and 1972, the U.S. Public Health Service let 399 African American men die in what came to be called the Tuskegee Syphilis Study. Under the pretense of offering these men treatment for a blood disorder which would relieve their symptoms of fatigue, they were left to "run the course" of their disease as medical professionals took notes. They experienced paralysis, tumors, blindness, insanity, and often, death, and were denied treatment when it became available in order to continue their study (ibid.). Henrietta Lacks' cells were harvested for the propagation of an in vitro cell lineage without her consent or awareness. The U.S. Army tested the efficacy of

---

Stars when you shine, you know how I feel; Scent of the pine, you know how I feel
Oh, freedom is mine! And I know how I feel
It's a new dawn, It's a new day, It's a new life for me
And I'm feeling good.

mustard gas as a war weapon specifically on African American soldiers. Even the origins of gynecology are rooted in the unethical and inhumane unanesthetized surgeries forced upon enslaved women, under the false assumption that their race made them more able to bear pain. These horrifying surgical experiments were also performed on babies. The true problems the women faced surrounding childbirth were largely dismissed; neonatal tetanus resulting from proximity to horse manure in nearby stables was labeled as a racial side effect (DeGruy, 2017).

Indigenous Americans and Their Legacy of Historical Trauma

Bearing all this in mind, we now face the fact that African Americans are not the only group to have experienced systematic, race-based atrocities at the hands of the United States. The arrival of European colonizers brought destruction to Indigenous Americans through genocidal military actions. The natives' home became wrought with disease, which radically reduced their populations. They were eventually coerced into signing treaties written in languages they could not read which allowed Europeans to force them off their land. Those who did not vacate were invaded, raped, and killed. The spiritual connection between Indigenous peoples and the land they live on is not something taken lightly; being forced off these lands was spiritually wounding. Additionally, restricted access to their lands, which had sustained them, meant a reduced ability to provide for themselves economically. These displacements became more and more extreme with time, the U.S. government forcing Indigenous Americans to live confined to reservations and wiping their cultural identity through forced assimilation. This meant the tearing of children from their parents and enrollment in boarding schools, which forbade speaking Native languages, religion, and symbolism (these were punished severely) (Duran, 1998). Children developed destructive coping strategies to deal with the grief of breaking within their

families and the abuse rampant in boarding schools (these included learned helplessness, manipulative tendencies, compulsive gambling, alcohol and drug use, suicide, denial, and scapegoating other Native American children) (Garrett and Pichette, 2000).

The health of the Indigenous American population spiraled downward as a result of neglect and inaccessibility on the reservations. This neglect was intentional, with many of the treaties pushing U.S. ownership of Indigenous Americans' land with the promise of health care. However, these treaties did not establish guidelines, requirements, or officials to enforce their promises. Even now, the Indian Health Service, which more than half of Indigenous Americans rely on for healthcare, meets only 60% of the estimated health needs in the community due to underfunding and inaccessibility (in some areas, doctor's offices and pharmacies only exist within hospitals) (Sarche and Spicer, 2008). Diabetes, heart disease, tuberculosis, and suicide are major issues. The Substance Abuse and Mental Health Services Administration writes, "This population has been exposed to generations of violent colonization, assimilation policies, and general loss." The intergenerational trauma endured by Indigenous Americans has destroyed much of their traditions, including cultural norms of family structure and care.

The term "historical trauma" is one that, upon introduction to Indigenous Americans, was immediately recognized and acknowledged as a lived experience. Even young Indigenous American children are aware of the suffering their ancestors have endured (Goodkind et al., 2012). As they age, it becomes apparent to them that the suffering of their people has not ended yet. The quote below, from a survey participant, illustrates the pervasiveness, as well as cumulative nature, of historical trauma:

> *"Historical trauma is not only a conceptual idea for American Indians, it is terminology to describe lived experiences: I didn't really know the concept or understand the concept*

> *of Historical Trauma until I read it, I think, in a research article when I went to college. I think maybe that's when I had that ah-ha moment and thought, oh wow. This is me. This is what I grew up with. Seeing and experiencing different forms of abuse. It was normal. For example, every woman I knew growing up experienced sexual assault in some form. Including my sister."* (Banks et al., 2018)

Additionally, within an Indigenous American focus group, the majority connected their drinking or other substance abuse to their desire to "numb themselves from cumulative stress related to historical trauma, as well as to ongoing racism and discrimination (Asamoa-Tutu, 2013)." From the same study, these experiences affected their beliefs about their access—or lack thereof—to opportunities and various life paths. The sample group also explained their experience with negative feelings about their Native American identity, which is a theme reflected in books by Indigenous American authors. One poignant example is found in Sherman Alexie's "Flight", which follows a young orphan who feels like he does not belong anywhere since he is neither fully Native nor White. He experiences major historical events through flashbacks when he is gravely injured which help him understand his roots, ending with an experience as his own father, who is homeless. The main character feels betrayed that his father did not keep him, and in the flashback, sees that his father was abused as a child by his parents; so the ultimate deciding factor of giving the main character to the orphanage was to keep him safe from any possibility of history repeating itself.[9] Alexie's work is noted as containing characters who have trouble expressing their suffering and turn to self-destructive tendencies to

[9] This story also shows the main character indirectly understanding how prior traumatic events have left scars on the population which perpetuate through historical trauma, exemplified by this poignant quote: "I am tired of hurting people. I am tired of being hurt. I need help." (161-162)

mute their pain, since their pain feels like it cannot be shared (Craddock, 2014). This is something that is true for many Indigenous peoples.

Recent research has shown that historical trauma is often contextualized as a factor contributing to mental illness. It should come as no surprise that the events in our lives affect our bodies. The histories of African Americans and Indigenous Americans presented here align with embodiment theory, which proposes that our circumstances in life become incorporated into our health. Our bodies tell stories, stories which cannot be considered separately from the conditions in which we live (Krieger, 2005). Biological embodiment of physical circumstance is the framework from which I will introduce my novel model of SIDS risk.

Embodiment theory also explains that the wounding effects of historical trauma do not easily "wear off" through generations. The embodiment of historical trauma constitutes a range of health ramifications, which researchers are continuously updating. The U.S. has known this for a long time, but has yet to accept accountability for their history. In a 2018 article, one scholar interpreted recent data as such:

> *"The shameful secret is that even when controlling for age, socioeconomic status and education, the U.S. Centers for Disease Control and Prevention (CDC) reports that "African-American women … face a nearly four times higher risk of death from pregnancy complications than white women. In parts of the U.S. with high concentrations of women of color who live in poverty, such as Mississippi, maternal death rates can surpass those of sub-Saharan Africa."* (Blayton, 2018)

Statistics like these must be related to atrocities of the past and are passed down generationally and further complicated by structural racism. As we have discussed, genetic

inquires have not completely explained the link between this intergenerational transmission and health outcomes due to the impact of SDHs. However, there are a few ways for our body's "programming" to be inherited, and of special interest to us is one which rapidly encodes current circumstances as well as retaining the embodiment of poor health in the past.

Chapter 4: Epigenetics of Trauma and Legacy Accumulation

To explain this other milieu of transmitting "programming" to future generations, we will do a brief thought experiment. Imagine a pair of identical twins through their lifetimes, with one living in an upscale and healthy environment and the other in a polluted area with very little access to healthcare or a nutritious diet. You probably realize that their health outcomes will not be identical, despite their genetic information being a 100% match. Extending this thought experiment now, what would the initial health status be of children born to each twin? Intuitively, we know that the child born to the twin with poorer health will also be less healthy than the child born to the other twin. Epigenetics is the field that examines why this is the case. From the standpoint of inherited genetic material, we know that the DNA passed on by each twin matches. So, the difference in inherited health must have come from something other than the genetic code. Their environments influence their gene expression without altering the genetic code, and the signals for these changes are heritable; this is the broad definition of epigenetics.

Epigenetics on a Molecular Level

The term genetic code as used here refers to the sequence of bases (As, Ts, Cs, and Gs) encoded in DNA. DNA is a 'master blueprint,' read by specialized proteins to make a miniature replica in the form of RNA, which is small enough to exit the nucleus. RNA, the 'assembly instructions', can then be read by other specialized proteins to bring together building blocks to form a protein.[10] Most cellular processes require proteins as their effectors. Given the size of cells and, by comparison, enormous amounts of DNA needed to run the cell, there is a problem

[10] For a review of how the process of DNA coding becoming protein works, supplemental reading can be found here: https://www.nature.com/scitable/topicpage/translation-dna-to-mrna-to-protein-393/#

of storage (Fig 7). In order to fit into the nucleus of the cell, DNA must be coiled tightly. To aid in this process, the strands of DNA are wrapped around disc-like proteins called histones (Wu et al., 2008). Visualize someone reducing the space taken up by their hair by twisting it into a bun. Along with DNA bases, histones can also be chemically modified to compact DNA more or loosen and allow more space. This is crucial for the cell.

As mentioned previously, the nucleus is packed full of DNA. When the DNA is wrapped up so tightly, the proteins which read the DNA to create RNA cannot access their starting points. In order for an area of DNA to be expressed (so the encoded protein is actively being made), the wrapping must loosen. An analogy for this is trying to detangle a pair of headphones if you stuffed them into a tight space (like a pocket) compared to leaving them on the desk. It's much easier to find a knot and separate it if the wires are already relaxed. When the cell has expressed an area of DNA which it needs, it compacts that area once more. Keep in mind that this is happening continuously and at numerous locations within the nucleus.

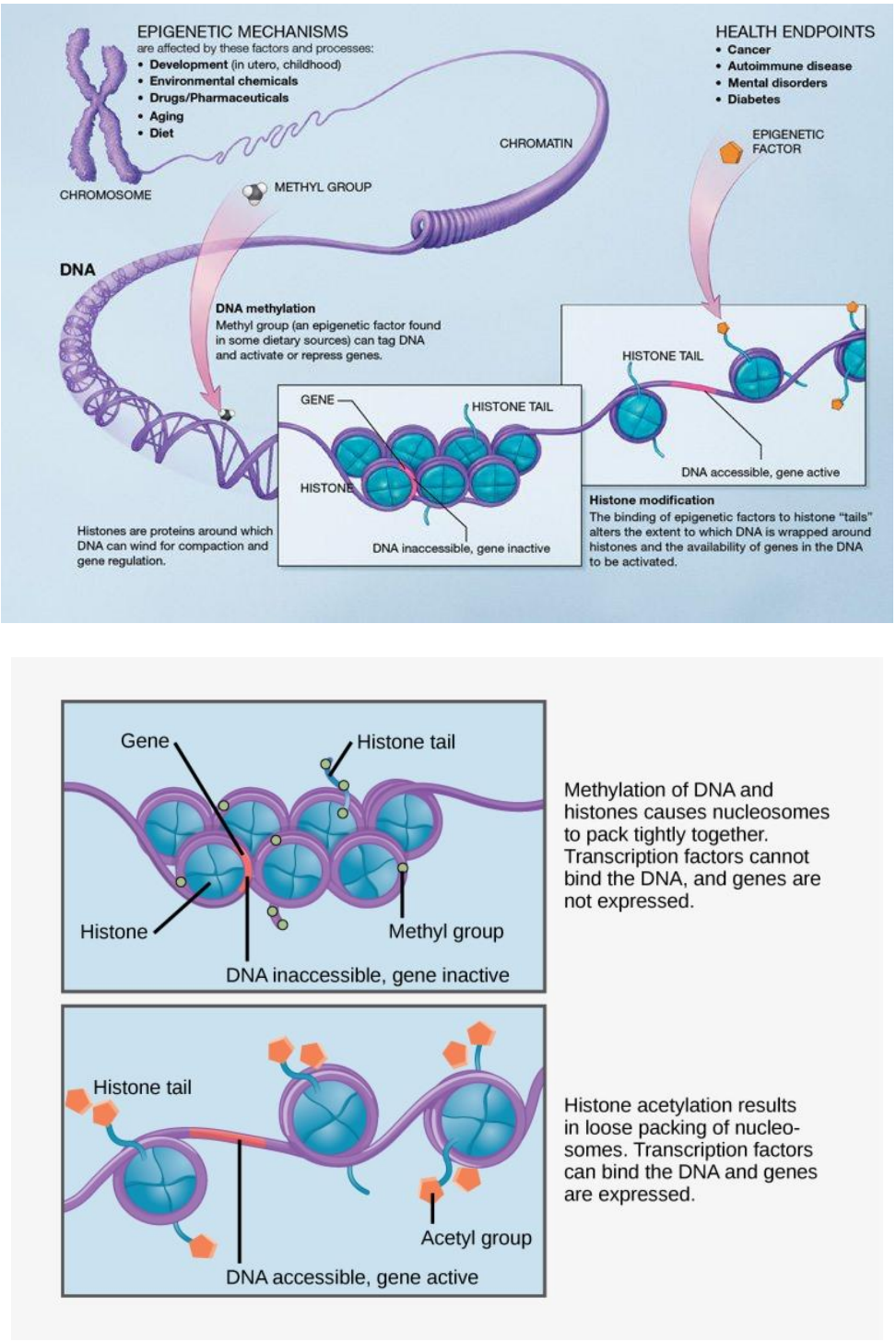


Fig. 7: Cartoon illustrations of supercoiling, histones, and histone modifying factors (Kubicek, 2011)

Epigenetic Studies in Biological Anthropology

Although there are many different ways to loosen or compact DNA, the most referenced by biological anthropology papers are DNA methylation and acetylation (Phillips, 2008). Methylation (the addition of a methyl group, a carbon with three hydrogens) serves as an "off" switch; it signals the cell to wrap the corresponding area of DNA more tightly while it is not in use to make space for active areas. The opposite effect is often accomplished by acetylation (the addition of an acetyl group, or carbon=oxygen-oxygen), which utilizes the repulsion between negatively charged DNA and negatively charged acetyl groups to create and sustain space between the histones and DNA, which allow DNA-reading machinery the space to do its job.[11]

Epigenetic modifications are accumulated throughout one's life. Diet (Zhang and Kutateladze, 2018), environment (Bacarelli and Bolatti, 2011), stress (Gudsnuk and Champagne, 2012), and other external factors have the capacity to alter the pattern of epigenetic modifications in DNA. Although these do not change your genetic code, their job is crucial, because their interactions decide which parts of your DNA to express or suppress, and to what extent. Every time a cell prepares to divide, it replicates its DNA along with the epigenetic modifications present on it. So, when DNA is passed down from parent to child, the child will receive those modifications. This answers the question of how the child of the less-fortunate twin was born in poorer health, when both children inherited a genetic code which was identical. Over the course

[11] Epigenetics includes more than DNA methylation and histone modification. The field is quickly growing and constantly uncovering more about ways cells communicate changes in gene expression. Noncoding RNAs are one such example, cited in the same study by Mansuy. These RNAs do not contain templates for proteins, but rather, they can change the programming of the cell by moderating expression of genes(mechanism of action explained here: https://www.sigmaaldrich.com/life-science/functional-genomics-and-rnai/mirna/learning-center/mirna-introduction.html). Such RNAs have not only been found in germ cells, but their levels differ in traumatized mice when compared with a control group.

of one twin's life, their DNA accumulated markers of stress from the polluted environment, lack of nutrition, and disease. These markers, the epigenetic modifications, were inherited by this twin's child. However, suppose the less-fortunate twin moves in with their well-off sibling to raise their child. With a cleaner environment and easier access to healthy food and medical treatment, the inherited modifications will receive input from the environment that they are no longer needed, and will gradually reverse. Just as an area of DNA or histone can be methylated or acetylated, it can be demethylated or deacetylated. Studies have shown extensively that this does, in fact, occur; this is of special importance when considering racial groups with generations' worth of accumulated trauma programmed into their epigenome.

Epigenetic studies have already begun to show their incredible value in the world of biological anthropology because they allow insight into generational changes, including those induced by traumatic events. One of the most notable early studies of epigenetics was an accumulation of observations following the Dutch famine of 1944. Women who were pregnant during the Hunger Winter gave birth to underweight children who grew up to later develop glucose intolerance. They additionally tended to develop obesity, heart disease, and hyperactive stress responses (Thayer and Kuzawa, 2011). Additionally, children of soldiers who were prisoners of war had significantly lower life expectancies than children whose fathers did not experience the same confinement, neglect, and interrogation (Curry, 2019). This study controlled for both SES and maternal health, so the effect observed can be said to be largely derived from epigenetics.

Epigenetics and Trauma Transmission

Through the use of animal models, it has been possible to determine whether epigenetics plays a role in trauma transmission. In one notable study, researchers classically conditioned male mice to fear a sweet, floral scent by coupling it with mild electric shocks. The pups of these mice, without any exposure to the shocks, were also afraid of the scent at the very first exposure. Furthermore, this effect was also noted in the subsequent generation (Mansuy, 2001)! The study ignited the exploration into epigenetics of trauma. Experiments were done to test whether a less intense emotion, such as stress could also cause this transgenerational affect. The findings clearly indicated that it could, and does, for both the offspring as well as the generation after that. However, a point of contention also arose: how could it be ascertained whether this effect was coming from within the genome or as an effect of parenting? The idea was that traumatized mice did not seem as attentive or calm as parents and could be inducing anxiety in them through their disregard for them, which could then be passed on as a behavioral legacy (opposed to a biological one) in the next generation by replication of the parenting observed.

A 2001 study disproved this hypothesis. In the design of this study, the male mice experienced the intensely stressful events, but were removed from their untraumatized mates' cages before the pups were born to prevent any behavioral inputs. After weaning, the siblings were also raised in mixed groups to ensure they would not alter one another's behavior. The findings were clear: the pups displayed altered behaviors as adults which mirrored those of the traumatized male mice. For example, when placed in a deep pool of water, they gave up much more quickly than the control group, as what the researchers deemed a depressive-like symptom (Curry, 2019). Recall that siblings of a SIDS victim have a higher likelihood of SIDS; epigenetic transmission from parents provides a potential explanation.

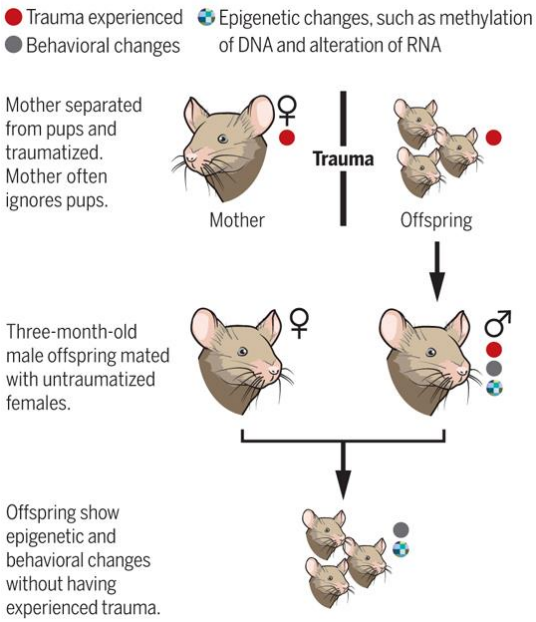


Fig. 8: Experimental flow and results from the 2001 study (Curry, 2019)

Additionally, the reversibility of epigenetic modifications was proven in an extension of the aforementioned mouse experiment. The mice with trauma responses were divided into groups, one of which lived in a standard cage, and the other in a luxurious enclosure with lots of friends and toys to stimulate their senses. The mice in the enriched environment showed marked improvement behaviorally and gave birth to pups which did not show the same signs of inherited trauma as their counterparts in the control cage (Mansuy, 2001). But to begin thinking about how to provide humans with this kind of enrichment, it is necessary to understand the traumas they bear, and that epigenetic profiles vary by race (Adkins et al., 2011), which may be connected to the fact that different racial groups have experienced different lives.

To discover the human side of epigenetically-encoded legacies of trauma, research has turned to studying populations such as the children of Holocaust survivors. Holocaust survivors were documented to have markedly different stress hormone profiles when compared with other Jewish adults. They additionally suffered higher rates of PTSD and anxiety disorders (Yehuda,

2015). A team of researchers investigated a few key genes which dictate a major stress center of the brain and found differences in methylation for children of Holocaust survivors. One of those same genes was found to have a similar methylation pattern in children of parents who lived through the atrocities committed by Dutch colonizers in the Democratic Republic of the Congo (Kertes et al., 2016), with some behavioral similarities as well (DeGruy, 2017).

Epigenetics and Race

The idea behind epigenetics, this encoding of circumstances into our genetic material, may be present in theories laid out by sociologists before the popularization of epigenetics. The weathering hypothesis, for example, states that African Americans experience an earlier deterioration in health as a consequence of the accumulation of repeated experience with social, economic, and political marginalization (Geronimus et al., 2006). This reasoning behind this theory is that chronic stress takes a toll on health, essentially aging a person more rapidly; they are 'weathering a storm' within their own bodies, hence the term 'weathering' to refer to this process. This could be related to epigenetics in two ways: Pre-existing epigenetic modifications may predispose African Americans to poor health and/or inequality through life can create epigenetic modifications which deteriorate health.

This has been explored primarily in relation to low birthweights among African Americans. African American women, particularly those who were born in poor neighborhoods and remained in a neighborhood of similar SES as adults (Love et al., 2010), had shorter gestation times and gave birth to lower-birthweight babies than white counterparts. Even when living in neighborhoods of similar SES, white women did not reflect the same trend, indicating that more than current circumstances are at play. Moreover, in middle-SES areas, birthweight

disparities persisted despite the provision of adequate prenatal care (Collins, 1997). It would be remiss to chalk SIDS entirely up to low birthweight or shorter gestational age, however, because on the other end of the spectrum, Indigenous Americans (as well as First Nations in Canada) tend to have high birthweight infants (Dennis, 2019), and rates of SIDS are very high for these groups. We can tentatively say that the epigenome must be responding differently to the conditions of each racial group, having received years of independently shaped experiences, compounded by current racial trauma and structural racism, in the form of lingering epigenetic modifications.

These health consequences resulting from epigenetic coding affect people far after birth. Take cancer mortality for example: Although breast cancer was found to occur more often in white women, African American women had the higher death rate due to the disease. In the tumors of those women, cancer-associated genes were more highly methylated than in the tumors from white women (Vick and Burris, 2017). Furthermore, African Americans' risk of heart disease is 1.3 times higher than that of whites, diabetes risk is 1.8 times higher, and hypertension rates are 2 times higher. Biomarkers which confirmed poor health included cortisol levels, blood pressure, immune system reactivity, and glycated hemoglobin levels (an indicator of diabetes). In turn, some of these factors negatively affect pregnancy, thus creating a cycle of health disadvantage. Adding impaired access to SDHs into this cycle creates further complications. To understand the pathogenesis of SIDS, however, I believe that this cycle of epigenetic trauma and SDHs reinforcing previous epigenetic modifications must be considered together.

Chapter 5: Scaffolding Theory

Although the terms post-traumatic slave syndrome and historical trauma were coined to discuss mental health, these paradigms closely relate to how suggest we understand SIDS. The model I am proposing for evaluating SIDS risk combines aspects of the theories explained which have previously not been considered in tandem, making my 'scaffolded' model novel. In the same way that the Triple Risk Model stated that the risk for SIDS increases as factors begin to overlap, similarly, I believe that these two factors feed into the pathology of SIDS, creating an elevated rate of SIDS deaths for certain sub-populations. By using the ideas of epigenetic transmission of trauma which we discussed in the previous chapter, and knowing what we do about historically traumatized groups in the U.S., this model proposes that historical trauma has been and is being passed down generations of Indigenous and African Americans via epigenetic modifications. Furthermore, racial trauma experienced via structural racism prevents drastic enrichment opportunities that could reverse epigenetic changes made in previous generations. This leads to a halting of intergenerational mobility, and ultimately maintains the status quo of poorer health status.

My scaffolding of multiple theories falls in line with the overall crux of embodiment theory. Different groups in the U.S. have been subject to various atrocities, which undeniably left their mark on their health, and their offspring's health through epigenetic transmission of trauma. Without remarkable opportunities present for healing and care, these epigenetic changes can persist in descendants of these groups. Previous theories have advanced the idea of slavery and similar traumas causing health disparities like low birthweight and SIDS because the effects on health have not had enough time to "wear off" (Jasienska, 2014), but in light of what we know about the nature of epigenetic mechanisms, I disagree. The major challenge lies in creating an

environment that can ameliorate the epigenetic encoding of trauma. The U.S. poses a uniquely onerous situation upon these groups due to the structural racism which exists to this day, making it likely for inheritance of trauma to continue. I have found it necessary to unite both factors to make this new model because it now captures elements of known risk factors in addition to providing a more solid explanation for the racial differences in SIDS death data.

Examining SUNDS Using the Scaffolded Model

We can begin using this model by applying it to a case eerily similar to SIDS. Sudden Unexpected Nocturnal Death Syndrome (SUNDS) began capturing researchers' attention in the early 1980s, when it presented en masse for otherwise healthy Hmong men. Like SIDS, there were no histologic explanations found for these deaths. Among Laotian and Hmong immigrants, the death rate was equivalent to the 5th leading cause of death among American males at the time (Minnesota Historical Society, 2008). Many experts began to theorize that SUNDS was rooted in the emotional stress these immigrants experienced after leaving their home countries. Through ethnography, it was well known that Hmong culture placed great value on their closeness with nature and their heritage, so the theory was plausible. The Hmong themselves explained SUNDS through spiritual attacks upon the soul, which they were more vulnerable to without traditional healers available to them anymore (Adler, 1991). Interestingly, most documented SUNDS deaths occur within the first two years after arrival in the U.S., implying a temporal factor or relation to immigration.

A recent investigation of SUNDS discovered certain malfunctions in the heart's electrophysiology as a potential pathology for the disease (Zheng et al., 2018). This has also been proposed as a reason behind SIDS, since the electric regulation of the heart is regulated by the

same structure in the brain that controls breathing. The similarities stretch further, too: SUNDS deaths lend support to the embodiment of trauma theory because they largely involve people who have undergone uniquely stressful events. In the years before the surge of SUNDS in the U.S., tens of thousands of Hmong men and boys fought in the Vietnam War. Those who survived the war soon became refugees when the Laotian monarchy was overthrown and Hmong soldiers or sympathizers were hunted down. Some found refuge in Thailand, others in the United Nations' refugee camp, where a later study revealed SUNDS had also taken its toll (Munger, 1987).

For other examples which lends support to the hypothesis that historical trauma is a major risk factor and contributor to SIDS, we can examine other populations for which SIDS rates are elevated. This includes the New Zealand Maori, Australian Aborigines, as well as the Canadian First Nations (Barnes, 2019). A common feature to all three of these groups is their history of being invaded by colonizers. Just as they did in the U.S., colonizers arriving in these places brought with them disease, guns, and war for land. This forced the decimated population into crowded living spaces with little access to traditional food sources, interrupting the indigenous Maori economy. The lack of nutrition only hastened the spread of disease. State policies of assimilation followed, just as they did in the U.S., and although they ranged in cruelty, all of them separated people from their language, culture, and land. European colonizers also brought with them tobacco and alcohol, often using them as trading incentives and relying on their addictive nature. All four populations of indigenous peoples discussed continue to face problems with substance abuse (Facing History, 2021). Unsurprisingly, SIDS rates have consistently been 7 times higher for First Nations than non-Indigenous Canadians (Sheppard, 2017). It is also the leading cause of infant mortality within that population.

Examining Enslaved African SIDS rates with the Scaffolding Model

We can also examine the applications of my proposed model by looking at the death records of enslaved Africans. Child mortality was unsurprisingly and heartbreakingly high during this era. Categorizations and death records kept for enslaved Africans were not kept to the same level of detail as they were for whites. Additionally, most records were made by biased census marshals in the presence of the white landowners, who often stereotyped and dehumanized enslaved Africans to justify their use of slave labor (Johnson, 1981). 60,000 of these records indicate overlaying/ smothering as the cause of death between 1790 and 1860. But some of these records have given scholars the impression that the deaths were never confirmed to be due to smothering. Some records do not even have an interview with the mother, but rather the white landowner. Wordings like, "smothered, probably" and "found dead in the morning" implies that even they were offering guesses (ibid.).

Researchers have noted the similarity between the SIDS age-of-death window and that of enslaved women's babies. Furthermore, they point out that pregnant women were not given a reduction in workload until several months into pregnancy (and some not at all), nor were they provided with nutritious food or safety from beatings or whippings. These findings present a case for SIDS being present, but dismissed as what we would now call SUID. The rate of deaths labeled as "smothering" fell dramatically after emancipation (ibid.). By removing the circumstances of such severe oppression, health improved. This furthers the idea that we can do something to change epigenetic embodiment of trauma, even in the modern day.

One of the ways we can accomplish this is through improved access to SDHs. Several SDHs, including health insurance, nutritious food, and prescription medication, are all implicated by our socioeconomic status (SES). The same is true for rates of SIDS, which have been

correlated with lower SES by multiple studies. However, I believe that this association must be tempered with a "focus on the broad societal and situational factors that may constrain mothers' choices (Lock, 2005)" so as to avoid an outright blaming of parents for the children's plight. Instead of behavior-blaming, this remainder of this chapter will seek to identify root causes leading to elevated SIDS risk by looking more closely at social determinants of health and the impact of racial groups' histories and current lived experience to upon them, as is consistent with the proposed model.

Interrelated SIDS and SES in Finland

To examine SIDS in relation to SES, we can examine Finland, which is lauded as one of the best countries in the world for maternal and infant health. Their infant mortality rates, once very similar to that of the U.S., are now one of the world's lowest (CDC, 2009). One very interesting initiative undertaken by the Finnish government is claimed to be a reason behind their success. Beginning in 1938, the government set aside money to provide mothers with 'baby boxes', which are literally carboard boxes filled with supplies like clothes, bath products, diapers, and a small mattress. These were at first available only to low-income families, but one decade later, became available to all. The requirements to obtain the supplies were minimal: visit a doctor or any pre-natal clinic before their 4th month of pregnancy (Lee, 2013). This was a clever way to ensure many mothers-to-be would begin prenatal appointments during their first trimester. Additionally, it got the mothers into the system, so follow-up appointments later in the pregnancy and after birth could be monitored. There was also the option for mothers to refuse the box and opt for a cash grant, but the initial visit to a health care provider was still required to qualify. The inclusion of a small, firm mattress also provided parents with a potential first bed

for their baby. By fitting the mattress into the box, parents can keep their baby close while sleeping, knowing they will not accidentally injure them. Recently, some hospitals in the United Kingdom have replicated this program. This was received with both enthusiasm and skepticism (ibid.). The underlying thought behind the skepticism was simple: there must be more behind the Finnish success story.

This thought was partially correct and partially incorrect. Many other simultaneous factors brought about the drastic improvement in infant mortality rates. For example, municipalities became legally obligated to provide maternity care and early childhood healthcare after the first few years of the baby boxes program. This made the percentage of pregnant women receiving prenatal care jump from 31% all the way to 86% (BBC, 2017). Another additional factor which accompanied the program was the home visiting plan. Since women were in the system after claiming a baby box, post-natal home visits by a nurse or social worker became increasingly common. This provides ample opportunity to ask health-related questions, learn about available resources, and get help if needed.

Another important difference when comparing the case of Finland with the U.S. is the treatment of low-SES mothers in terms of government provisions. For example, U.S. states show a trend of lower household incomes correlating to lower rates of breastfeeding infants (Purtill and Kopf, 2017). This is speculated to be because breastfeeding is extremely time-consuming. For a mother working on per-hour pay, this is time they cannot afford to lose. Furthermore, women are much more likely to breastfeed given maternity leave (Mirkovik et al., 2016). Upon returning to work, most women were found to lower the frequency of breastfeeding and switch to formula feeding (Chuang et al., 2010).

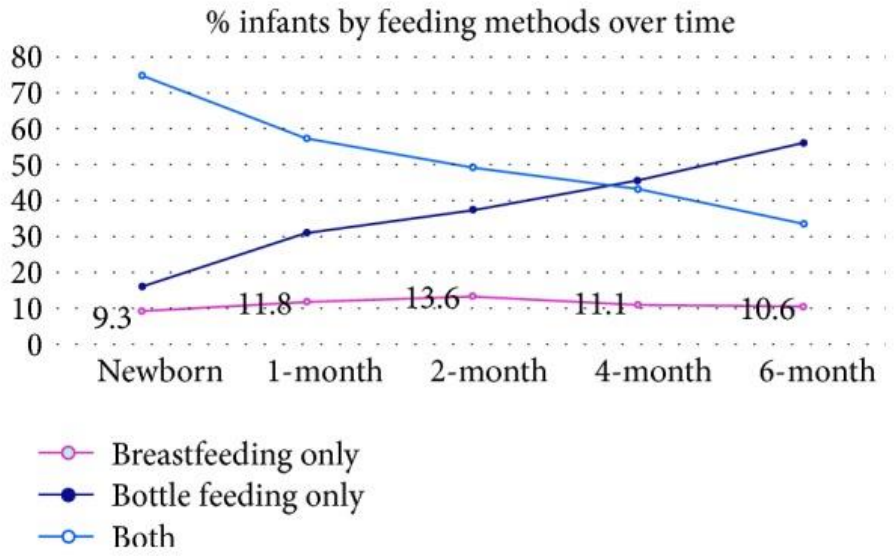
Dismantling "The Hispanic Paradox"

One of the most breastfeeding-adherent populations is Hispanic mothers. Recall that Hispanic infant SIDS rates are only slightly higher than white infant SIDS rates. This has come to be informally known as "the Hispanic paradox." Despite having high rates of being uninsured and high rates of poverty, SIDS deaths among Hispanics living in the U.S. remain lower than other ethnic groups with similar incomes. The numbers for Hispanic SIDS cases more closely resemble those of whites than African American or Indigenous American. This puts the idea of SES being the sole determinant of SIDS to rest, but also results in scapegoating of racial groups with higher SIDS rates. For example, researchers have searched for potential answers in parental behaviors; they found that Hispanic mothers tend to breastfeed their babies and lay their babies supine. Some arguments also used biology, claiming that Hispanic women's comparatively low rates of hypertension indicate low levels of maternal stress and satisfaction with their quality of life, especially post-immigration. But none of these hypotheses address every aspect of the paradox.

In a study of Mexican immigrants, infants with U.S.-born mothers had a greater risk of SIDS than those with mothers born in Mexico, despite controlling for maternal age, birthweight, maternal education, use of prenatal care, SES, and maternal education (Parks et al., 2017). The result of this study led to some dissonant interpretations, such as the speculation of behavioral factors being more important than biological factors in determining SIDS risk. This does have some support: Within the low-SES bracket, Hispanic mothers are most likely to initiate breastfeeding at a rate of 80% (McDowell et al., 2008). However, the biological component cannot be dismissed. In assessments of newborn health, Hispanic infants did not fare as well as white infants (Profit et al., 2017). Additionally, research to prove maternal stress variance by

race has had mixed results, and no definitive answer has been reached (Dominguez, 2008). Moreover, the idea that quality of life is guaranteed to improve post-immigration is not backed by studies. The decision to immigrate from Mexico is mediated by both "pull factors" as well as "push factors," meaning this choice may not always feel like a choice (Garip, 2010). Furthermore, immigration from Mexico is dangerous and costly, and some research suggests that trauma from the journey has epigenetic traces.

A more likely explanation can be found simply, in the fact that once Hispanic women come to the U.S., they find it more difficult to breastfeed[12]. This can be seen through retention of the practice: Although they are the most likely ethnic group to initiate breastfeeding, it is quickly replaced by bottle-feeding over a few months (Sloand et al., 2016). Recall that the critical window for most SIDS cases falls between 2 and 4 months, at which point, breastfeeding and bottle-feeding rates resemble one another.



[12] This is consistent with the internalization of neoliberalism as explained by Carney in "The Unending Hunger."

Fig. 9: Trends of bottle feeding and breastfeeding over time in a cohort of 2nd generation Mexican immigrants in the U.S. (McKinney and Hahn-Holbrook, 2016)

The Role of Governmental Provisions: Comparative Populations

Government provisions for expecting mothers likely contributes to lowering SIDS rates. Given a comparable high rate of SIDS, particularly among members of the First Nations, Canada can be used as a comparative case. While the U.S. does offer options like Medicaid, Canada has provided universal health insurance since 1957 (Government of Canada, 2021). This means that Canadian citizens and permanent residents do not have to pay out-of-pocket for most healthcare services; it is covered through taxes. Additionally, all emergency medical services are free. The only cases which may require private insurance are for dental care, physiotherapy, certain prescription medications, and prescription eyeglasses (ibid.). Medication coverage depends on the province.

Health care coverage in the U.S. is starkly different, being provided by separate legal entities in the private sector, and therefore not guaranteeing that every citizen has insurance. Even in the case of the Indian Health Service (IHS), which provides free healthcare to tribe-associated Indigenous Americans, there is no case of guaranteed coverage for expenses. Although the IHS's presence on reservations and underserved areas is tremendously helpful, it does not cover all health expenses and is not a substitute for health insurance, according to their website. Additionally, infrastructure of IHS buildings are often neglected by the government due to limited yearly budgets. This financial strain means the IHS cannot provide coverage for outside services (private hospital bills, for example, must be petitioned and are often rejected)

and is itself limited in what it can afford to offer. The IHS budget provides approximately half of what is needed, making enrollment in health insurance even more imperative.

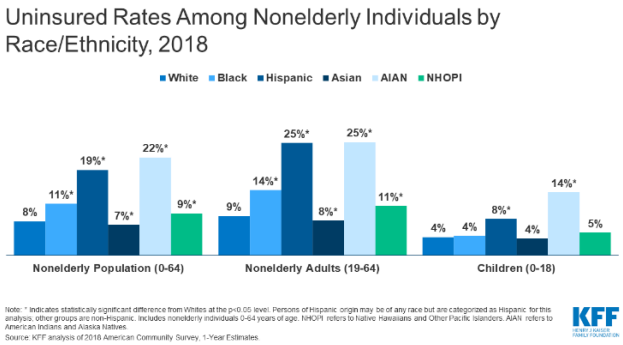


Fig. 10: Uninsured populations by age and race in the U.S. (Kaiser Family Foundation, 2018)

The subsequent question, then, is whether having universal healthcare is worth it in terms of improving health disparities. Canadian health officials often claim that their insurance makes certain that lower SES groups receive the same care that higher SES groups do, thus making their citizens more equal. No one can buy their way to better health. In regards to SIDS, it seems they may have a point. Although First Nations (including Inuit) populations still lead the country's SIDS cases by a wide margin, the rate of decline in overall SIDS deaths is impressive. Between 2000 and 2013, SIDS rates dropped dramatically (Fig 11). Comparing this with the U.S. in the same time frame (note that the figure starts much earlier), the drop is not so sharp, showing a slower descent and almost stagnating in recent years.[13] Notice that the rate of approximately 45

[13] When considering these graphs, it is also important to note the inclusion of "Unknown Cause of Death" on the U.S. side. By definition, SIDS is a death without known cause, implying that some cases are hidden in this separate category. Canada is also trying this tactic: In 2018, they announced coroners would no longer use SIDS as a category, instead opting to say "Unknown/

per 100,000 in the U.S as of 2013 corresponds to 11.3 SIDS cases per 100,000 live births in Canada.

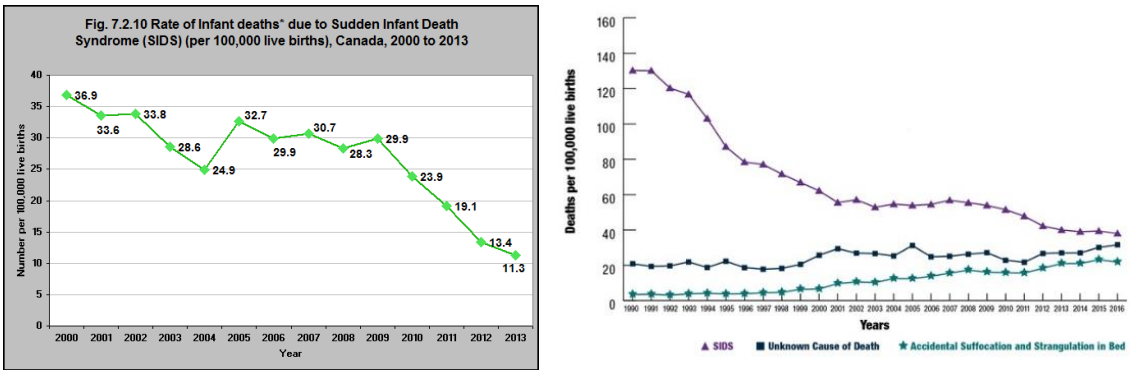


Fig. 11 (Left) Decline of SIDS in Canada (2000-2013) (Canada's Children, 2021) (Right) Decline of SIDS, and increasing rates of Unknowns in the U.S. (NIH, 2017)

The decline of SIDS rates has frequently been tied to smoking cessation. Since smoke and nicotine exposure are risk factors, it is worth investigating the reasons for maternal smoking. Prevalence of maternal smoking during pregnancy is fairly low, but shows the highest rates within populations of Alaskan Inuit (36.3%), Indigenous Americans (20.6%), followed by whites and then African Americans (Tong et al., 2009). The development of smoking's prevalence among the aforementioned minority populations can be partially explained by its ties to boarding school and past trauma. Smokers report being neglected and physically abused in childhood and adolescence. Indigenous American smokers also note that there are fewer feasible ways to quit available to them. These factors make them more likely to smoke during pregnancy and have others who smoke in the house with an infant (Hodge and Nandy, 2011). This illustrates the intergenerational and pervasive nature of historical trauma inheritance.

Undetermined" when assigning cause of death as a manner of 'innocuously' manipulating national data.

SES and Health Revisited

Recall that my model unites historical trauma with ongoing difficulty in accessing social determinants of health, which compound to maintain epigenetic modifications. For Indigenous Americans, systemic barriers to healthcare services are undeniable. Involved in this are issues such as the lack of infrastructure (see Fig 12), underfunding of the IHS, food insecurity, and lack of private health insurance. The historical trauma of Indigenous Americans has left the population with higher rates of mental health problems, sexual and interpersonal violence, and substance abuse.[14] With all these factors contributing detrimentally to the social determination of health, it is also important to note that 41% of Indigenous American women cite cost as a barrier to healthcare, and are, by extension, 3-4 times more likely to delay prenatal care until the final trimester (National Partnership for Maternal Health, 2019). As it was in the case of African American women, Indigenous American women are more likely to receive lower quality care. Additionally, there is a comparative dearth of research on Indigenous Americans, as well as cultural understandings of parental practices.

[14] This, however, is not caused by genetic susceptibility. The misconception is explained well here: https://www.theverge.com/2015/10/2/9428659/firewater-racist-myth-alcoholism-native-americans

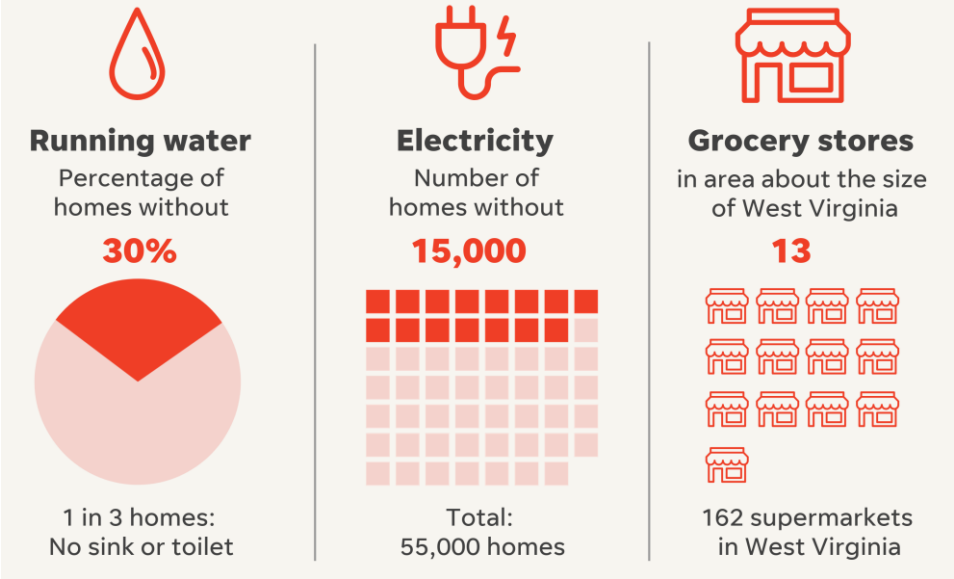


Fig. 12: Statistics of reservation resource access (Partnership of Navajo Water Project, American Public Power Association, and Partners In Health)

Low SES, which includes 26% of all Indigenous Americans, often leads to a higher likelihood of food insecurity, less time to sleep (due to irregular hours, multiple jobs,[15] and longer commute times), and a diminished ability to obtain medicine or treatment for mental health stemming from issues with payment (Dinges and Basner, 2014). These are all directly related to SDHs mentioned in Chapter 2. Researchers have proposed that babies who learn disrupted sleep patterns are at higher risk for SIDS. Several associative studies provide support for this idea. For example, infant night waking is correlated to maternal depression (Goldberg et al., 2013). One symptom of clinical depression is trouble with sleep. Low income is also correlated with trouble sleeping, both of which can reinforce preexisting mental health trouble

[15] In America, approximately 50 million people work multiple jobs. This population is 61 percent more likely to sleep less than 6 hours on a weeknight. Individuals who work multiple jobs also tend to have disrupted circadian rhythms, as a result of being expected to work longer and later at night: for more information, see https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4926781/ .

(Cushner, 2021). Here, we can once again see the interplay of parents' health and income affecting children's health indirectly. The SDHs like employment and environment compound parental stress, which is unconsciously learned by children, making it difficult for epigenetic programming to reverse. If the outside environment does not stop signaling the need for an epigenetic modification, it is retained. In this way, health risks like SIDS may be passed down more consistently in low-SES environments.

Another potential example of low-SES compounding the effects of epigenetic transmission of historical trauma is through the all-important SDH: Access to food. Food insecurity affects 15% of all U.S. households as of ten years ago, and lower income tends to reduce the likelihood of a high-quality diet (USDA, 2017). The way commodity crops are compensated ensures that fatty, sugary, grain-based foods are the cheapest option. Fresh fruit or a bag of frozen vegetables cost more than as 3 gas-station hot dogs and large soda. Additionally, access to supermarkets is largely dictated by neighborhood (Food Research and Action Center, 5). Programs like SNAP provide benefits, but the amount does not cover the cost of meals in 99% of U.S. counties (Nestle, 2018), nor does it cover vitamins, which could provide much-needed nutritional supplements. Poor nutrition has multiple pathways affecting the health of a growing body. Considering my model, poor nutrition may maintain epigenetic modifications which then create what the Triple Risk Model calls a "vulnerable infant." Food insecurity is also directly implicated in increasing SIDS cases through gestational diabetes, which is more common among women of lower-SES (Mayo Clinic, 2015). It is mildly associated with SIDS risk and affects women of color much more often than white women (Bell and Tenant, 2013).

Social determinants of health, therefore, do not tell a full story without the epigenetic trauma variances by race. Even when comparing a group of mothers with extremely different

profiles of prenatal care, diabetes, mental health background, and smoking, racial trends are still apparent (Thomas et al., 2014). Furthermore, we know that social mobility has varying effects by race: among women growing up in low-SES environments, upward social mobility was associated with improved birth outcomes (measured by birthweight and length of gestation) for white women, but the same did not apply for African American women (Geronimus, 2006).

This chapter has reviewed factors associated with SIDS and their relationship to lower SES, connecting them with potential SDHs that could exacerbate epigenetic traces of historical trauma. The connection between SIDS and SES has been well-documented, but has been given too much credit as an independent rather than "stacking" factor, as we have seen in the interplay of SDHs, leading to elevated SIDS rates. My hope is that SES and race be considered as additive factors as opposed to two entities which need to be teased apart. This would also do its part in acknowledging the embodiment of trauma which racial groups in the U.S. experience. Doing so would set the stage for potentially life-saving changes to lower SIDS rates.

Conclusion: Implications

SDHs and their constant interplay with low-SES seems a logical place to start when laying out future steps to prevent SIDS. As we have seen, SDHs are difficult to access when structural racism is embedded in routes of access to them. Thus, several initiatives which could lower SIDS rates and generally improve child health would have to come from the Congressional level. Paid maternity leave, enhanced funding for SNAP and WIC (specific food stamp bonuses for women with infants and children) and improvements to infrastructure in low-SES neighborhoods and IHS clinics all address multiple SDHs. Many studies note the role that WIC-associated clinics could play in advocating sleep positioning for infants, enrollment options in SNAP, and vaccination (Blakeney et al., 2019), all of which are protective factors for SIDS but also show some patterns with lower-SES. WIC as a program also provides nutrition assessments and counseling, supplemental food, breastfeeding support, referrals to social services, and connections to Medicaid. Prenatal WIC participation has been shown to lower African American infant mortality rate (data was not specified to SIDS) and close the racial gap in those rates (McGinnis, 2002).

Commercial enterprises including grocery stores and athletic facilities have long avoided highly segregated urban areas as a consequence of redlining. On average, ZIP codes with a more diverse racial makeup pay more for housing, food, and insurance (Williams and Collins, 2011). Additionally, they receive more targeted advertising from tobacco and alcohol industries (ibid.). As we have seen, trauma and substance use exist in a pernicious cycle. While companies will not stop pushing their products, there are still options to help stop the cycle. Places of employment offering smoking cessation programs have found increased success when the programs are part of mandatory training to reduce job-related health issues (Williams et al., 2010). Another

potential for improving health in segregated areas is to connect communities with their local WIC or, when applicable, IHS centers.

The importance of having IHS clinics is undeniable, and more should be done to support their work. Money should be allocated to renovating IHS infrastructure to the point where they compare to an average urban hospital. Several IHS hospitals are in a state of disrepair because they were never overhauled after their original construction. Unlike the $8 million from the Coronavirus Aid, Relief, and Economic Security Act of March 2020, this money for reconstruction should not have an expiration date or Congress-mandated recipient. Communities know their areas of need best. Additional money could also be used to improve access to behavioral health services. As we have seen, these services would address historical trauma and hold the potential to stop or levee intergenerational transmission.

Fig. 13: All IHS health centers and hospitals (left) compared to IHS centers offering counseling, psychiatric services, and substance abuse recovery facilities (right) (Indian Health Services, 2021)

As awareness of historical trauma grows, communities are taking steps towards healing, and clinicians want to facilitate this. It is important to improve the efficacy of care received by Indigenous Americans, especially for mental health and substance abuse issues (Myhra, 2011). One major finding from interviews with Indigenous Americans undergoing treatment for

substance abuse was the importance of traditional healing during their treatment.[16] The definition of traditional healing is a dynamic one, since practices vary by tribe, but the overall goals are to find harmony between oneself, people around you, and the environment. It must involve a spiritual aspect because spirituality is considered an integral tenet of holistic health. Especially in trauma therapy, the spiritual root must be addressed for effective healing to occur. One understanding of trauma that appeared in several readings was soul wounding, in which a person experiencing trauma has endured so much pain that it fragmented their soul, and to feel whole again, a healer must help them retrieve the part/s of their soul which have been lost over time (Duran, 2006). Additional values of traditional healing include social connection, creating safe spaces, and reconnecting to as well as reclaiming one's culture (McCabe, 2008).

The Lakota have an established process of healing we can examine as an example. To walk the Red Road means following their Creator's seven sacred values in order to walk a good path in life after issues with substance abuse or interpersonal trauma (Myhra, 2011). The seven values are prayer, honesty, humility, compassion, respect, generosity, and wisdom. Guided by a traditional healer, this practice provides a holistic way to enhance mental and spiritual wellness. Some scholars also vouch for the importance of reconnecting with cultural practices. Luther Standingbear, upon returning from boarding school, began a journey to reintegrate with his home culture, noting that dancing "is his way of expressing devotion, of communing with unseen power, and in keeping his tribal identity (Standingbear, 1997)."

---

[16] It is important to use the term traditional healing. One scholar explains: "by naming traditional methods as an "alternative" form of "fixing" an individual, rather than viewing these practices as personal and collective traditions that bring wholeness and healing into the mind, body, environment, and spirit, Western culture again fails to acknowledge American Indian perspectives and Indigenous Worldview (from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3327107/)"

With the rise of cultural exchange through social media, becoming reconnected with one's culture is an achievable goal. Supporting the education of people of color, providing training and education about diversity, and showing respect for different cultures are all things that social media has expedited. Acknowledging Indigenous land, renouncing racial slurs and cultural appropriation, and empathizing with people of color as they come to terms with their double consciousness are also becoming more common, and are in and of themselves acts of healing to minorities. Strong communities act as a safety net, allowing exchange of resources and support.

Even simple education on historical trauma and epigenetics could dramatically change how trauma is viewed, both interpersonally and intrapersonally. Consider this excerpt from an interview with a leading scholar in epigenetics, when asked what is most helpful to her therapy focus group participants:

"Just the information. There was one time, in one of the Holocaust groups, one of the women was talking about something stressful that had happened at work. It was in a group psychotherapy, and it was a terrible story. But then she stopped, and she said, "And then I remembered that Dr. Yehuda said I have poor shock absorbers, and I should just let it pass, [laughs] because my biology is going to have extreme responses before it calms down. And then I did, and it really worked." (Yehuda, 2017)

This sentiment is echoed in the Black Lives Matter movement; when asked what she would want to tell critics of the movement's protests, one racial trauma therapist said:

"I wish they understood the impact of post-traumatic slave syndrome and how it has been passed down generationally. I wish they understood epigenetics and intergenerational trauma. I wish they understood our pain." (McGirt, 2020)

What might the role of healthcare providers be in this web of overlapping traumas and health conditions imposed by structural racism? Medical care is a relatively small contributor to overall health status (Williams et al., 2010), since most conditions begin with SDHs, but there are two goals I believe would improve the care received. First, we need to properly educate new healthcare workers and stop the chain of misinformation. The state of misinformation in the U.S. can be described with this study: A sample of white medical students and residents were asked to read a list of misconceptions about African Americans' bodies. Half of the participants endorsed those false beliefs (statements claiming African Americans have thicker skin, a higher pain tolerance, etc.). When the group was divided and provided with "cases" to treat, half receiving white names and the other half black names, participants responded the more severe injuries, which were designed to belong to black patients, with the same level of treatment white patients with less severe injuries (Hoffman et al., 2016).

As a further example, we can examine a research study which sought to control all SIDS risk factors which were tied to lower SES to discover whether the association of SIDS rates and race were only due to differences in SES. When all the factors were statistically controlled for, the influence of race "disappeared, suggesting that elevated SIDS rates among blacks… is due to the higher incidence of the measured risk factors (Principe, 1997)." These risk factors included variables mentioned in this chapter: maternal age, education, smoking status, insurance status, and birthweight. It also included an Apgar score, which is an assessment of a newborn's muscle

tone, pulse, reflexes, skin appearance, and respiration. It is known, however, that African American babies tend to be ranked lower on the Apgar scale when compared with their white counterparts. The meaning of this is twofold: Infant health is, as advocated by epigenetic ideas of embodiment theory, different at birth, and this study factored out the inheritance of trauma when determining whether race matters in SIDS rates. Although the study acknowledged the difference in Apgar scores, it is likely that ideas on epigenetics were not advanced enough at the time to explain how infant health could vary at birth. With growing knowledge in the field, however, young professionals must be well-educated on how race has fueled misconceptions in their field.

This leads to the second goal for healthcare providers which I believe to be feasible and necessary: the adoption of narrative medicine into practice. Narrative medicine bridges the divide which separates healthcare providers and their patients (Charon, 2001). By recognizing patients' journeys through their medical care, providers may better see the obstacles and be able to provide creative solutions. In the case of historical trauma and structural racism blocking access to SDHs many take for granted, it is incumbent upon providers to meet their patient where they are. As the U.S. continues its attempts to find cost-effective healthcare options, keeping the focus of care centered on patients can improve patient outcomes (ibid.). This is important because money saved through accurate and efficient care would benefit low-SES patients and potentially create avenues for the government to make care more affordable to them.

Better education of healthcare providers and policy changes will pave the way to truly provide equitable care. Besides that, it would also promote the consideration of health as being heavily determined by social factors, which would reduce the amount of behavior-blaming on parents and would start the U.S. on a path to making amends for traumas inflicted in the past. The model I proposed scaffolds epigenetic embodiment of trauma with the impact of structural

racism upon health. To improve the health of those in highest risk categories for SIDS, it is incumbent upon us to improve their current and future circumstances.

I believe that change is possible, and with it, a reduction in SIDS rates. History has shown that economic gains and better access to medical care accompanying the Civil Rights Movement in the 1960s reduced the number of low birthweight infants born between 1967-69 when compared to 1961-63 (Williams et al., 2010). We are once again at a crucial moment in racial history. One of the founders of the Black Lives Matter movement explains it plainly:

"I remember the anger I felt in my young adult life at the first institutional response being punitive and defaulting to criminalization. There was nothing restorative in place for anyone. The system punished and left more disaster in its wake." (Cullors, 2019)

Her message is frighteningly resemblant to this poem from almost 80 years ago:

"Looky here, America
What you done done---
Let things drift
Until the riots come.

Now your policemen
Let your mobs run free.
I reckon you don't care
Nothing about me."
(Hughes, 1943)

From the framework I proposed to examine SIDS, we know that prevention starts by stopping future traumas from occurring. What we have discussed, in terms of prevention, has been specific to the U.S., but recall that SIDS data is often difficult to parse due to the narrow definition, behavior-blaming, and potential overlapping health conditions. We may see more data from other parts of the world in years to come, especially from places having undergone long periods of turmoil. As for the U.S., shootings and family separation are parts of a punitive system which only worsen the racial trauma faced by minorities today, which stacks onto epigenetic traces of intergenerational trauma, further preserving the embodiment of trauma. Additionally, ignoring the underlying issues preventing better access to social determinants of health only contributes to making marginalized groups even more invisible in the eyes of the world. SIDS deaths, in a metaphorical sense, are just symptoms we see on the surface of a weakened America. To prevent SIDS two and three generations from now, we must take up the mantle to both heal the nation as well as advocate for safety and well-being for future generations.

"If you care about something enough, it's going to make you cry.
But you have to use it. Use your tears. Use your pain. Use your fear. Get mad."
-Sherman Alexie

References

Adkins, Ronald M., et al. “Racial Differences in Gene-Specific DNA Methylation Levels Are Present at Birth.” *Birth Defects Research. Part A, Clinical and Molecular Teratology*, vol. 91, no. 8, Aug. 2011, pp. 728–36. *PubMed Central*, doi:10.1002/bdra.20770.

Adler, Shelley R. “Refugee Stress and Folk Belief: Hmong Sudden Deaths.” *Social Science & Medicine*, vol. 40, no. 12, June 1995, pp. 1623–29. *DOI.org (Crossref)*, doi:10.1016/0277-9536(94)00347-V.

“American Indian and Alaska Native Women’s Maternal Health: Addressing the Crisis.” *National Partnership for Women and Families*, 2019, http://www.nationalpartnership.org/our-work/resources/.

Baccarelli, A., and V. Bollati. “Epigenetics and Environmental Chemicals.” *Current Opinion in Pediatrics*, vol. 21, no. 2, Apr. 2009, pp. 243–51.

Barnes, Helen Moewaka, and Tim McCreanor. “Colonisation, Hauora and Whenua in Aotearoa.” *Journal of the Royal Society of New Zealand*, vol. 49, no. sup1, Nov. 2019, pp. 19–33. *Taylor and Francis+NEJM*, doi:10.1080/03036758.2019.1668439.

Barker, Tammy R., "The Psychological Impact of Historical Trauma On the Native American People" (2013). All Regis University Theses. 218. https://epublications.regis.edu/theses/218

Bartick, Melissa, and Cecília Tomori. “Sudden Infant Death and Social Justice: A Syndemics Approach.” *Maternal & Child Nutrition*, vol. 15, no. 1, 2019, p. e12652. *Wiley Online Library*, doi:https://doi.org/10.1111/mcn.12652.

Basner, Mathias, et al. “Sociodemographic Characteristics and Waking Activities and Their Role in the Timing and Duration of Sleep.” *Sleep*, vol. 37, no. 12, Dec. 2014, pp. 1889–906. *PubMed*, doi:10.5665/sleep.4238.

Beaulieu-Banks, Renee; Sundeen, Kim; and Christopherson, Kyra. (2018). American Indian Perspectives on Healing from Historical Trauma: An Indigenous Inquiry. Retrieved from Sophia, the St. Catherine University repository website: https://sophia.stkate.edu/ma_hhs/19

Bell and Tennant. “Pre-Existing Diabetes in Pregnancy Increases Risk of Fetal, Infant Death.” ScienceDaily, https://www.sciencedaily.com/releases/2013/11/131127225447.htm. Accessed 24 Mar. 2021.

Blair, P. S., et al. “Smoking and the Sudden Infant Death Syndrome: Results from 1993-5 Case-Control Study for Confidential Inquiry into Stillbirths and Deaths in Infancy. Confidential Enquiry into Stillbirths and Deaths Regional Coordinators and Researchers.” *BMJ (Clinical Research Ed.)*, vol. 313, no. 7051, July 1996, pp. 195–98. *PubMed*, doi:10.1136/bmj.313.7051.195.

Blair, Peter S., et al. “Bed-Sharing in the Absence of Hazardous Circumstances: Is There a Risk of Sudden Infant Death Syndrome? An Analysis from Two Case-Control Studies Conducted in the UK.” *PLOS ONE*, vol. 9, no. 9, Sept. 2014, p. e107799. *PLoS Journals*, doi:10.1371/journal.pone.0107799.

Blakeney, Erin L., et al. “Social Determinants of Health and Disparities in Prenatal Care Utilization during the Great Recession Period 2005-2010.” *BMC Pregnancy and Childbirth*, vol. 19, no. 1, Oct. 2019, p. 390. *BioMed Central*, doi:10.1186/s12884-019-2486-1.

Blayton, Oscar. If Education Is the Answer, Why Do Black Women with College Degrees Have Higher Maternal and Infant Mortality Rates than White Women Who Dropped out of High School? | The Crusader Newspaper Group.

Boyce, Richard, et al. “REM Sleep and Memory.” *Current Opinion in Neurobiology*, vol. 44, June 2017, pp. 167–77. *ScienceDirect*, doi:10.1016/j.conb.2017.05.001.

Brave Heart, Maria Yellow Horse, et al. “Historical Trauma Among Indigenous Peoples of the Americas: Concepts, Research, and Clinical Considerations.” *Journal of Psychoactive Drugs*, vol. 43, no. 4, Oct. 2011, pp. 282–90. *DOI.org (Crossref)*, doi:10.1080/02791072.2011.628913.

Caiola, Samantha. “Black Babies Die in Sleep at Higher Rates in Sacramento. Why? And Can We Fix It?” *Center for Health Journalism*, https://centerforhealthjournalism.org/fellowships/projects/black-babies-die-sleep-higher-rates-sacramento-why-and-can-we-fix-it. Accessed 24 Mar. 2021.

Carpenter, R. G., et al. “Sudden Unexplained Infant Death in 20 Regions in Europe: Case Control Study.” *Lancet (London, England)*, vol. 363, no. 9404, Jan. 2004, pp. 185–91. *PubMed*, doi:10.1016/s0140-6736(03)15323-8.

CDC. “Safe Sleep for Babies.” *Centers for Disease Control and Prevention*, 27 Nov. 2018, https://www.cdc.gov/vitalsigns/safesleep/index.html.

Charon R. Narrative Medicine: A Model for Empathy, Reflection, Profession, and Trust. JAMA. 2001;286(15):1897–1902. doi:10.1001/jama.286.15.1897

Chitrala, Kumaraswamy Naidu, et al. “Race-Specific Alterations in DNA Methylation among Middle-Aged African Americans and Whites with Metabolic Syndrome.” *Epigenetics*, vol. 15, no. 5, May 2020, pp. 462–82. *PubMed*, doi:10.1080/15592294.2019.1695340.

Chong, Angeline, et al. “Effect of Prone Sleeping on Circulatory Control in Infants.” *Archives of Disease in Childhood*, vol. 82, no. 3, Mar. 2000, pp. 253–56. *adc.bmj.com*, doi:10.1136/adc.82.3.253.

Collins, J. W., et al. “Adequacy of Prenatal Care Utilization, Maternal Ethnicity, and Infant Birthweight in Chicago.” *Journal of the National Medical Association*, vol. 89, no. 3, Mar. 1997, pp. 198–203.

“Colonization.” *Facing History and Ourselves*, https://www.facinghistory.org/stolen-lives-indigenous-peoples-canada-and-indian-residential-schools/historical-background/colonization. Accessed 24 Mar. 2021.

Cornwell, A. C., et al. “SIDS, Abnormal Nighttime REM Sleep and CNS Immaturity.” *Neuropediatrics*, vol. 29, no. 2, Apr. 1998, pp. 72–79. *PubMed*, doi:10.1055/s-2007-973539.

Cornwell AC, Feigenbaum P. Sleep biological rhythms in normal infants and those at high risk for SIDS. Chronobiol Int. 2006;23(5):935-61. doi: 10.1080/07420520600921070. PMID: 17050210.

Craddock, T. “INTERGENERATIONAL TRAUMA IN AFRICAN AND NATIVE AMERICAN LITERATURES.” 2014.

Curry. Jul. 18, rew, et al. “Parents’ Emotional Trauma May Change Their Children’s Biology. Studies in Mice Show How.” *Science | AAAS*, 18 July 2019, https://www.sciencemag.org/news/2019/07/parents-emotional-trauma-may-change-their-children-s-biology-studies-mice-show-how.

Cushner. “The Sleep Gap in America: How Wealth and Race Affect Sleep.” Tuck Sleep, https://www.tuck.com/the-inequality-of-sleep/. 2013.

Data and Statistics for SIDS and SUID | *CDC*. 10 Nov. 2020, https://www.cdc.gov/sids/data.htm.

Dennis, Jeff A. “Birth Weight and Maternal Age among American Indian/Alaska Native Mothers: A Test of the Weathering Hypothesis.” *SSM - Population Health*, vol. 7, Oct. 2018. *PubMed Central*, doi:10.1016/j.ssmph.2018.10.004.

Digital History. https://www.digitalhistory.uh.edu/disp_textbook.cfm?smtid=2&psid=3047. Accessed 24 Mar. 2021.

“Do Baby Boxes Really Save Lives?” *BBC News*, 25 Mar. 2017. *www.bbc.com*, https://www.bbc.com/news/magazine-39366596.

Dominguez, Tyan Parker, et al. “Racial Differences in Birth Outcomes: The Role of General, Pregnancy, and Racism Stress.” *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, vol. 27, no. 2, Mar. 2008, pp. 194–203. *PubMed*, doi:10.1037/0278-6133.27.2.194.

Duncan, Jhodie R., and Roger W. Byard. “Sudden Infant Death Syndrome: An Overview.” *SIDS Sudden Infant and Early Childhood Death: The Past, the Present and the Future*, edited by Jhodie R. Duncan and Roger W. Byard, University of Adelaide Press, 2018. *PubMed*, http://www.ncbi.nlm.nih.gov/books/NBK513399/.

Duran, Eduardo, et al. “Healing the American Indian Soul Wound.” *International Handbook of Multigenerational Legacies of Trauma*, edited by Yael Danieli, Springer US, 1998, pp. 341–54. *DOI.org (Crossref)*, doi:10.1007/978-1-4757-5567-1_22.

Duran, Eduardo & Duran, Bonnie & Brave Heart, Maria & Horse-Davis, Susan. (1998). Healing the American Indian Soul Wound. 10.1007/978-1-4757-5567-1_22.Dutil, Caroline, et al. “Influence of Sleep on Developing Brain Functions and Structures in Children and Adolescents: A Systematic Review.” *Sleep Medicine Reviews*, vol. 42, Dec. 2018, pp. 184–201. *ScienceDirect*, doi:10.1016/j.smrv.2018.08.003.

Dwivedi, Shailendra, et al. “Tobacco Exposure by Various Modes May Alter Proinflammatory (IL-12) and Anti-Inflammatory (IL-10) Levels and Affects the Survival of Prostate Carcinoma Patients: An Explorative Study in North Indian Population.” *BioMed Research International*, vol. 2014, 2014. *PubMed Central*, doi:10.1155/2014/158530.

Ekblad, Mikael, et al. “Smoking during Pregnancy Affects Foetal Brain Development.” *Acta Paediatrica (Oslo, Norway: 1992)*, vol. 104, no. 1, Jan. 2015, pp. 12–18. *PubMed*, doi:10.1111/apa.12791.

Ellison, Ralph. “Invisible Man.” 2nd Vintage International ed. New York: Vintage International, 1995.

Farnell, Gregory S., et al. “The Influence of Ethnicity on Thermoregulation After Acute Cold Exposure.” *Wilderness & Environmental Medicine*, vol. 19, no. 4, Dec. 2008, pp. 238–44. *www.wemjournal.org*, doi:10.1580/07-WEME-OR-138.1.

Filiano, James J., and Hannah C. Kinney. “A Perspective on Neuropathologic Findings in Victims of the Sudden Infant Death Syndrome: The Triple-Risk Model.” *Neonatology*, vol. 65, no. 3–4, 1994, pp. 194–97. *www.karger.com*, doi:10.1159/000244052.

Flandrin, Jean Louis. Families in Former Times: Kinship, Household, and Sexuality. Cambridge University Press, 1979.

Food Research and Action Center. Replacing the Thrifty Food Plan in Order to Provide Adequate Allotments for SNAP Beneficiaries. 2012.

Gapp, Katharina, et al. “Potential of Environmental Enrichment to Prevent Transgenerational Effects of Paternal Trauma.” *Neuropsychopharmacology*, vol. 41, no. 11, Oct. 2016, pp. 2749–58. *www.nature.com*, doi:10.1038/npp.2016.87.

Garip, Filiz, and Sara Curran. “Increasing Migration, Diverging Communities: Changing Character of Migrant Streams in Rural Thailand.” *Population Research and Policy Review*, vol. 29, no. 5, Oct. 2010, pp. 659–85. *PubMed Central*, doi:10.1007/s11113-009-9165-2.

Garrett, and Pichette. *APA PsycNet*. Red as an apple: Native American acculturation and counseling with or without reservation. Journal of Counseling & Development, 78(1), 3–13. https://psycnet.apa.org/record/2000-13217-001. Accessed 24 Mar. 2021.

Gaspaire, Brent. *Redlining (1937-)* •. 28 Dec. 2012, https://www.blackpast.org/african-american-history/redlining-1937/.

Geronimus, Arline T., et al. "'Weathering' and Age Patterns of Allostatic Load Scores Among Blacks and Whites in the United States." *American Journal of Public Health*, vol. 96, no. 5, May 2006, pp. 826–33. *PubMed Central*, doi:10.2105/AJPH.2004.060749.

Gettler, Lee T., and James J. McKenna. "Evolutionary Perspectives on Mother–Infant Sleep Proximity and Breastfeeding in a Laboratory Setting." *American Journal of Physical Anthropology*, vol. 144, no. 3, Mar. 2011, pp. 454–62. *PubMed Central*, doi:10.1002/ajpa.21426.

---. "Evolutionary Perspectives on Mother–Infant Sleep Proximity and Breastfeeding in a Laboratory Setting." *American Journal of Physical Anthropology*, vol. 144, no. 3, Mar. 2011, pp. 454–62. *PubMed Central*, doi:10.1002/ajpa.21426.

Goldstein, Richard D., et al. "Overall Postneonatal Mortality and Rates of SIDS." *Pediatrics*, vol. 137, no. 1, Jan. 2016, p. e20152298. *DOI.org (Crossref)*, doi:10.1542/peds.2015-2298.

Goodkind, Jessica R., et al. "'We're Still in a Struggle': Diné Resilience, Survival, Historical Trauma, and Healing." *Qualitative Health Research*, vol. 22, no. 8, Aug. 2012, pp. 1019–36. *PubMed Central*, doi:10.1177/1049732312450324.

Government of Canada, Statistics Canada. *Birth Outcomes among First Nations, Inuit and Métis Populations*. 15 Nov. 2017, https://www150.statcan.gc.ca/n1/pub/82-003-x/2017011/article/54886-eng.htm#:~:text=SIDS%20accounted%20for%2024%25%20of,Inuit%20were%20generally%20not%20reportable.

Gudsnuk, Kathryn, and Frances A. Champagne. "Epigenetic Influence of Stress and the Social Environment." *ILAR Journal*, vol. 53, no. 3–4, Dec. 2012, pp. 279–88. *PubMed Central*, doi:10.1093/ilar.53.3-4.279.

Hardyment C. Dream babies: child care from Locke to Spock. London: Jonathan Cape1983. p 15.

"Hmong Timeline." *Minnesota Historical Society*, https://www.mnhs.org/hmong/hmong-timeline. Accessed 24 Mar. 2021.

Hodge, Felicia, and Karabi Nandy. "Factors Associated with American Indian Cigarette Smoking in Rural Settings." *International Journal of Environmental Research and Public Health*, vol. 8, no. 4, Apr. 2011, pp. 944–54. *PubMed Central*, doi:10.3390/ijerph8040944.

Hoffman, Kelly M., et al. "Racial Bias in Pain Assessment and Treatment Recommendations, and False Beliefs about Biological Differences between Blacks and Whites." *Proceedings of the National Academy of Sciences*, vol. 113, no. 16, Apr. 2016, pp. 4296–301. *www.pnas.org*, doi:10.1073/pnas.1516047113.

Horne, Rosemary S. C., et al. "Postnatal Development of Ventilatory and Arousal Responses to Hypoxia in Human Infants." *Respiratory Physiology & Neurobiology*, vol. 149, no. 1–3, Nov. 2005, pp. 257–71. *PubMed*, doi:10.1016/j.resp.2005.03.006.

"How Student Debt and the Racial Wealth Gap Reinforce Each Other." *The Century Foundation*, 9 Sept. 2019, https://tcf.org/content/report/bridging-progressive-policy-debates-student-debt-racial-wealth-gap-reinforce/.

Huelke D. F. (1998). An Overview of Anatomical Considerations of Infants and Children in the Adult World of Automobile Safety Design. Annual Proceedings / Association for the Advancement of Automotive Medicine, 42, 93–113.

Hughes, Langston, Arnold Rampersad, and David E. Roessel. The Collected Poems of Langston Hughes. 1st Vintage classics ed. Vintage Classics. New York: Vintage Books, 1995.

Hunt CE, The cardiorespiratory control hypothesis for sudden infant death syndrome. Clin Perinatol191992757771

Immigration, Refugees and Citizenship Canada. “Understand How Health Care Works in Canada.” *Aem*, 31 May 2009, https://www.canada.ca/en/immigration-refugees-citizenship/services/new-immigrants/new-life-canada/health-care-card.html.

“Johann Friedrich Blumenbach (1753–1840).” *Nature*, vol. 145, no. 3663, Jan. 1940, pp. 63–63. *www.nature.com*, doi:10.1038/145063a0.

Johnson, Michael P. “Smothered Slave Infants: Were Slave Mothers at Fault?” *The Journal of Southern History*, vol. 47, no. 4, 1981, pp. 493–520. *JSTOR*, doi:10.2307/2207400.

Kato, Ineko, et al. “Incomplete Arousal Processes in Infants Who Were Victims of Sudden Death.” *American Journal of Respiratory and Critical Care Medicine*, vol. 168, no. 11, Dec. 2003, pp. 1298–303. *atsjournals.org (Atypon)*, doi:10.1164/rccm.200301-134OC.

---. “Incomplete Arousal Processes in Infants Who Were Victims of Sudden Death.” *American Journal of Respiratory and Critical Care Medicine*, vol. 168, no. 11, Dec. 2003, pp. 1298–303. *atsjournals.org (Atypon)*, doi:10.1164/rccm.200301-134OC.

Kellum BA. Infanticide in England in the later middle ages. Hist Child Q 1974.1:367–388.

Kertes, Darlene A., et al. “Prenatal Maternal Stress Predicts Methylation of Genes Regulating the Hypothalamic-Pituitary-Adrenocortical System in Mothers and Newborns in the Democratic Republic of Congo.” *Child Development*, vol. 87, no. 1, Jan. 2016, pp. 61–72. *PubMed Central*, doi:10.1111/cdev.12487.

Kopf, Corinne Purtill, Dan. “The Class Dynamics of Breastfeeding in the United States of America.” *Quartz*, https://qz.com/1034016/the-class-dynamics-of-breastfeeding-in-the-united-states-of-america/. Accessed 24 Mar. 2021.

Krieger, Nancy. “Stormy Weather: Race, Gene Expression, and the Science of Health Disparities.” *American Journal of Public Health*, vol. 95, no. 12, Dec. 2005, pp. 2155–60. *PubMed Central*, doi:10.2105/AJPH.2005.067108.

Leary, Joy DeGruy, and Randall Robinson. *Post Traumatic Slave Syndrome: America’s Legacy of Enduring Injury and Healing*. Joy DeGruy Publications, 2005.

Lock, Margaret. Comprehending the Body in the Era of the Epigenome. Current Anthropology 2015 56:2, 151-177.

Love, Catherine, et al. “Exploring Weathering: Effects of Lifelong Economic Environment and Maternal Age on Low Birth Weight, Small for Gestational Age, and Preterm Birth in African-American and White Women.” *American Journal of Epidemiology*, vol. 172, no. 2, July 2010, pp. 127–34. *Silverchair*, doi:10.1093/aje/kwq109.

Lund, Crick, et al. “Social Determinants of Mental Disorders and the Sustainable Development Goals: A Systematic Review of Reviews.” *The Lancet Psychiatry*, vol. 5, no. 4, Apr. 2018, pp. 357–69. *www.thelancet.com*, doi:10.1016/S2215-0366(18)30060-9.

Annamma Mathew, Mala. “The Manifestation of Slave Trauma in Lyrics: A Reading of Select Slave Songs.” International Journal of Comparative Literature and Translation Studies, vol. 6, no. 3, July 2018, p. 27. DOI.org (Crossref), doi:10.7575/aiac.ijclts.v.6n.3p.27.

Mathews, T. J., et al. “Infant Mortality Statistics from the 2002 Period: Linked Birth/Infant Death Data Set.” *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, vol. 53, no. 10, Nov. 2004, pp. 1–29.

McCabe, G. (2008). Mind, body, emotions and spirit: Reaching to the ancestors for healing. Counseling Psychology Quarterly, 21(2), 143-152. https//dx.doi.org/10.1080/09515070802066847

McDowell MM, Wang CY, Kennedy-Stephenson J: Breastfeeding in the United States: Findings from the National Health and Nutrition Examination Surveys, 1999-2006. NCHS Data Brief 5:1-8, 2008.

McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy attention to health promotion. Health Aff (Millwood). 2002 Mar-Apr; 21(2):78-93.

McGirt, Ashley. "Dying While Black: Links Between Mental Health, Chronic Stress, & Death." TEDx Programming. April 7, 2020.

McKenna, James J., Sarah S. Mosko, et al. "Bedsharing Promotes Breastfeeding." *Pediatrics*, vol. 100, no. 2, Aug. 1997, pp. 214–19. *pediatrics.aappublications.org*, doi:10.1542/peds.100.2.214.

McKenna, James J., Helen L. Ball, et al. "Mother–Infant Cosleeping, Breastfeeding and Sudden Infant Death Syndrome: What Biological Anthropology Has Discovered about Normal Infant Sleep and Pediatric Sleep Medicine." *American Journal of Physical Anthropology*, vol. 134, no. S45, 2007, pp. 133–61. *Wiley Online Library*, doi:https://doi.org/10.1002/ajpa.20736.

McKinney, C. O., Hahn-Holbrook, J., Chase-Lansdale, P. L., Ramey, S. L., Krohn, J., Reed-Vance, M., Raju, T. N., Shalowitz, M. U., & Community Child Health Research Network (2016). Racial and Ethnic Differences in Breastfeeding. Pediatrics, 138(2), e20152388. https://doi.org/10.1542/peds.2015-2388

Mitchell, E. A., et al. "Four Modifiable and Other Major Risk Factors for Cot Death: The New Zealand Study." *Journal of Paediatrics and Child Health*, vol. 28, no. s1, 1992, pp. S3–8. *Wiley Online Library*, doi:https://doi.org/10.1111/j.1440-1754.1992.tb02729.x.

Morrison, Toni. "The Bluest Eye." 1st Vintage International ed. New York: Vintage International, 2007.

Mosko, Sarah, et al. "Maternal Proximity and Infant CO2 Environment during Bedsharing and Possible Implications for SIDS Research." *American Journal of Physical Anthropology*, vol. 103, no. 3, 1997, pp. 315–28. *Wiley Online Library*, doi:https://doi.org/10.1002/(SICI)1096-8644(199707)103:3<315::AID-AJPA2>3.0.CO;2-P.

Mukhopadhyay, Carol Chapnick, et al. *How Real Is Race? A Sourcebook on Race, Culture, and Biology*. Second edition, AltaMira Press, a division of Rowman & Littlefield, 2014.

Munger, R. G. "Sudden Death in Sleep of Laotian-Hmong Refugees in Thailand: A Case-Control Study." *American Journal of Public Health*, vol. 77, no. 9, Sept. 1987, pp. 1187–90.

Myhra. "'It Runs in the Family': Intergenerational Transmission of Historical Trauma among Urban American Indians and Alaska Natives in Culturally Specific Sobriety Maintenance Programs." *American Indian and Alaska Native Mental Health Research*, vol. 18, no. 2, 2011, pp. 17–40. *DOI.org (Crossref)*, doi:10.5820/aian.1802.2011.17.

Nestle, Marion, and Michael Pollan. Food Politics: How the Food Industry Influences Nutrition and Health. University of California Press, 2013.

Oden R, Joyner BL, Ajao TI, et al: Factors influencing African-American mothers' decisions about sleep position: A qualitative study. J Natl Med Assoc 102:870-880, 2010

Oldenburg, C. E. M., et al. "Ethnic Differences in Rates of Infant Mortality and Sudden Infant Death in Sweden, 1978-1990." The European Journal of Public Health, vol. 7, no. 1, Mar. 1997, pp. 88–94. DOI.org (Crossref), doi:10.1093/eurpub/7.1.88.

"On Epigenetics: We Are Not Just Our DNA." *ECR Community*, 11 Mar. 2016, https://ecrcommunity.plos.org/2016/03/11/on-epigenetics-we-are-not-just-our-dna/.

Opdal, Siri H., and Torleiv O. Rognum. "The Sudden Infant Death Syndrome Gene: Does It Exist?" *Pediatrics*, vol. 114, no. 4, Oct. 2004, pp. e506–12. *pediatrics.aappublications.org*, doi:10.1542/peds.2004-0683.

Opdal SH, Vege A, Stave AK, Rognum TO. The complement component C4 in sudden infant death. Eur J Pediatr.1999;158 :210– 212

Parks, Sharyn E., et al. “Racial and Ethnic Trends in Sudden Unexpected Infant Deaths: United States, 1995–2013.” *Pediatrics*, vol. 139, no. 6, June 2017. *pediatrics.aappublications.org*, doi:10.1542/peds.2016-3844.

Paterson, David S., et al. “Multiple Serotonergic Brainstem Abnormalities in Sudden Infant Death Syndrome.” *JAMA*, vol. 296, no. 17, Nov. 2006, p. 2124. *DOI.org (Crossref)*, doi:10.1001/jama.296.17.2124.

Pickett, Kate E., et al. “Widening Social Inequalities in Risk for Sudden Infant Death Syndrome.” *American Journal of Public Health*, vol. 95, no. 11, Nov. 2005, pp. 1976–81. *PubMed Central*, doi:10.2105/AJPH.2004.059063.

Products - Data Briefs - Number 23 - November 2009. 7 June 2019, https://www.cdc.gov/nchs/products/databriefs/db23.htm.

Profit, Jochen, et al. “Racial/Ethnic Disparity in NICU Quality of Care Delivery.” *Pediatrics*, vol. 140, no. 3, Sept. 2017. *pediatrics.aappublications.org*, doi:10.1542/peds.2017-0918.

---. “Racial/Ethnic Disparity in NICU Quality of Care Delivery.” *Pediatrics*, vol. 140, no. 3, Sept. 2017. *pediatrics.aappublications.org*, doi:10.1542/peds.2017-0918.

“Rachel Yehuda — How Trauma and Resilience Cross Generations.” *The On Being Project*, https://onbeing.org/programs/rachel-yehuda-how-trauma-and-resilience-cross-generations-nov2017/. Accessed 24 Mar. 2021.

Racial and Ethnic Disparities Continue in Pregnancy-Related Deaths | CDC Online Newsroom | CDC. 6 Sept. 2019, https://www.cdc.gov/media/releases/2019/p0905-racial-ethnic-disparities-pregnancy-deaths.html.

Ray, B. J., et al. “Infant Sleep Position Instruction and Parental Practice: Comparison of a Private Pediatric Office and an Inner-City Clinic.” *Pediatrics*, vol. 99, no. 5, May 1997, p. E12. *PubMed*, doi:10.1542/peds.99.5.e12.

Sadeh, Avi, et al. “Parenting and Infant Sleep.” *Sleep Medicine Reviews*, vol. 14, no. 2, Apr. 2010, pp. 89–96. *DOI.org (Crossref)*, doi:10.1016/j.smrv.2009.05.003.

Sarche, Michelle, and Paul Spicer. “Poverty and Health Disparities for American Indian and Alaska Native Children: Current Knowledge and Future Prospects.” *Annals of the New York Academy of Sciences*, vol. 1136, 2008, pp. 126–36. *PubMed Central*, doi:10.1196/annals.1425.017.

Schechtman, V. L., et al. “Sleep State Organization in Normal Infants and Victims of the Sudden Infant Death Syndrome.” *Pediatrics*, vol. 89, no. 5 Pt 1, May 1992, pp. 865–70.

Schor, Paul (2017). "The Disappearance of the 'Mulatto' as the End of Inquiry into the Composition of the Black Population of the United States". Counting Americans: How the US Census Classified the Nation. New York: Oxford University Press. pp. 155–168.

“SIDS Is Not...” *Https://Safetosleep.Nichd.Nih.Gov/*, https://safetosleep.nichd.nih.gov/safesleepbasics/SIDS/SIDSisNot. Accessed 24 Mar. 2021.

“Sleep Apnea - Causes & Symptoms.” *Sleep Foundation*, 1 Sept. 2020, https://www.sleepfoundation.org/sleep-apnea.

Sloand, Elizabeth, et al. “Breastfeeding among Latino Families in an Urban Pediatric Office Setting.” *Nursing Research and Practice*, vol. 2016, 2016. *PubMed Central*, doi:10.1155/2016/9278401.

Social Determinants of Health - Healthy People 2030 | Health.Gov. https://health.gov/healthypeople/objectives-and-data/social-determinants-health. Accessed 24 Mar. 2021.

Sondik, Edward J., et al. “Progress toward the Healthy People 2010 Goals and Objectives.” *Annual Review of Public Health*, vol. 31, 2010, pp. 271-281 4 p folliwng 281. *PubMed*, doi:10.1146/annurev.publhealth.012809.103613.

Sudden Infant Death Syndrome (SIDS) | Kaiser Permanente. https://healthy.kaiserpermanente.org/health-wellness/health-encyclopedia/he.sudden-infant-death-syndrome-sids.hw194381. Accessed 24 Mar. 2021.

Suess. “The Lorax.” 1971.

Suzuki, Miho M., and Adrian Bird. “DNA Methylation Landscapes: Provocative Insights from Epigenomics.” *Nature Reviews Genetics*, vol. 9, no. 6, June 2008, pp. 465–76. *DOI.org (Crossref)*, doi:10.1038/nrg2341.

Standing Bear, L. (2006). Land of the spotted eagle (New ed). University of Nebraska Press.

Stone L. The family, sex and marriage in England, 1500– 1800. New York: Harper and Row. 1977.

Thayer, Zaneta M., and Christopher W. Kuzawa. “Biological Memories of Past Environments: Epigenetic Pathways to Health Disparities.” *Epigenetics*, vol. 6, no. 7, July 2011, pp. 798–803. *DOI.org (Crossref)*, doi:10.4161/epi.6.7.16222.

THE BRAIN FROM TOP TO BOTTOM. https://thebrain.mcgill.ca/flash/d/d_11/d_11_p/d_11_p_cyc/d_11_p_cyc.html. Accessed 24 Mar. 2021.

Thomas, Melanie, et al. “Maternal Differences and Birth Outcome Disparities: Diversity Within a High-Risk Prenatal Clinic.” *Journal of Racial and Ethnic Health Disparities*, vol. 1, no. 1, Mar. 2014, pp. 12–20. *Springer Link*, doi:10.1007/s40615-013-0002-2.

Thompson-Miller, R. JIM CROW’S LEGACY: SEGREGATION STRESS SYNDROME. 2011.

Tong VT, Jones JR, Dietz PM, et al: Trends in smoking before, during, and after pregnancy—Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 31 sites, 2000-2005. MMWR Surveill Summ 58:1-29, 2009

Trachtenberg FL, Haas EA, Kinney HC, Stanley C, Krous HF. Risk factor changes for sudden infant death syndrome after initiation of Back-to-Sleep campaign. Pediatrics. 2012;129(4):630-8.

USDA ERS - Key Statistics & Graphics. https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics/. Accessed 24 Mar. 2021.

van Steenwyk, Gretchen, et al. “Transgenerational Inheritance of Behavioral and Metabolic Effects of Paternal Exposure to Traumatic Stress in Early Postnatal Life: Evidence in the 4th Generation.” *Environmental Epigenetics*, vol. 4, no. 2, Oct. 2018. *PubMed Central*, doi:10.1093/eep/dvy023.

Vick, Alexis D., and Heather H. Burris. “Epigenetics and Health Disparities.” *Current Epidemiology Reports*, vol. 4, no. 1, Mar. 2017, pp. 31–37. *PubMed Central*, doi:10.1007/s40471-017-0096-x.

Walker, A. “The Color Purple,” 87. 1982.

Watson JB. Psychological care of the infant and child. London and New York: Allen and Unwin. 1928.

Weese-Mayer, Debra E., et al. “Association of the Serotonin Transporter Gene with Sudden Infant Death Syndrome: A Haplotype Analysis.” *American Journal of Medical Genetics. Part A*, vol. 122A, no. 3, Oct. 2003, pp. 238–45. *PubMed*, doi:10.1002/ajmg.a.20427.

“Why Finnish Babies Sleep in Cardboard Boxes.” *BBC News*, 4 June 2013. *www.bbc.com*, https://www.bbc.com/news/magazine-22751415.

Williams, D. R., & Collins, C. (2001). Racial residential segregation: a fundamental cause of racial disparities in health. Public health reports (Washington, D.C. : 1974), 116(5), 404–416. https://doi.org/10.1093/phr/116.5.404

Williams, D. R., Mohammed, S. A., Leavell, J., & Collins, C. (2010). Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. Annals of the New York Academy of Sciences, 1186, 69–101. https://doi.org/10.1111/j.1749-6632.2009.05339.x

Wu, Roy S., et al. "Histones and Their Modification." *Critical Reviews in Biochemistry*, vol. 20, no. 2, Jan. 1986, pp. 201–63. *Taylor and Francis+NEJM*, doi:10.3109/10409238609083735.

Yehuda, R., et al. "Vulnerability to Posttraumatic Stress Disorder in Adult Offspring of Holocaust Survivors." *The American Journal of Psychiatry*, vol. 155, no. 9, Sept. 1998, pp. 1163–71. *PubMed*, doi:10.1176/ajp.155.9.1163.

Yehuda, Rachel, et al. "Holocaust Exposure Induced Intergenerational Effects on FKBP5 Methylation." *Biological Psychiatry*, vol. 80, no. 5, Sept. 2016, pp. 372–80. *www.biologicalpsychiatryjournal.com*, doi:10.1016/j.biopsych.2015.08.005.

Young J. Night-time behavior and interactions between mothers and their infants of low risk for SIDS: a longitudinal study of room sharing and bed sharing. Doctoral thesis, University of Bristol. 1999.

Zhang, Yi, and Tatiana G. Kutateladze. "Diet and the Epigenome." *Nature Communications*, vol. 9, no. 1, Aug. 2018, p. 3375. *www.nature.com*, doi:10.1038/s41467-018-05778-1.

Zheng Jingjing, et al. "Sudden Unexplained Nocturnal Death Syndrome: The Hundred Years' Enigma." *Journal of the American Heart Association*, vol. 7, no. 5, p. e007837. *ahajournals.org (Atypon)*, doi:10.1161/JAHA.117.007837.