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Exploring the Intersection of Race, Socioeconomic Status, Breastfeeding and Breast Cancer

Joanna LaFrance

EXPLORING THE INTERSECTION OF RACE, SOCIOECONOMIC STATUS, BREASTFEEDING AND BREAST CANCER

by

Joanna K. LaFrance

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Advisory Committee Members
Lynn A. Atkins, Instructor of Biology, advisor
Amanda Henderson, MSN, RNC-MNN, IBCLC, CCE.
Leonard Kass., Associate Professor of Biological Sciences
Andre Khalil, Professor of Biomedical Engineering
Jennie Woodard, Preceptor of the Honors College

ABSTRACT

This thesis examines the negative correlation between breastfeeding duration and breast cancer rates and how they may intersect with race and socioeconomic status for Black women in the United States. There is well documented evidence that exclusive breastfeeding for at least six months, as recommended by the American Pediatric Association, has numerous benefits to both mother and baby, specifically in decreasing the mother's lifetime risk of developing breast cancer (1). Similarly, many resources state a negative correlation between number of offspring and breast cancer risk. However, after a systematic analysis of 91 articles was conducted, it appears that statements like these can be deceiving. High rates of parity, the number of times a woman has been pregnant and carried the pregnancies to a viable gestational age (offspring), only decreases the risk of hormone receptor positive cancers and may increase the risk of the more aggressive estrogen receptor negative and triple-negative breast cancers *unless* it is paired with the recommended duration of breastfeeding where the risk is then reduced. TNBC cells do not contain either hormone receptors and does not over-express the HER2 gene, making it triple-negative.

Of the groups studied, Black women are more likely to be diagnosed with this aggressive breast cancer type, triple-negative breast cancer (TNBC). On average, Black women have lower rates of breastfeeding (17.2% breastfeed at 6 months compared to 29.5% whites) and have higher rates of parity (2.1 for Blacks vs 1.8 births for whites) (2), (3). This could explain the observed higher rates of triple-negative breast cancer (TNBC) in Black women (4) because TNBC was shown to be increased when parity is high and breastfeeding rate is low. The results from this study also supported the hypothesis that

one of the contributing factors as to why Black women breastfeed less which contributes to their cancer rate, is stress caused by low socioeconomic status. Low socioeconomic status has a significant negative impact on the duration of breastfeeding for Black mothers which may contribute to their inflated rates of triple-negative breast cancer.

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INTRODUCTION

As of February 2021, the World Health Organization has declared breast cancer the most diagnosed cancer in the world. On average, breast cancer affects 1 in 8 women in her lifetime, and an estimated 281,550 women are expected to be diagnosed in 2021 in the U.S. (5). Previous epidemiological evidence (6), (7) has suggested that for every 12 months of breastfeeding, a woman's likelihood of developing breast cancer is decreased (Figure 1). There are many factors that may influence the likelihood of breastfeeding and risk of breast cancer. Several studies state that high socioeconomic status (SES) is a risk factor for higher incidence of breast cancer because women with higher SES tend to have fewer children, consume alcohol, have children at a later age, and use birth control pills (8), (9). However, higher SES also allows for better diagnosis, prognosis and higher survival rates for those diagnosed with breast cancer. Those within a lower socioeconomic status may be less likely to breastfeed for the recommended time frame which can cause higher rates of breast cancer, specifically triple-negative (2).

Breast cancer is partially dependent on lactation and lactation is partially dependent on socioeconomic status. Black women are significantly less likely to breastfeed, and this may explain why Black women also have a higher likelihood of being diagnosed with triple-negative breast cancer (TNBC), an aggressive form of breast cancer (4). Breastfeeding is especially protective for TNBC, but because Black women are less likely to breastfeed, likely due to low socioeconomic status, they suffer from a higher incidence of triple-negative breast cancer (2). Understanding social inequalities

that give rise to disparities is necessary before additional preventative interventions can be implemented and we work towards health equity.

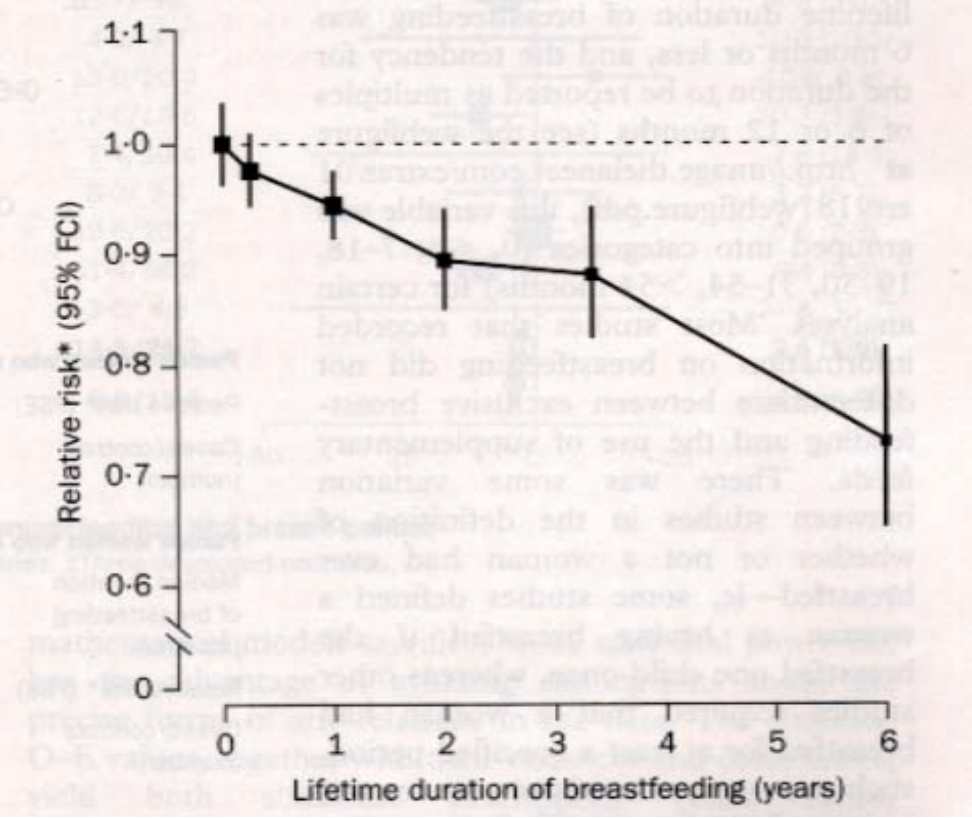

Figure 1: Negative Correlation Between Breastfeeding Duration and Breast Cancer Risk
Lancet's collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. Study continues to be referenced as the basis of the correlation between breastfeeding rates and breast cancer rates (6).

BACKGROUND

Anatomically, the breast lies on the pectoralis major muscle with ligaments to support the breast to the chest. On average, the breast contains 15-20 lobes arranged in a circular pattern that are each formed by clusters of lobules which contain alveoli glands necessary for milk production (1). These are attached to the ducts, a thin tube that carries milk from the lobules to the nipple (11). The arrangement of these anatomical parts can be seen in Figure 2.

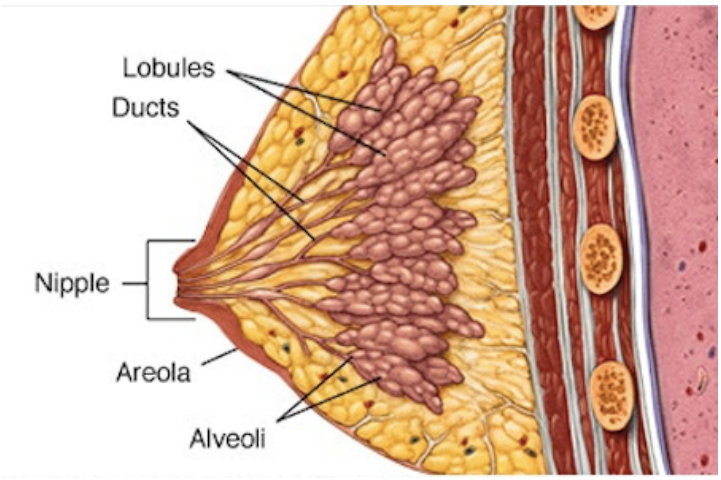

Figure 2: Anatomical Depiction of the Lobules, Ducts, and Nipple
Image shows the flow of milk during breastfeeding and the locations where breast cancer forms (11).

For the offspring, breastfeeding provides necessary nutrients for growth, confers immunological protection to the infant and fosters a mother-baby bond. For the mother, breastfeeding also provides significant benefits. The longer a woman breastfeeds, the lower her risk of breast cancer, ovarian cancer, Type II diabetes and high blood pressure (1). The breast is an organ that undergoes multiple complex developmental changes throughout a woman's life and these changes can either promote or prevent oncogenesis, the process of cells dividing uncontrollably. A significant milestone of the breast that is particularly relevant is the development of the breast during lactation and involution, a process where an organ reverts to its normal state (13).

Lactation is a physiological process that occurs with plasticity; milk production can be up or down regulated and is dependent on the stimulation to the mammary glands (12). Mammary development begins during early fetal life but extends through puberty with the involvement of estrogens and progesterone and further changes during parity. Mammary glands enlarge during the first twenty weeks of pregnancy mostly due to prolactin and placental lactogen (12). Milk production occurs in the alveoli of the breast, arranged into lobules, and once milk is made, is squeezed out into the milk ducts which carry the milk through the breast, to the nipple. When the baby cries or suckles, the brain is signaled to release prolactin and oxytocin. Release of prolactin causes the alveoli to make milk and release of oxytocin causes muscles around alveoli to contract and squeeze milk to the ducts (12).

Involution, the process where the breast reverts to its pre-lactation state, occurs in mammary glands at the termination of lactation, when the baby is weaned from the breast. At weaning, the mammary gland is remodeled to resemble its normal state. This mammary gland involution process occurs in two steps (13). First, depletion of lactogenic hormones, mainly prolactin during weaning, signals apoptosis of terminally differentiated, potentially cancerous mammary cells. It is during this stage where the fully differentiated cells that have oncogenic potential are excreted from the breast after cell death. Cells with higher oncogenic potential have a higher likelihood of dividing uncontrollably and becoming cancerous. This is followed by a second stage where the pre-pregnancy state of the mammary gland is achieved after gradual remodeling occurs (13). There are many inflammatory and anti-inflammatory genes and pathways that are at work during involution to prevent inflammation. Involution involves an influx of immune

cells, removal of excess extracellular matrix and removal of dead cells, debris and remaining milk (14). Although this process will proceed normally when the process is gradual, if there is a lack of or shortened lactation period, inflammation of the breast and delayed differentiation of cells can occur. It has been proposed that breast cancers, specifically TNBC's, may stem from immune system/inflammatory processes during postpartum involution, conditions that oncogenic cells thrive in (14). Additionally, if differentiation does not occur, progenitor cells could be retained in the breast lobules rather than being excreted, and after a heightened inflammatory environment during early weaning, these cells could be converted into precursors for triple-negative breast cancer cells (14).

There are numerous physical, psychological and environmental factors that influence the initiation and continuation of breastfeeding for women (15). The causes of low rates of breastfeeding may be multifactorial. Limiting factors may include lack of knowledge about breastfeeding, pain or physical discomfort, poor familial and social support, cultural and social norms, concerns about milk supply, and unsupportive work and childcare environments that make it difficult for many mothers to meet their breastfeeding goals (15). Certain barriers are disproportionately experienced by Black women or women of a lower socioeconomic status. These include earlier return to work, work schedule inflexibility and pressure, an inadequate receipt of breastfeeding information from providers, and lack of access to professional breastfeeding support (15). Identifying the factors that may inhibit breastfeeding is critical to reducing the risk of breast cancer among Black women.

Although breast cancer deaths have steadily declined since 1990 due to earlier detection, screening and improved treatment, and incidence rates have declined likely due to reduced use of hormone replacement therapy, improvements have been smaller and less consistent among Black women (16). Breast cancer predominantly affects women, and its impact by race varies. Breast cancer can be detected by physically feeling a lump, by change in breast size, or by nipple discharge, but most often it is found through routine screenings, such as mammograms. Like most cancers, early detection by screening correlates with a higher survival rate (17).

Breast cancer can initially present in the lobules, mammary glands, mammary ducts, or, less commonly, in the connective tissue that contains fibrous and fatty tissue. These structures can be seen in Figure 2, the anatomy of the breast. Breast cancer most often begins in the lobules (groups of alveoli) or in the ducts, which prove to be two vital components of lactation (18). Cancerous cells are those that have abnormal properties: divide uncontrollably (oncogenic) and cluster to form tumors. A tumor that begins in the ducts or lobules can spread to connective tissue which can then spread to surrounding lymph nodes and through the lymphatic system or bloodstream. When this occurs, the cancer is now metastatic (19). The various types of breast cancer are dependent on the initial location of the cancerous cells and more importantly, the type of cell that becomes cancerous (18). Hormone receptors are proteins found in and on breast cells that detect hormone signals which promote cell growth. At the time of diagnosis, results show whether the cells possess estrogen receptors or progesterone receptors. When present, these receptors influence cells to grow by detecting signals from estrogen or progesterone, respectively (20). The growth promoting protein HER2 (human epidermal

growth factor receptor) is a receptor found on all breast cells. Normally, these proteins help regulate how healthy breast cells grow, divide, and repair themselves (20). However, in 10-15% of breast cancers, HER2 gene amplification occurs, where the gene does not function properly and makes too many copies of the protein for which it codes. The additional HER2 genes signal the breast to make many HER2 receptors, known as HER2 overexpression and is classified as HER2-positive cancers. When this happens, breast cells grow and divide uncontrollably (20).

Breast cancers are categorized into three subgroups. Luminal A cancers include tumors that are estrogen and progesterone receptor positive (ER+/PR+ respectively) and negative for HER2 (HER2-). Cancers that are ER+, PR- and HER2+ are considered Luminal B cancers. Basal-like breast cancers are called triple-negative breast cancers because they are negative for both types of hormone receptors (ER-/PR-) and are also HER2 negative (HER2-) (21). According to the National Cancer Institute, data indicates that from 2013-2017, 68% of breast cancers are of the luminal A subtype and are slow growing, less aggressive, have low recurrence, and have a high survival rate because of its response to traditional endocrine therapy (22). Luminal B and basal-like subtypes have a 10% occurrence rate, occurring more than 6 times less than Luminal A cancers. Luminal B cancers have high proliferation rates and although these tumors also respond to endocrine therapy, there is a worse prognosis when compared to luminal A cancers. Basal-like breast cancers, typically TNBC, have a younger age at diagnosis, high rates of recurrence, and the poorest short-term prognosis (22). Triple-negative breast cancers have these distinctive characteristics mainly because there are few targeted therapies and because they are classified with a high grade. Cancers with a high grade have cancer cells

that appear least like normal healthy breast cells and have a high mitotic rate (increased growth and replication) (23).

Epidemiologic literature (6) supports that risk factors vary dramatically by subtype of breast cancer and that many established risk and protective factors are more strongly associated with hormone receptor positive cancers (10). Educating women about identified, modifiable risk as well as protective factors is especially important in decreasing breast cancer incidence and improving survival rates of those affected by all cancer types. Risk factors that increase incidence rates of all types of breast cancer are being female, being overweight, smoking and alcohol use, a poor diet high in fat, and personal and familial history (17).

Hormone-receptor positive breast cancers are caused primarily by reproductive factors and milestones that increase exposure to estrogen (17). This can include nulliparity, or never having carried a full-term pregnancy, menstruation, breastfeeding, and exogenous hormone use and exposure. Therapeutic and supplemental estrogen and progesterone is commonly used as a contraceptive in premenopausal women and as a hormone replacement therapy in postmenopausal women. Such treatments increase lifetime exposure to estrogen. Hormone-receptor positive cancers are more likely to affect older women (11). Protective factors for hormone receptor positive cancers include increased parity and breastfeeding (17).

When controlling for genetic risk factors for TNBC, the only risk factors left are those of lifestyle and history, such as socioeconomic status and other life experiences. The few risk factors identified include being of a younger age, being Black, and increased parity without breastfeeding (20). Another risk factor is having obesity, and Black

women are more likely to have higher body mass indices (43). The only known protective factor for triple negative breast cancer is breastfeeding. Although the importance and influence of women's health and reproductive history is well recognized, literature is inconsistent and protective factors are less well-known for triple-negative breast cancer, the cancer that disproportionately affects Black women. Investigating these cultural factors that may be impacting a Black women's risk may be beneficial in mitigating the Black-white disparity.

Breastfeeding and breast cancer must be looked at collectively due to research that shows correlations between the two (6), (7). The landmark study performed by Lancet researchers in 2002 establishes the notion that for every 12 months a woman breastfeeds, the risk of breast cancer is decreased by 4.5%. The study also claims a 7.0% decrease in breast cancer risk for every additional birth (6). Previous research, including Lancet's study, may produce misleading information. Resources, like this one, say non-specific claims like "increased parity reduces risk of breast cancer". Statements like this can be deceiving because parity only decreases the risk of ER+/PR+ cancers, and instead, increases the risk of ER- and TNBC *unless* paired with breastfeeding where the risk is then reduced. High parity without lactation was positively associated with ER-/PR- breast cancer (24). Because as a group Black woman exhibit this pattern of higher parity with lower rates of breastfeeding, their TNBC incidence may be increased.

Breastfeeding reduces the risk of hormone receptor positive cancers by decreasing the body's exposure to estrogen. This reduction may be due to mechanisms such as removal of estrogens or carcinogenic cells via breast milk, fewer menstrual cycles, or a delay in ovulation (25). Although the specific reasoning for the link in breastfeeding to

reduction in hormone receptor negative cancers and TNBC has not been elucidated, previous studies have suggested that breastfeeding reduces the risk of these types of breast cancer primarily through involution (26). Remodeling the mammary glands back to their original state encourages the removal of the precursor cancer cells. This happens in the post-lactation weaning stage. Researchers have proposed that when pregnant, there is an increase in fully differentiated cells as they specialize for high levels of milk production. These cells, with oncogenic potential, must be eliminated at the end of lactation by massive rates of cell death (26). It is also during this time that the mammary gland undergoes reorganization and returns to its pre-pregnancy state. Longer duration of breastfeeding steers mammary cells to terminal differentiation and could kill these oncogene-expressing cells (27). Little to no breastfeeding could lead to persistence of some oncogene cells with oncogenic potential due to suppression of apoptosis, which can convert these cells into precursors for post-pregnancy TNBC (26), (27). It is uncertain exactly how lactation and involution partially influence ER-/PR- cancers, however, prolonged breastfeeding may prevent abnormal involution, specifically differentiation and inflammation (27).

There is limited information as to why Black women have a higher incidence of negative breast cancer types and elevated mortality rates in comparison with white women (4). I predict that low socioeconomic status and the stress that it partners with causes increased prevalence of known risk factors as well as poor health care access and lower standard of care. Black women in the United States are more likely to be diagnosed with TNBC, cancer that is at a later stage, are less likely to receive stage appropriate treatment, and are more likely to have lower stage-for-stage survival rates (28). Minority

groups in the US are more likely to suffer from greater poverty, psychosocial stressors and adversity during prenatal and early life that integrate to increase breast cancer rates and contribute to racial disparities. Breast cancer incidence rates tend to be positively associated with SES however SES and breastfeeding needs to be better incorporated into research because of these racial differences (29).

Breastfeeding initiation and duration have consistently improved among Black and white infants over the past decade, however the difference in breastfeeding rates between Black and white infants continues to be substantial (2). Interventions specifically addressing barriers to breastfeeding for Black women are needed. According to a study published in 2017 that collected data from the National Immunization Survey, results showed that Black women had the lowest percentage of initiated breastfeeding, the lowest percentage of exclusive breastfeeding through 6 months and the lowest percentage exclusive breastfeeding at 12 months when compared to their white counterparts (30).

HYPOTHESIS

For every cumulative 12 months a woman breastfeeds, there is a 4.5% decrease in her risk of breast cancer (6), (7). According to the CDC's data for babies born in 2017, Black women have the lowest breastfeeding initiation rate and shortest breastfeeding duration at 73.7% and 47.8%, respectively (27). This is compared with 86.7% initiation and 61.9% exclusive breastfeeding for 6 months for white women and 84.1% initiation and 58.3% exclusive at 6 months overall (27). This highlights that a larger percentage of Black women do not breastfeed for the recommended duration needed to benefit from the protective effects against breast cancer, specifically TNBC, when compared to white women. Black women have a 2-fold higher TNBC rate and have a 40% higher mortality rate when compared to white women (31). This type of cancer is specifically responsive to breastfeeding protection. Why is this result seen throughout the available data? What is largely contributing to this outcome?

When exploring possible explanations, it was clear that a gap in the research was present. A substantial portion of the research summed race and socioeconomic status but didn't discuss which one was the driving force for these rates. Much of the literature discusses the impact of race on breastfeeding rates, and that race contributes to varying breast cancer incidence rates but does not consistently attribute these differences between the two groups to a particular factor. Why is the Black community differently impacted than white women? Is it due to biological differences? Is it due to access or environmental factors? Is it due to traditional habits, lifestyle, or other attitudes? The correlation between breastfeeding and breast cancer is evident: breast cancer risk

decreases with increased duration of lifetime lactation experience. Black women often fail to initiate breastfeeding or cessate early. Black women have higher incidences of aggressive triple-negative breast cancer and are more likely to die from it (4).

After fully analyzing data from secondary articles, I hypothesize that the breastfeeding and breast cancer rates seen in Black women have little to do with race itself and are more likely due to differences in socioeconomic status, the stress this causes, and the living experience of Black women, including access to resources, support and availability. Black women are considerably more likely to be a part of lower socioeconomic status, receive governmental aid, and work low paying jobs that likely lack benefits when compared to white women (32). Their likelihood of breastfeeding is greatly dependent on household income and education; two bases that measure socioeconomic status. According to National Federal Poverty Guidelines, the poverty line is defined by annual income in relation to the number of persons in a household (32). A study has found that Black women are more likely than white women to have incomes less than 100% of the poverty level (49.3% versus 17.8%), to receive Special Supplemental Nutrition Program for Women, Infants, and Children benefits (78.2% versus 34.1%), and have less education (32). In this study, low socioeconomic status was defined as having lower educational attainment and having a total income that was close to, at, or below the federal poverty line.

Socioeconomic status may contribute to a poor initial introduction to breastfeeding from healthcare professionals and inconsistent professional lactation support. Black women are faced with increased pressure to return to work prematurely due to a lack of maternity leave, inflexible work hours, a lack of privacy and benefits, and

job insecurity (17). Similarly, breast cancer prognosis and survival rate are dependent on SES, specifically healthcare access; low SES women are unable to obtain breast cancer screening and early detection coupled with various treatment options (33). *Through systemic analysis, I hypothesize that low socioeconomic status largely inhibits Black women from breastfeeding and therefore they lose the mitigating effect of breastfeeding and experience higher risk of TNBC posed by their increased parity.*

METHODOLOGY

A systematic analysis was performed to identify and synthesize the available scientific literature on breastfeeding and breast cancer rates among Black women. A systematic analysis can suggest themes, reveal theories, and identify gaps by critically evaluating the existing knowledge of the subject (36). This is in contrast with the numerous research papers completed during my undergraduate education which consisted of experimental lab reports based on primary research. Normally, when writing a research paper only those sources that directly support or explain the idea are included. However, when writing a systematic analysis, a larger scope and review process is involved rather than only including studies that will lend support to a particular idea. Approaching research in this way may help to reduce bias.

Searches were conducted through the Google Scholar database. Google Scholar was chosen because it provides a simple way to broadly search for scholarly literature. When compared to PubMed, an academic database, Google Scholar provides twice as many relevant and precise articles for a given search (34). Ultimately, Google Scholar rendered significantly greater access to free, full-text publications than other academic databases (34), which is why it was employed for this analysis. Google Scholar provided many peer reviewed articles which are subject to certain standards (35). Because my work is one that draws upon others' material, it is critical that the research meet these qualifications. To begin, the following search terms were entered into Google Scholar: race AND breastfeeding, socioeconomic status AND breastfeeding, race AND breast cancer, and socioeconomic status AND breast cancer. Other keywords searched were

"relationship/correlation between breastfeeding and breast cancer", "contributing factors of breastfeeding" and "contributing factors of breast cancer" (table 1, column 1). These terms and keywords were chosen because they provided encompassing results related to the research question.

Upon performing entry level searches to narrow my thesis topic, I discovered that Black women were less likely to breastfeed, had high rates of parity, and were more likely to be diagnosed with triple-negative breast cancer. Further, I discovered that there was a negative correlation between breastfeeding duration and breast cancer incidence. Many articles did not discuss potential causes for this disparity or the implications for Black women. It was evident that a gap existed, and I could hypothesize why it was happening, but I aimed to see if other available research suggested a similar explanation. I formulated the following hypothesis: *I hypothesize that low socioeconomic status largely inhibits Black women from breastfeeding and therefore they lose the mitigating effect of breastfeeding and experience higher risk of TNBC posed by their increased parity.* I aimed to investigate how much of the available literature supported or opposed this prediction. The Google Scholar searches showed thousands of entries of which a pool of 91 articles were selected based on the methods described below. These 91 articles are included in the appendix.

The objective of this systematic analysis is to evaluate whether the available research supports or opposes my hypothesis and then to determine how much weight should be applied to each study given the number of inclusion criteria met. First, an upper limit of 100 articles to review was set to ensure an adequate sample size prior to data collection. The time frame given for this project made this attainable and provided a

sample size with meaningful results. Data collection was terminated at the end of January 2021. Ninety-one articles were obtained when entering the keywords described above in Google Scholar. Initially, those articles were evaluated to determine support or opposition of the hypothesis. Articles that supported the hypothesis suggested that low socioeconomic status was a significant contributing factor to lack of breastfeeding and breast cancer rates. Those sources that opposed the hypothesis either (1) suggested that another factor was more influential than low socioeconomic status, (2) hypothesized that socioeconomic status was not a contributing factor at all, or (3) did not mention low socioeconomic status in the study.

After the initial evaluation of determining support or opposition of the 91 articles, they were weighted using four inclusion criteria (table 1, column 2). Inclusion criteria were predefined characteristics used to weigh sources cited in a study. These included demographic, location, date, and sample size. These criteria were used as a second way of analyzing the sources and revealed the amount of weight to apply to the results, ideas, and suggested claims. It was determined that articles that met at least 3 of the inclusion criteria provided more support for and were pertinent to the research question. This may mean that these sources are more universal or have more evidence. Those sources that met 2 or fewer inclusion criteria were weighted less for this study. By evaluating support or opposition for the hypothesis prior to being subject to inclusion criteria, I could determine if those that support or oppose are most applicable and provide a meaningful result. This added strength to the hypothesis I was attempting to suggest. *I hypothesize that low socioeconomic status largely inhibits Black women from breastfeeding and therefore they lose the mitigating effect of breastfeeding and experience higher risk of*

TNBC posed by their increased parity. For example, if a large percentage of sources supported the hypothesis but met fewer than two inclusion criteria, then although they may lend a similar idea to my hypothesis, they may not be the best representations for this study. A source that may have been written prior to 2015 or published outside of the United States, for instance, was not excluded from this study, however, those that meet those qualifications AND support the hypothesis may better express the desired claim (low socioeconomic status being a significant factor). A systemic analysis was optimal because it allowed for results of many studies to be combined to estimate the magnitude of a particular finding, in this case, a possible elucidation for the disparity between Black and white women's rates of breastfeeding and aggressive breast cancers.

Table 1: Search Terms and Inclusion Criteria
Search terms entered into Google Scholar (left) and inclusion criteria used to measure weight of articles (right) after evaluating support or opposition for hypothesis.

Search Terms	**Inclusion Criteria**
Race AND breastfeeding	Demographics (women, race, socioeconomic status)
Socioeconomic status AND breastfeeding	Publish or review date (within past 5 years)
Race AND breast cancer	Methodological quality (minimum of 100 participants)
Socioeconomic status AND breast cancer	Geography (data collected within the U.S)
Relationship/correlation between breastfeeding and breast cancer	
Contributing factors of breastfeeding	
Contributing factors of breast cancer	

RESULTS

Systematic analysis allowed me to grade the quality of evidence and strength of recommendations. Extracting and synthesizing data in this way revealed the overall level of evidence, degree of consistency in the findings and how many studies found an association between socioeconomic status and breastfeeding and breast cancer (36). Upon initial evaluation, the studies that supported or opposed the hypothesis provided information about potential significant factors and what the information available was expressing. However, the second round of evaluation, filtering through inclusion criteria added additional weight to whether each study supported or opposed the hypothesis.

After analyzing the articles, 81.3% of the articles (74 out of 91) contained conclusions that supported the initial hypothesis, that socioeconomic status is a large contributing factor to Black women's rates of breastfeeding and breast cancer. This supported my claim. Secondly, 18.7% of the articles (17 out of 91) provided evidence that did not support the hypothesis. This may have included not discussing SES at all, stating that SES was not a significant factor, or by describing a factor that is of greater significance than SES. When compared to the number of articles that supported the hypothesis, articles in opposition comprised a relatively small percentage. Importantly, of the 81.3% of supportive articles, 97.3% of them met at least 3 of the 4 inclusion criteria (figure 4). This means that through both evaluations, the studies were good representations of what this hypothesis is hoping to convey: study supports hypothesis *and* met most of the inclusion criteria. In comparison, of the 18.7% of non-supportive articles, 35.3% of those articles met 2 or fewer of the 4 study selection criteria, which

may give an explanation as to why these didn't support the hypothesis and thus were not ideal matches for this study. There were 43 articles that met 3 of the 4 inclusion criteria, and of this total, 29 of the articles met all the inclusion criteria except for falling within the relevant date range of 2015 to present. This implies the general lack of *recent* information.

Hypothesis: *I hypothesize that low socioeconomic status largely inhibits Black women from breastfeeding and therefore they lose the mitigating effect of breastfeeding and experience higher risk of TNBC posed by their increased parity.*

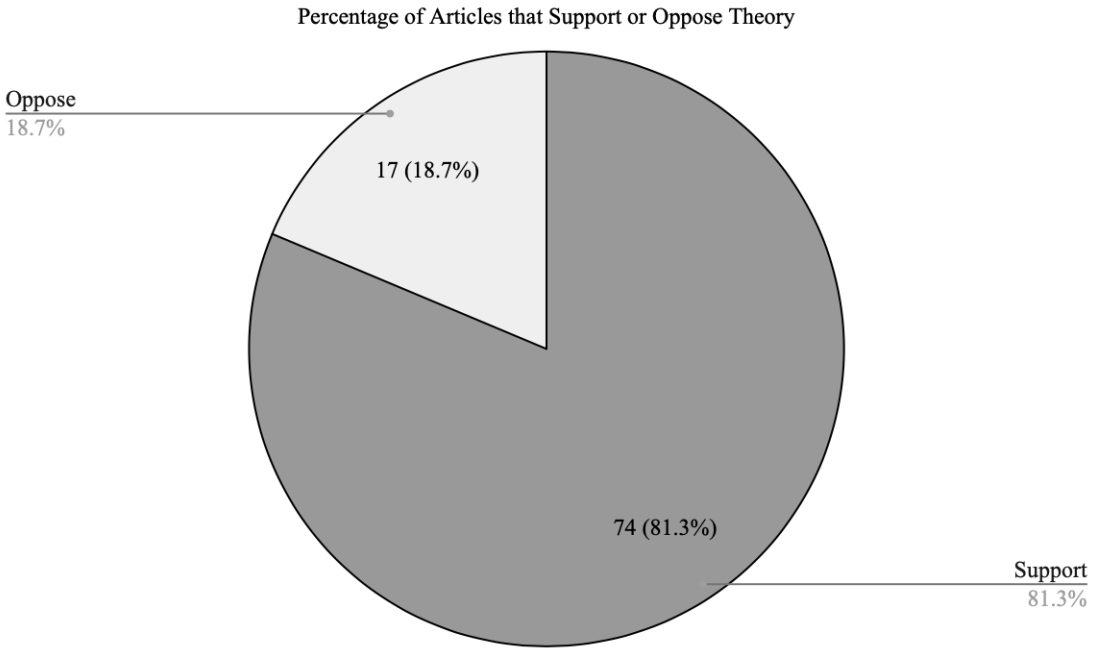

Figure 3: Percentage of Articles in Support or Opposition of Hypothesis
Of the 91 articles reviewed in systematic analysis, shows the percentage that support central hypothesis and percentage that oppose hypothesis prior to use of inclusion criteria.

Table 2: Inclusion Criteria with Description
Inclusion criteria used to measure weight of articles after evaluation of support or opposition.

Inclusion Criteria	Description
Demographics	relevant population of study (women, race (i.e.. Black or white), socioeconomic status)
Publish or review date	relevant time frame (within the last 5 years)
Methodological quality	sufficient sample size (minimum of 100 participants)
Geography	applicable location (data collected within the United States)

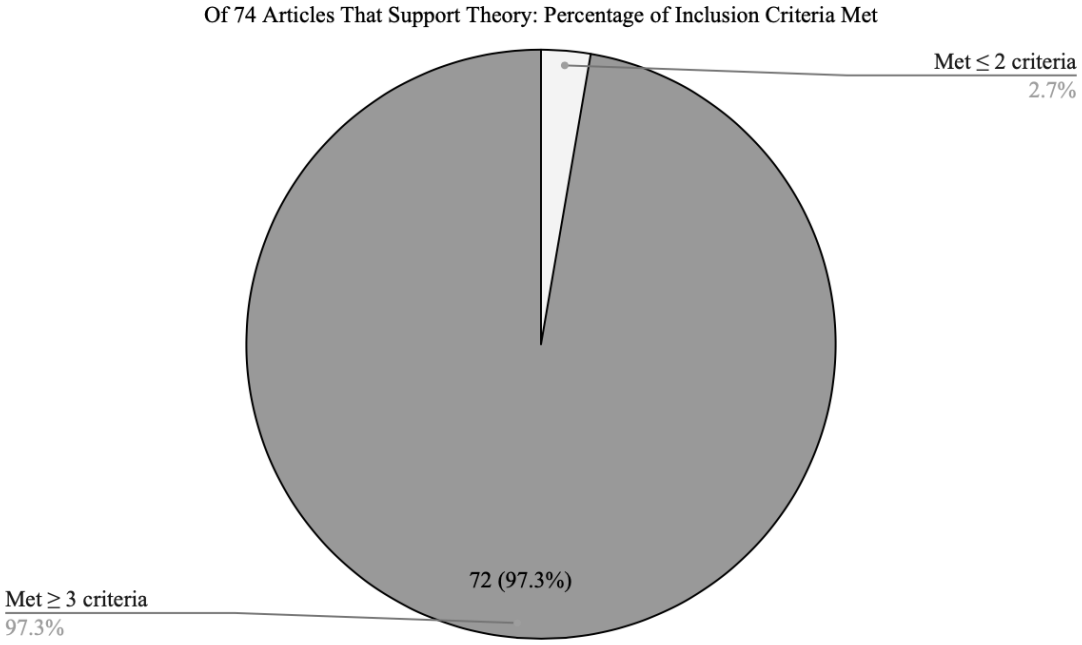

Figure 4: Evaluation of Supportive Articles using Inclusion Criteria
Inclusion criteria provides a level of weight that should be applied to sources. Figure shows the percentage of supportive articles (74 articles) that met at least 3 or fewer than 2 inclusion criteria.

DISCUSSION

It is important that 81.3% of articles support the hypothesis, but more importantly, 97.3% of those that supported, met at least 3 of the inclusion criteria provided. This indicates that socioeconomic status is a major contributing factor for Black women not breastfeeding for the intended duration, which may contribute to breast cancer. Socioeconomic status as related to a lack of breastfeeding may cause a higher instance of triple-negative breast cancer. Results also implied that socioeconomic status has the potential to influence survival rates from breast cancer due to healthcare access; screening, treatment, and racial discrimination (33). Based on my hypothesis and the sources explored, SES may inhibit Black women from breastfeeding which could cause them to be at higher risk for developing the aggressive hormone receptor negative breast cancers. Additionally, SES also contributes to delayed screening (late-stage diagnosis) and poor treatment options which may explain poor survival outcomes of these inflated rates (33). Although increased parity was presumed to decrease risk of breast cancers, recent studies have shown that increased parity is associated with reduced rates of ER+/PR+ cancers but that increased parity increases the risk of ER-/PR- and TNBC without breastfeeding (37).

Breastfeeding is one of the few factors found to be consistently associated with a reduction in both hormone positive and negative breast cancers (24). Risk for TNBC increases with parity but breastfeeding mitigates the risk, making it specifically protective to this type (24). When these negative hormone receptor cancers were viewed in combination with breastfeeding behavior, the increased risk of ER−PR− breast cancer

associated with high parity was only found in women who had children but did not breastfeed (38). Childbearing women who breastfed had no increased risk of TNBC compared with women who did not. This confirms research that breastfeeding decreases the risk of breast cancer regardless of hormone receptor status and that this association is stronger for negative breast cancers (38). Those with ER+ breast tumors were more likely than ER- cases to have breastfed at least one child. After adjustment for several known breast cancer risk factors, women who breastfed were 3x more likely than those who never breast fed to have an ER+ tumor rather than an ER- cancer (25). The most common cause of late-stage diagnosis and unacceptable treatment options in women, specifically Black women, is a lower socioeconomic status (33). I propose that the same factor significantly reduces Black women's likelihood of breastfeeding, a well-known protective factor.

Table 3: Confounding Factors of Breastfeeding
Factors of breastfeeding that may influence initiation and duration that were not heavily focused in this study. Although results show that SES is a large contributing factor, many others exist that weren't considered and researched.

Other factors that influence breastfeeding	
Infant nutrition and weight	Other children at home
High socioeconomic status	Maternal perception of quantity of breast milk
Mother nutrition and health issues	Postpartum infection
Number of infants (multiples)	Use of pacifier
Marital status	Infants' irritability and breastmilk desire
Paternal Support	Mother's job, financial considerations,
Modesty/cultural expectations	Vitamin D deficiency causes rickets to affect Black families

Table 4: Confounding Factors of Breast Cancer
Factors of breast cancer that may influence incidence and mortality that were not heavily focused in this study. Although results show that SES is a large contributing factor, many others exist that weren't considered and researched.

Other factors that influence breast cancer	
Genetic mutations (BRCA gene)	Stress and anxiety
Various lived historical experiences	Employment inhibiting treatment flexibility
Breast density and varying	
Diet and exercise	

A linkage was found between breastfeeding and breast cancer, specifically TNBC in Black women. The gap shows that Black women are breastfeeding at lower rates, are not receiving its protective benefits, and have higher rates of TNBC (2). I propose that a possible rationale for this disparity could be that Black women experience conditions that impact their socioeconomic status which may affect breastfeeding likelihood and breast cancer rates. Breastfeeding has been inversely related to hormone receptor negative breast cancers and therefore provides a widely accessible and affordable risk-reducing strategy for these aggressive pathologies if socioeconomic status and its implications are largely considered.

Women who attend breastfeeding and postpartum support groups have been found to be more than twice as likely to initiate and continue breastfeeding (39). Soon after delivering their baby, all mothers should have access to support groups within their community to express concerns and share experiences. In doing this, women may feel a greater sense of community and have a support system which may provide advice and help. Although professional lactation support would likely be beneficial to breastfeeding rates, peer to peer interventions may remove the conflicting power struggle between

healthcare professionals and Black women. Allowing this peer support to be facilitated by someone who they may better relate to may foster respect and empathy between the supporter and those they are supporting. For example, an effective support group for Black women may not be orchestrated by a white, privileged, professional but instead by a fellow Black mother who can empathize and understand the struggles and feelings involved with being a Black mother in America. This leader could be trained by medical professionals or even be a medical professional to ensure the information is accurate. The information may be better received when delivered by someone who has had similar experiences. However, I recognize the duality of this situation. While it may be comforting to have a Black mother teach these interventions, it is not the Black mother's responsibility to be this person, and being the educator is another pressure and job placed onto her. Similarly, minority patients may benefit from having a minority healthcare provider, though this may be difficult to supply. Increasing the number of Black healthcare professionals can be achieved by further supporting Black people who are seeking medical degrees. This may include extra financial considerations and encouragement that they are needed and appreciated in the healthcare field.

Research shows that large numbers of women, Black women in particular, are unaware of the benefits that breastfeeding may have for their own health (40). While they may be knowledgeable of how breast milk is advantageous to their baby, many do not know that breastfeeding can also reduce their risk of all types of breast cancer, specifically cancer that may affect them (TNBC) (40). Health professionals should implement culturally targeted education to new mothers on potential impacts of breastfeeding for their own health and breast cancer risk. This pre and postnatal education

should be promoted in local clinics, hospitals and within the healthcare system to reach a wide array of women. I believe an effective way to decrease this disparity is by physicians listening to their patients. Rather than listing "non-compliant" as a reason for their health status, they should aim to figure out the barriers that Black women may face. They should begin to offer full explanations to questions they have and offer alternate recommendations that may better align with their experiences. Many diseases can be prevented, and breastfeeding practices can be promoted, but providers should focus more on *why* certain things may be occurring or not occurring and what they can do to help abate those causes. Healthcare providers have a responsibility to educate and support their patients, however, the best way to do this may not be directly from them.

Breastfeeding is new to many mothers, and common concerns include wariness of pain and discomfort, unstable milk supply, convenience of bottle-feeding, and embarrassment to breastfeed in public (15). By providing professional and peer lactation support in the form of at-home visitation, Black mothers may be more apt to express their fears, feel heard and receive strategies and tips to continue. From a policy standpoint, laws can be enacted that ensure that all working women have rights that allow for, assist in and encourage breastfeeding so that they may feel supported while still providing for their families. This can include larger encompassing maternity leave, lactation space and time at work, and greater understanding when problems surrounding breastfeeding occur. Perhaps employers can be provided with incentives to support and encourage women to breastfeed. At the same time, we must be careful not to alienate those who still choose not to participate or cannot for some reason.

It is not uncommon for women, of all races, to feel shame and embarrassment when breastfeeding in public. For Black women, this could be explained from cultural expectations or it may be felt due to the breastfeeding stigma of our society where showing your breasts, even in the capacity of feeding a baby, is sexualized. The best way to mend this issue is to remove the stigma surrounding a breast being visible during public breastfeeding. It may take many years for this removal of a deeply ingrained societal norm to occur. Until this happens, increasing the number of private spaces available to a mother to breastfeed if she is uncomfortable in public will allow breastfeeding to occur without subjecting the mother to negative feelings.

Black cultural inhibition can be described as the events and treatments, mostly unfair and corrupt, of Black women and people throughout history. American society has never been a society free of prejudices, especially for the Black community. The Black representation and common experiences likely cause psychological and physical difficulties, and these cultural and historical experiences of Black women must not go unvalidated. An example of this is the concept of "wet-nursing" where the exploitation of enslaved women as workers and reproducers became entangled. During this time, Black women were forced to nurse white babies who often belonged to their owners. This practice manipulated a women's motherhood for white people's own benefits (41). Although such an example likely has lasting impacts on a Black woman's decisions, this wound may begin to be repaired by listening and validating Black women's concerns and opinions. Physicians, specifically, must acknowledge historical events like these and others that may still be impacting a Black woman's decision to breastfeed.

While I believe that implementing practices to increase breastfeeding rates for Black women would likely reduce their risk for TNBC, there are also interventions that can be made to reduce the high mortality rates of Black women who are diagnosed. Even though the aggressive pathology of TNBC may be the cause of the increased mortality rates, these findings highlight the need for equal, all-encompassing, affordable healthcare to mitigate the black–white disparity. Healthy diets high in phytoestrogen, folate, fiber and calcium intake may protect against ER negative tumors, nutrients that Black women with lower SES may find difficult to access in their diet due to the prevalence of food deserts and the high cost of minimally processed foods such as fruits, vegetables and fish (29). Increasing the number of grocery stores that provide fresh, affordable produce in low-income neighborhoods can help increase these essential, protective nutrients. Black women have higher rates of obesity, another barrier potentially caused by lower socioeconomic status. Higher body mass index (BMI) has been shown to correlate with a high incidence of cancer, which may be further complicating these disparities between white and Black women (43). Breastfeeding has been shown to aid in healthy weight loss for postpartum mothers, therefore, breastfeeding not only decreases the risk of breast cancers, but may also lower BMI which can further reduce risk of breast cancer. Educating Black mothers of these benefits may help increase breastfeeding initiation rates and duration.

Black women with a high risk of breast cancer are not being screened and often do not receive stage appropriate treatments. Early detection is especially important when being diagnosed with TNBC, as it greatly impacts the prognosis (33). To mitigate this, affordable healthcare that provides good quality medical services to everyone should be

enacted. This will provide screening and adequate treatment for all, not only for those who can afford it. For example, one initiative to increase participation could be an incentive given to those who get their yearly mammogram.

Additionally, those who do have access to healthcare screening and treatment may have cultural expectations of being less trusting of medical communities due to experiences in history. For example, the U.S. Health Service Syphilis Study at Tuskegee began in 1932 to 1972. During this, adequate treatment was withheld from a group of poor Black men who had the disease. Unnecessary pain and suffering occurred and since, the federal government has made changes to prevent moral breaches like this from ever happening again (42). Regardless, this event, and others that are similar, may have caused lasting mistrust of medical professionals and the healthcare system when the intention is toward helping and healing people, not hurting. To help heal this relationship, physicians must prioritize their Black patient's wellbeing. Forming a connection can build trust and this may be done by listening, paying attention and coming from understanding rather than judgement.

It is important to use respectful language when speaking to someone who may not share the same heritage or culture so that a positive experience is produced and judgment for the Black community is reduced. Working in the medical field is a privilege that must be recognized to not appear 'all knowing' towards patients. For some physicians, marginalization, poverty, and discrimination simply might not seem real. Unrecognized privilege can be the basis of bias that certain actions and discrimination may be founded on, even if it is subconscious. Additionally, it is important to admit that these barriers may not be exclusively affecting Black women. There are many factors that influence a

mother's decision to breastfeed which can also influence her risk of breast cancer. Many of these other factors can be encompassed by socioeconomic status.

Biologists and scientists acknowledge and generally do not accept the terms 'black and white' as categories of people. Scientifically, being Black and white is 'skin-deep' and only refers to the amount of melanin in the skin. These terms were used in this paper as a way to distinguish groups, however, scientific research should begin to abstain from using these terms, as skin color is not relevant to biological subject fields. We should begin to change the language surrounding characterizing humans in this way, as it may be potentially harmful and may be contributing to racial injustice.

While it has been long thought that parity decreases the risk for breast cancer, it appears that the reduction is only for ER+/PR+ cancers. This distinction is significant. Agencies like the CDC need to be more explicit and clearer in the claims they make. As additional research is produced, sites must be updated to inform the population. The database states that parity decreases the risk of breast cancer but adding "in *some* cancers" would be less misleading. Additionally, although it is true that breastfeeding decreases the risk of all breast cancer types, I believe that the necessity for breastfeeding if you are Black needs to be emphasized. Low socioeconomic status and other historical experiences play a significant role in the lives of, and decisions made by Black women today. If these could be acknowledged to a greater extent by researchers and physicians alike, we may begin to reduce the lasting negative effects of these horrific historical events and can work to bridge the socioeconomic gap between minority groups and whites.

CONCLUSION

Based on my hypothesis and the research available, a major contributing factor of these differences in breastfeeding and breast cancer rates is based on the living experience of Black women, specifically implications of socioeconomic status. Low socioeconomic status often inhibits Black women from breastfeeding because of a demand to return to work, lack of benefits, financial insecurity, less professional lactation support etc. Breastfeeding is especially protective for TNBC which can mitigate the increased risk posed when parity rates are high, as seen in Black women. Various strategies and practices may be implemented that can increase the deflated rates of breastfeeding in this group which may also reduce the high TNBC risk. Improving the health of historically disadvantaged populations is critical for social justice, and this includes recognizing and improving barriers caused by many socioeconomic issues.

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Links to the 91 articles used in the analysis can be found in Appendix

APPENDIX

1. A Systematic Review of the Association between Breastfeeding and Breast Cancer
https://www.liebertpub.com/doi/abs/10.1089/jwh.2008.0917

2. Breastfeeding and Breast Cancer Risk
https://link.springer.com/article/10.1007/BF00051791

3. Knowledge of the Relationship Between Breastfeeding and Breast Cancer Risk Among Racial and Ethnic Minority Women
https://link-springer-com.wv-o-ursus-proxy02.ursus.maine.edu/article/10.1007/s13187-019-01580-9

4. Prospective assessment of breastfeeding and breast cancer incidence among 89,887 women
https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(96)90010-0/fulltext

5. Breastfeeding and breast cancer risk reduction: Implications for Black mothers
https://www.sciencedirect.com/science/article/pii/S0749379717303173

6. Parity, breastfeeding, and breast cancer risk by hormone receptor status and molecular phenotype: results from the Nurses' Health Studies
https://link.springer.com/article/10.1186/s13058-019-1119-y

7. Knowledge of the Relationship Between Breastfeeding and Breast Cancer Risk Among Racial and Ethnic Minority Women
https://link.springer.com/article/10.1007/s13187-019-01580-9

8. Racial/Ethnic Differences in the Impact of Neighborhood Social and Built Environment on Breast Cancer Risk
https://cebp.aacrjournals.org/content/26/4/541.figures-only

9. Differences in breast cancer incidence among young women aged 20-49 years by stage and tumor characteristics, age, race and ethnicity
https://link.springer.com/article/10.1007/s10549-018-4699-9

10. Awareness that breastfeeding reduces breast cancer risk
https://journals.lww.com/greenjournal/Citation/2020/12000/Awareness_That_Breastfeeding_Reduces_Breast_Cancer.14.aspx

11. Regional Variation in Disparities in Breast Cancer Specific Mortality Due to Race/Ethnicity, Socioeconomic Status, and Urbanization
https://link-springer-com.wv-o-ursus-proxy02.ursus.maine.edu/article/10.1007/s40615-016-0274-4

12. Breast Cancer Racial Disparities: Unanswered Questions
https://cancerres.aacrjournals.org/content/71/3/640.full

13. Variation in breastfeeding behaviors, low-income statewide sample of WIC participants in the U.S
https://onlinelibrary.wiley.com/doi/full/10.1111/j.1740-8709.2007.00105.x

14. Breastfeeding history, pregnancy experience and risk of breast cancer
https://www.nature.com/articles/bjc1997346

15. Psychometric testing of the breastfeeding self-efficacy scale- short form in a sample of Black women in the United States
https://onlinelibrary.wiley.com/doi/abs/10.1002/nur.20368

16. Racial and Geographic Differences in Breastfeeding - United States, 2011-2015
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5687589/

17. Understanding and effectively addressing breast cancer in African American women: unpacking the social context
https://acsjournals.onlinelibrary.wiley.com/doi/full/10.1002/cncr.29935

18. Disparities in race/ethnicity and socioeconomic status: risk of mortality of breast cancer patients in the California Cancer Registry 2000-2013
https://link.springer.com/article/10.1186/1471-2407-13-449

19. The independent associations of parity, age at first full term pregnancy, and duration of breastfeeding with the risk of breast cancer
https://www.sciencedirect.com/science/article/abs/pii/0895435689901613

20. First- and second trimester WIC participation is associated with lower rates of breastfeeding and early introduction of cow's milk during infancy
https://pubmed-ncbi-nlm-nih-gov.wv-o-ursus-proxy02.ursus.maine.edu/20430131/

21. Relationships between Family Levels of Socioeconomic Status and Distribution of Breast Cancer Risk Factors
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4360352/

22. Health Disparities in breast cancer: biology beats socioeconomic
https://link-springer-com.wv-o-ursus-proxy02.ursus.maine.edu/article/10.1007/s10549-010-0827-x

23. Progress in Increasing Breastfeeding and Reducing Racial/Ethnic Differences - United States
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4604816/

24. Racial Discrimination and Breast Cancer Incidence in the US
https://academic.oup.com/aje/article/166/1/46/135692?login=true

25. What do Pregnant low-income women say about breastfeeding?
https://www.liebertpub.com/doi/abs/10.1089/bfm.2009.0034

26. Racial and Ethnic Differences in Reasons for Breastfeeding Cessation Among women participating in the special supplemental nutrition program for WIC
https://onlinelibrary.wiley.com/doi/abs/10.1111/jmwh.13031

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AUTHOR'S BIOGRAPHY

Joanna LaFrance is a Biology major in the College of Natural Sciences, Forestry and Agriculture at the University of Maine. She will graduate in May of 2021 with a Bachelor of Science degree with a pre-medicine concentration. During her undergraduate education she worked as a Maine Learning Assistant and volunteered at the local hospital and covid-19 clinic. She was also a member of Women in STEM and Partners for World Health. Joanna has recently accepted a position at Southern Maine Health Care as an Emergency Department Technician. She is eager to immerse herself in the clinical setting and continue learning. She plans to further her education and attend graduate school in the hopes of working in the medical field, likely in women's health or pediatrics.