The Role of Nutrition and Breast Cancer, Preventive Measures, and Community Engagement- Addressing Breast Cancer Using a Community Lens

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Abstract

Background
Although breast cancer deaths are declining, new cases are on the rise. When observing incidence, mortality rates, and survival from breast cancer, studies show that preventative measures such as early detection and screening (i.e. mammography) increased breast cancer diagnosis and reduced deaths. According to the CDC, breast cancer is the most common cancer in women, regardless of race and ethnicity and it is the leading cause of death among women ages 40-50. Thirty percent (30%) of cancer deaths are due to diet and nutrition while 15% are attributed to genetics, and 15-20% have been linked to environmental factors. This article focuses on the intersection of all three factors (nutrition, genetics, and environment) using a sociological model to explore how each factor impacts breast cancer in low-income women. Moreover, we make the case that those who wish to help these communities need to complement their primary prevention and intervention models with community-based health promotion models to understand how genes are influenced by lifestyle and environment.

Objective
To explore the role that nutritional habits have on the incidence of breast cancer, emphasizing on preventive measures and community engagement.

Quality of Evidence
Peer-reviewed articles were identified by searching PubMed from January 2000 to July 2017 using the keywords: built environment, policy, health behavior, ecological models, primary prevention, dietary patterns, breast cancer, chronic disease, global health, inflammation, epidemiology of cancer, genomic expressions, health disparities, equity, under-resourced, and health equity in breast cancer, local, national, and global reports on cancer statistics, nutritional guidelines, population health reports, health disparities, equity, food groups, and potential cancer-fighting agents. The Authors found articles on Global Nutrition Research, Nutrition and Breast Cancer Prevention Models, Role of Nutrition in Preventing Cancer, and Adolescent Dietary Fiber, Vegetable Fat, Vegetable Protein, and Nut Intakes and Breast Cancer. The evidence showed that nutrition, genetics, and environment play a role in cancer and influence prevention models.

Key words
Socioecological model; Breast cancer; Global health; Built environment; Health policy; Nutrition; Health disparities; Community based participatory research

Introduction
Although breast cancer deaths are declining, new cases are on the rise [1]. When observing incidence, mortality rates, and survival from breast cancer, studies show that preventative measures such as early detection and screening (i.e. mammography) increased breast cancer diagnosis and reduced deaths [2]. According to the CDC, breast cancer is the most common cancer in women regardless of race and ethnicity, and the leading cause of death among women ages 40-50 [2]. As of 2015, 124.9 per 100,000 new breast cancer cases have been reported, contributing to the existing 242,476 breast cancer cases [1]. Thirty percent (30%) of cancer deaths are due to diet and nutrition while 15% are attributed to genetics, and 15-20 % have been linked to environmental factors [3]. This article focuses on the intersection of all three factors (nutrition, genetics, and environment) using a socioecological model to explore how each factor impacts...
breast cancer in low-income women. Moreover, we make the case that those who wish to help these communities need to complement their primary prevention and intervention models with community-based health promotion models to understand how genes are influenced by lifestyle and environment. To address this public health issue on a local, national, and global level a public policy framework is necessary that focuses on promoting healthy food consumption while addressing environmental factors that influence chromatin-based mechanisms of gene expression in low socioeconomic neighborhoods in communities of color [4].

Lifestyle factors in the development of cancer is shown in Figure 1. Only 5–10% of all cancers are due to an inherited gene defect. Research has shown that cancers are a result of multiple mutations [5]. This mutation is due to interaction with the environment.

Cancer results from multiple mutations in a cell line that turn off the cell's natural abilities to stop replicating [6]. These mutations may come from inherited genetic defects, but also, dietary and environmental influences like smoking, alcohol consumption, and infections. While an individual cannot modify her genes, her diet and environmental exposures can theoretically be adapted.

Researchers feel that individuals can reduce their cancer risk by as much as 40% by eating more vegetables, fruits, and other plants with certain phytochemicals in them [7] (Figure 2). Studies show that some phytochemicals may:

- help cells stop and wipe out any cancer-like changes
- help stop the formation of potential carcinogens
- help stop carcinogens from attacking cells

Additionally, Tamoxifen is approved by the FDA as a chemo preventive agent for reducing the risk of breast cancer. Tamoxifen was found to reduce breast cancer incidence by 50% in women considered high-risk [2]. When using tamoxifen, there is an increased risk of serious side effects such as uterine cancer, blood clots, ocular disturbances, hypercalcemia, and stroke [5] (Figure 3).

A Look at Prevention from a Community Level

The relationship between breast cancer, genetics, diet, and environment

Literature shows that the conditions where one is born, raised, lives, and works impacts health [4,8-11]. Historically, built environments in urban communities were developed without considering the resources and services community members needed to reach optimal health (Figure 4). As such, built environments in low-income communities are associated with low amount of physical activity, poor dietary habits, and poor health outcomes [4,8-11]. Exposure to inadequate housing, stress, lack of social support, lack of physical activity, smoking, poor diet, and lack of resources (i.e. strategies to prevent the development of breast cancer)

The socioecological model explains how wider structures in the community, society, and throughout the globe affect individuals’ health behaviors (Figure 5). The Center for Disease Control and Prevention (CDC) has adopted this approach to address breast cancer prevention [8]. Another reason this model is used is to allow for community-based participatory approaches to be adopted in order to engage the community in their overall health and wellbeing [17,18].

Prevention at an Individual Level

The individual level of the socioecological model identifies the individual characteristics that influence health behavior; such as knowledge, attitudes, beliefs and perceptions. At this level, the goal is to eliminate the risk factors associated with the disease and provide the necessary tools to help the immune system fight precancerous cells (primary prevention) [19].
In a report conducted by the World Cancer Research Fund and American Institute for Cancer Research (WCRF/AICR), a correlation was found between dietary habits and breast cancer. This research revealed that a diet rich in legumes, vegetables, and fruits with little to no meat or sweet drink consumption can assist in reducing the number of cancerous cells the body produces and boosts immune system [18]. This report also found a high correlation between breast cancer and trans-fat [18]. Trans-fat has been shown to increase the risk of mammary gland cancer, which weakens the immune system and increases the chances of developing breast cancer [20].

In addition to dieting, physical activity has been shown to reduce the risk of breast cancer. For instance, exercising for 30 minutes reduces the risk of developing breast cancer by 10–25%, compared to women who do not exercise [21]. Additionally, about 25% of breast cancer cases correlate with a sedentary lifestyle [22].

Additionally, it is crucial to encourage secondary prevention to prevent a malignant tumor from developing through early detection. At this level, health behaviors such as knowledge, attitudes, beliefs and perceptions influence the need, intent, risk, and benefits of seeking breast cancer screenings [23].

Mammography screenings have been shown to decrease the death risk by 15-20% [24]. According to the 2015 National Health Interview Survey, 50% of women reported obtaining an annual mammogram and 64% reported getting a mammogram in the past 2 years [25]. This is an advance from previous screening methods. In the 2003 National Health Interview Survey (NHIS) about 56% of breast cancers were found using self-administered breast examinations, even though, the American Cancer Society advises not to rely on administered breast self-exams (BSE) because they are unreliable.

Prevention at a Community and Societal (Policy) Levels

The community level of the socioecological model involves discussing the settings where relationships take place such as recreational areas, grocery stores, churches, health care services, transportation, and neighborhood infrastructure. At this level, it is important to address the health disparities community members experience.

Substantial research shows a strong correlation between breast cancer and the built environment where individuals grow up, live, work, and play [4,11]. For example, it is crucial the environment women live in provide them with easy access to affordable, healthy food options that decrease their chances of developing breast cancer. In addition, safe recreational spaces are needed so community members can go for a walk, jog, run, or engage in a physical activity class [21].

Equally important is addressing the poor neighborhood infrastructure (i.e. overextended transportation system) that serves as a barrier to seeking high quality health services. Being uninsured or experiencing financial hardships are two factors strongly correlated with higher rates of late-stage breast cancer diagnosis [3,27]. In low-income communities, lack of transportation and excessive travel times serve as barriers to early detection of breast cancer [1]. The lack of access to health care services, such as free to low cost breast exam screenings, or not having the equipment to administer mammography exams, has detrimental effects on low-income communities since it delays the early detection of breast cancer [28].

If researchers hope to address community-level factors that harm health, they need to partner with members of that community who have the most profound understanding of their communities’ social ecology, health needs, strengths, and how leverage its own resources. At the same time, community members hope to partner with researchers to build their own capacity, improve their communities’ access to high quality health services. This type of research partnership is known as community-based participatory research. This relationship-based research capacity-building offers a promising way to eliminate breast cancer detection disparities by offering a fuller consideration of factors influencing breast cancer at all levels of the socioecological model.

For example, in a community-based study designed to measure the effects of a church-based breast cancer education program on African-American women, church-based programming along with social support and resources impacted health behaviors [19]. The church-based educational program increased the rates of breast cancer screenings such that about 64% of those who fully participated and 79% of participants that partially participated in the program sought breast cancer screening services [19].

In a study funded by the National Cancer Institute, a community-based initiative was established between Women’s Health Network Program (WHN), Mass Health (Massachusetts’ Medicaid program), and the YMCA to create a culturally relevant free breast cancer screening program for low-income women via a mobile unit [7]. During the five days the mobile unit provided services, an estimated 183 women received mammography screening, of whom 92% were Hispanic/Latina with Spanish as their primary language, 46% were uninsured, and 42% reported having at least a high school education [7]. For the women who reported being uninsured at the time of registration, 92% enrolled into the Women’s Health Network (WHN) Program to receive free access to health care services [7].
Time and time again research has shown an association between chronic diseases and environmental and social determinants, and breast cancer is no exception [29]. But if we hope to move one step further and impact the early breast cancer detection in many communities, policy change is needed.

The CDC recommends the federal, state, and local governments be involved in breast cancer prevention activities to create policies that can positively impact health outcomes. This includes collaborating with policymakers to create policies that can address the poor neighborhood infrastructure in low-income communities such as lack of access to recreational spaces, healthy food, adequate housing and transportation in addition to the lack of access to quality health care services at all levels of the socioecological model [30].

Through the use of public health research, legislators and government officials have been able to develop and enforce laws to protect the health of its constituents. One example of this are federal, state, and local governmental anti-tobacco policies. Epidemiology was able to capture how first and secondhand smoke leads to “cancer, heart disease, and lung disorders”. And now there are policies that protect the health of all people as smoke-free places have been enforced.

More recently, food legislation has been introduced that has focused on nutritional guidelines, prohibited unhealthy food options from being offered at schools, and promoted physical activity through education and screening programs [31]. Although, these bills have helped protect the health of children by addressing school-based food environments, it is important to note that in order to alleviate health inequalities associated with social and environmental conditions, policies are needed to prevent exposure to risk factors that negatively impact the health of community members living in low-income communities.

For this reason, policies need to be clear, translated, transparent, and understood by community members so they are informed and involved in keeping policymakers accountable. This way low income communities and communities of color will be empowered to engage in decision making to create environmental changes.

Prevention at a Global Level

Breast cancer rates are rapidly increasing around the globe. In data found for 2012, more than 1.7 million new cases of breast cancer occurred among women globally [32]. Research shows that gene expression is controlled by epigenetic heritage and environmental factors that are influenced by diet, lifestyles, chemicals in the environment, and social groups [4]. Many studies have measured the impact diet has on epigenetics, and has been proven to influence breast cancer outcomes. Yet, current practices do not have the reach to address the diet and epigenetics globally [4].

The World Health Organization (WHO) has indicated that low and middle income (LMI) countries are heavily burdened. Because of their poor economic situation, most of these LMI countries lack the proper infrastructure to support their populations’ health and well-being. As such, LMI countries are in need of primary prevention models that can address poor nutrition and lack of infrastructure. By creating a comprehensive infrastructure that can promote their health, it can support their livelihood and decrease the incidence of chronic diseases such as breast cancer. Since nutrition helps to aid in prevention and intervention of cancer it is very important for the global world to take notice of the IBNCN initiative.

The International Breast Cancer & Nutrition (IBCN) initiative brings together teams of clinicians, researchers, and other stakeholders to develop a model that includes detection and intervention with us. The story inspired us to write this article. From this story, we learned that economic cost has to be factored into primary prevention. Understanding the limited environment Barbara Cunningham mother came from could have prevented her from being diagnosed with cancer in her 40s and passing at young age.

Figure 6: IBNC research project model illustrating the connection between epigenome, dietary habits, and types of cancer. www.ncbi.nlm.nih.gov/pmc/articles/pmc3901298

Main Message

When the interplay between all three factors (nutrition, genetics, and environment) is explored, researchers get a better understanding of how these factors influence a woman’s chance of surviving breast cancer. To alleviate health inequalities associated with social and environmental conditions, policies are needed to prevent exposure to risk factors. To achieve this, researchers need to partner with members of that community who have the most profound understanding of their communities’ health needs. By engaging community, culturally relevant preventative measures and policies can be developed to detect breast cancer early.

Conclusions

Studies have repeatedly shown the impact nutrition, genetics, and environment have on breast cancer. To protect the health of low-income women, primary prevention needs to be complemented with community-based health promotion models that are culturally sensitive to the community health needs. This can lead to culturally competent preventative measures that could help detect and screened for breast cancer early. In addition, community engagement can also lead to environmental policies to protect and promote the health of low-income women at all levels of the socioecological model (individual, community, societal, and global).

Acknowledgments

We thank Barbara Cunningham for sharing her mother’s story with us. The story inspired us to write this article. From this story, we learned that economic cost has to be factored into primary prevention. Understanding the limited environment Barbara Cunningham mother came from could have prevented her from being diagnosed with cancer in her 40s and passing at young age.

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