EXAMINING RACIAL AND ETHNIC HEALTH DISPARITIES AMONG WOMEN WHO RECEIVED BREAST CANCER SCREENINGS

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DEDICATION

Dedicated, in gratitude, to those family and friends, and professors, who have
guided and inspired me in incalculable ways. I couldn’t ask for more encouraging, capable,
or patient people in my life. Thank you!
All the adversity I've had in my life, all my troubles and obstacles, have strengthened me... You may not realize it when it happens, but a kick in the teeth may be the best thing in the world for you.

- Walt Disney
ABSTRACT OF THE THESIS

Examining Racial and Ethnic Health Disparities Among Women Who Received Breast Cancer Screenings
by
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In the United States, according to the American Cancer Society, breast cancer is the second most fatal cancer in women with a 1 in 8 lifetime probability of having breast cancer. An estimated 40,170 deaths in 2009 accounted for 15% of cancer fatalities in women. Incidence continues to rise as women age and minority populations increase. This study aimed to identify what breast cancer screening exams were utilized. Data from The National Health Interview Survey (NHIS) 2010 from CDC, investigated trends in types of Breast Cancer screening exams; no screening, only clinical breast exam, only mammogram, or both exams in women 40 years and older. The study explored relationships of type of breast cancer screening exams by race/ethnicity, age, family history of breast cancer, educational attainment, health insurance, household income, region/geographical location, and visitation to one’s doctor. In total 14,900 women reported about their breast cancer screening experience, 79.8% of women reported receiving some type of breast cancer screening exam. Using univariate and multivariate polychotomous logistic regression, women aged 60-69 had statistically significant odds of having only CBE, only mammogram, or both exams in OR = 10.2 (95% CI 6.46, 15.5), OR = 6.17 (95% CI 3.36, 10.2), OR = 8.04 (95% CI 4.84, 13.7) than women 70 years and older. With multivariate analysis significant associations between family history of breast cancer (p = 0.0144), health insurance (p = <0.0001), and visitation to one’s doctor (p = <0.0001) were associated with being screened for breast cancer. Contrary to hypothesis, the final weighted model showed no significant differences between race/ethnicity and screening type. Interestingly, 10.2% of women with insurance neglected any screening type. In supporting Healthy People 2010 and 2020, this study will provide important research for future directions in the development and implementation of programs that influence and persuade women to receive breast cancer screening for early detection and control of breast cancer.
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CHAPTER 1

INTRODUCTION

BACKGROUND

The Centers for Disease Control and Prevention (CDC) report that nearly 70% of deaths among Americans each year are due to chronic diseases (Kung, Hoyert, Xu, & Murphy, 2008). Of these diseases, heart disease, cancer, diabetes, and chronic obstructive pulmonary disease (COPD) account for 50% of all deaths and over $500 billion dollars in direct and indirect costs in the United States each year (Xu, Kochanek, Murphy, & Tejada-Vera, 2010). Furthermore, the National Vital Statistics Report estimates that these chronic diseases led to 1,378,248 deaths in 2007 (Xu et al., 2010). Among racial/ethnic groups, there are clear differences in the burden of chronic disease. The national age-adjusted cancer death rate in 2006 was 181.1 per 100,000 and highest among Blacks (218.8 per 100,000), followed by Whites (180.1 per 100,000), then American Indian/Alaska Natives (120.4 per 100,000), Hispanics (119.4 per 100,000), and Asian/Pacific Islanders (107.8 per 100,000) (National Program for Cancer Registries [NPCR], 2010).

While there is significant work to be done in the area of decreasing the burden chronic disease has on Americans, significant differences among racial/ethnic groups in chronic diseases impact the nation as a whole. These differences in health outcomes are termed health disparities. The United States Public Law 106-525 defines health disparities as a “a significant disparity in the overall rate of disease incidence, prevalence, morbidity, mortality or survival rates in the population as compared to the health status of the general population” (United States Department of Health and Human Services [DHHS], 2005). Health disparities have been documented in heart disease, infant mortality, cancer, stroke, asthma, and various infectious diseases (Baltimore City Health Department [BCHD], Office of Epidemiology and Planning, 2010). These disparities are partially driven by differences in access to resources, health care and healthy decision making opportunities (BCHD, Office of...
Epidemiology and Planning, 2010). Many subgroups are affected by disparities and include racial/ethnic groups, residents of rural areas, those with disabilities, women, children, and elderly populations who lack the ability to obtain such resources and care (United States National Library of Medicine [NLM], 2010).

According to the World Health Organization (WHO; 2010) 7.0 million deaths worldwide each year can be attributed to cancer. In the United States, it is the cause of 1 in 4; accounting for an estimated 569,490 fatalities in 2010, making it the second leading cause of death in the United States. The American Cancer Society (ACS; 2009) estimated there would also be 1.52 million new diagnosed cancer cases for 2010. The lifetime probability of a women being diagnosed with invasive breast cancer is 1 in 8, making it a major health concern. Breast cancer can affect both men and women; however, this paper will focus on breast cancer and screening in women, as it is found more frequently in the female gender (Jemal et al., 2009).

Although there are some risk factors for breast cancer that can be controlled, the more potent risk factors, such as age, genetics, race, family history, and gender are not modifiable. Early diagnosis of breast cancer is extremely important and is strongly associated with reduced mortality. The major factor or key to early diagnosis, when breast cancer is still local or regionalized, is education and regular screening for breast cancer. Among the most common screening tools are Clinical Breast Exam (CBE) and Mammography. The importance of routine CBE’s and mammograms are widely disputed, however, and recommendations vary across organizations. Guidelines for CBE range from being strongly recommended annually for certain age groups, to no considerations of recommendations one way or the other because of insufficient evidence, mammograms are widely known to be performed routinely without hesitation. Whether there is disparity in age, ethnic identity, family history of breast cancer, education, or socio-economic status between women who receive CBEs and mammograms are important when identifying target groups for breast cancer screening.

Over the past 30 years, health professionals and policy makers have increasingly invested more time on addressing health disparities at the local, state, and national levels. Research indicates that health disparities negatively impact the health of not only those who are directly affected, but also of the surrounding community and local area (Office of
Minority Health and Health Disparities [OMHD], 2009). To eliminate these disparities, policy makers, and public and private organizations have made strides to identify and address disparities in populations throughout the nation. For example, the DHHS (2000) made eliminating health disparities a major goal of Healthy People 2010 and local health departments have followed suit. In addition, several state and local health departments, such as the Georgia Department of Community Health [DCH] Minority Health Advisory Council, (2008) and the Baltimore City Health Department’s Office of Epidemiology and Planning (2010) have developed health disparity reports to address health concerns and issues in their local cities and communities. As health disparities becomes a more prevalent avenue of interest, further research of these disparities and their etiology will be needed.

**STATEMENT OF THE PROBLEM**

In September 1990, the Department of Health and Human Services released Healthy People 2000: National Health Promotion and Disease Prevention Objectives, a strategy for improving the health of Americans by the end of the century (DHHS, 2000). In January 2000, the Department of Health and Human Services launched Healthy People 2010 building on similar initiatives pursued over the preceding two decades (DHHS, United States Preventive Services Task Force [USPSTF], 2009). Healthy People 2000 contained 319 unduplicated main objectives grouped into 22 priority areas, with cancer being the 16th priority, and female breast cancer deaths was 8th on the Health Status Indicator (CDC). Healthy People 2020 increased objectives to 467 and into 28 focus areas. Cancer has increased in priority to 3rd with the importance of two overarching goals — to increase quality and years of healthy life and to eliminate health disparities. In the Department of Health and Human Services targeting disparities and cancer within our population, breast cancer is a prime target and concern for our society including understanding the factors associated with this disease.

Breast Cancer is a major health concern in the United States. Early detection has been shown to decrease mortality rates of those who have been diagnosed with breast cancer (WHO, 2010). While the exact contribution of CBE to early detection is to some extent controversial and difficult to determine, many breast cancers are first detected by self-examinations or from CBE and then later confirmed and diagnosed through technical
imagining as in mammography (WHO, 2010). Studies have looked at trends in CBE usage over time by age group as well as the factors that are associated with where women receive CBE. These studies are among women 40 and older who have received a CBE within the last 2 years. Past studies have not looked at associations among women 40 years and older who receive CBE’s or mammograms in the recommended breast cancer screening suggested by American Cancer Society. This study will examine and provide an estimate of the prevalence of clinical breast exams (CBE’s), mammograms, both or no screening exams among women ages 40 and older from the 2010 National Health Interview Survey (NHIS; National Center for Health Statistics, 2010), as well as assesses factors and predictors associated with breast cancer screening within the public.

**PURPOSE OF THE STUDY**

The main purpose of this study was to determine the prevalence of Breast Cancer screening and specific types of screenings women have received. Breast Screening types included; no screening exams, a clinical breast exam only, mammogram only, or both CBE and mammogram exams together in women ages 40 years and older using a nationally representative data. In addition, to evaluate other factors associated with breast cancer screening exams which include demographic characteristics and personal factors such as family history of breast cancer, region/geographical location, income, and yearly visit with a women’s health doctor. Finally using multivariate analysis determining what factors and characteristics predict what specific type of breast cancer screening exam was received by women. The results from this study may help in gaining a better understandings of what influential factors enforce and persuade women to receive clinical breast exams and mammogram for the early detection and control of breast cancer.

**GOALS AND HYPOTHESES**

1. There will be Health Disparities in the receipt of both Clinical Breast Exam and Mammogram within the population sampled.
   - Whites and Asian American will have a significantly higher rates than of adherence for both CBE and mammogram, whereas African American and Hispanics will have significantly lower rates of CBE and mammograms.

2. Characteristics under investigation will include; race/ethnicity, socioeconomic status (income, educational attainment, and health insurance coverage) and geography will
be significantly associated with receipt of Clinical Breast Exam and Mammogram together than those who are limited with resources.

- Those with a higher socioeconomic status, positive health behaviors, and reside in urban areas will have higher rates adherence to screening with both of CBE’s and mammograms than those who are in lower socio-economic status.

**THEORETICAL BASIS**

Studies have consistently shown there to be an association between socio-economic status and demographic factors on how often a women receives breast cancer screening. Studies have also looked at what factors are associated with where women receive CBEs, as well as trends in CBE usage over time. While the results have found mammogram usage increased for women of all ages from 1990 to 2000, usage of CBEs has been shown to have declined (Meissner, Breen, & Yabroff, 2003). These studies were composed of a population of women 40 years and older who have had a CBE within the last 2 years (Coughlin, Sabatino, & Shaw, 2008; Meisser et al., 2003). The age at which the American Cancer Association recommends annual CBE is at age 40 and earlier for those women who have an elevated risk of breast cancer.

A number of studies have looked at how demographic factors and socioeconomic status are associated with the receipt of CBE. Older age, lower education attainment, and Hispanic ethnicity are associated with a lower prevalence of CBE within the last 2 years (Coughlin et al., 2008; Meisser et al., 2003). This study aims to estimate the prevalence of three types of screening within the last year for women 40 years and older, while exploring the associations between screening types, demographic characteristics and personal factors such as family history of breast cancer, region, income, race, education, and yearly visit to a women’s health doctor.

In order to explain the differences among race/ethnic groups this study draws upon psychosocial theory about health disparities. To explain the role race/ethnicity plays in health status is Resource Deprivation Theory. The *Resource Deprivation Theory* explains the role that resources play on the impact of health. Specifically, the theory states that minorities live in communities lacking resources that promote a healthy lifestyle (LaViest, 2005). These resources include access to nutritious foods), health care, high quality jobs, educational opportunities, and parks/recreational areas. Socioeconomic status (income, educational
attainment, and health insurance coverage) and behavioral activities were used to assess this theory in the study. Those women whom are lacking knowledge of breast cancer screening availability, ACS recommendation, lack in health insurance, and basic resources as in transportation to a health care facility all effect the type of breast cancer screenings a women will receive.

**LIMITATIONS OF THE STUDY**

This study has a number of limitations. First and foremost, this study uses population data from 2010 NHIS (National Center for Health Statistics, 2010) to analyze breast cancer screening. Thus, conclusions can only be made at the group level – results cannot be directly attributed to the individual. However, given that the country addresses health issues at the population level, results and conclusions will still be beneficial in providing information about the regions and racial/ethnic groups.

Additionally, the behavioral variables of interest were self-reported, and thus may not represent the true activity of the population. Next, proxies were used to assess socioeconomic status and access to resources. Lastly, this study used a cross-sectional design – causal inferences can be made about the study.

**BASIC ASSUMPTIONS**

1. Results from this analysis will be generalizable to the overall population.
2. Self reported responses to the questionnaires are accurate.
3. Methods of administering the computer-assisted personal interviewing (CAPI) by Census interviewers are standardized across all U.S sites and have remained constant throughout the 2010 NHIS Survey.
4. Study data was entered correctly and accurately.

**DEFINITIONS**

**Health Disparity** – A gap in the quality of health care or health status by group – often by racial/ethnicity, socioeconomic status, and gender.

**Ductal carcinoma in situ (DCIS)** - most common type of noninvasive breast cancer forming in the cell lining of the ducts of the breast

**Invasive ductal carcinoma (IDC)** - when diagnosed is the most common type of invasive breast cancer among women

**BRCA1 or BRCA2** – mutated genes associated in familial breast cancer
USPSTF (United States Preventive Services Task Force) - conducts scientific evidence reviews of a broad range of clinical preventive health care services (such as screening, counseling, and preventive medications) and develops recommendations for primary care clinicians and health systems.

**ACRONYMS**

ACR  American College of Radiology  
BIQSA  Breast Imaging Quality Standards Act  
BI-RADS  Breast Imaging Reporting and Data System  
CAD  Computer-Aided Detection  
DCIS  Ductal Carcinoma in Situ  
FDA  Food and Drug Administration  
FN  False Negative  
FP  False Positive  
GAO  Government Accountability Office, formerly General Accounting Office  
IOM  Institute of Medicine  
LCIS  Lobular Carcinoma in Situ  
MQSA  Mammography Quality Standards Act  
SBI  Society of Breast Imaging  
SEER  Surveillance, Epidemiology, and End Results  
TN  True Negative  
TP  True Positive
CHAPTER 2

LITERATURE REVIEW

In the past century, significant progress has been made in the prevention and treatment of diseases in the United States. In this, the burden of infectious disease has dramatically declined. However, in its place, the prevalence of chronic diseases has increased. Nationally, chronic disease has a dramatic effect on residents, health care facilities, and health care professionals. However, the burden these chronic diseases such as cancer have on racial/ethnic groups vary. Health disparities further exacerbate the burden chronic disease has on the nation and complicate the process in developing prevention measures to reduce these illnesses. Researchers have identified health disparities between racial/ethnic groups in cancer, and chronic diseases (Thomson, Mitchell, & Williams, 2006). Several studies have identified these disparities at the individual level, while fewer have attempted to address disparities at the collective level (Yin et al., 2010). Additionally, few studies have attempted to understand the role that geography plays in development of health disparities between racial/ethnic groups.

GLOBAL IMPACT

According to the World Health Organization (2010) 7.9 million deaths worldwide each year can be attributed to cancer. For women, breast cancer makes up 16% of all cancer cases, making it the most common form of cancer among women across all countries, regardless of the countries’ socioeconomic status. Although some risk factors can be determined through healthy diet, exercise, and not smoking (for example), they will not have a major impact on the majority of breast cancer cases. Early detection, through education and screening for breast cancer remains the key to breast cancer control contributing to increasing survival, in both developing and developed countries (WHO, 2010).
IMPACT IN THE UNITED STATES

Cancer is the second leading cause of death in the United States, causing 1 in 4 deaths, and accounting for an estimated 565,650 fatalities in 2008. The American Cancer Society (2009) estimated that there would also be 1.41 million new diagnosed cancer cases in 2008. For women, the leading three diagnosed sites of cancer are the breast, lung and bronchus, and colon and rectus. Although incidence rates have declined by 3.5% from 2001 to 2004 for breast cancer among women, it is still the most commonly diagnosed, accounting for 27% of all new cancer cases, with the number of diagnosed in 2009 estimated to be 192,370 (not including in situ breast cancer cases which was estimated to be 63,280). Breast cancer is also the second most fatal cancer in women, with an estimated 40,170 deaths in 2009, accounting for 15% of cancer fatalities in women, again second only to lung cancer. For women ages 40-79, breast cancer is the leading causes of death, giving women 1 in 8 probability of having breast cancer within their lifetime (Jemal et al., 2008, 2009).

OVERVIEW OF BREAST CANCER

Breast cancer can begin in different areas of the breast – the ducts, the lobules, or in some cases, the tissue in between. The female breast is composed of mostly milk glands (lobules), ducts that carry the milk to the nipple, and fatty and connective tissue called stoma. Although some cancer starts in the lobules and other tissues, the cells that line the ducts of the female breast are the most common sites where breast cancer starts and forms. Cancer that begins in the lobules or the ducts are commonly called adenocarcinomas (glandular tissue cancer), and can be classified as noninvasive (carcinoma in situ) or invasive (spreading beyond the original site and layer of the cells). Sarcomas, cancers forming and starting in connective tissue, are not commonly found in the breast. With the different sites of breast cancer formation, there are different types of breast cancer within the breast, and the same tumor can have a combination of the different types of cancer, as well as characteristics of being invasive and noninvasive. Certain and different specific types of breast cancer are easier to detect than others, and some forms of breast cancer are more easily detected with certain types of screening methods. The more common types of breast cancer are ductal carcinoma in situ, lobular carcinoma in the situ, invasive ductal carcinoma, and invasive lobular carcinoma (ACS, 2009).
Types of Breast Cancer

Ductal carcinoma in situ (DCIS), is the most common type of noninvasive breast cancer, and starts forming in the cell lining of the milk ducts of the breast, accounting for about 1 in 5 newly diagnosed cases of breast cancer found in women. Fortunately, DCIS is usually curable if discovered and treated. Even though ductal carcinoma in situ is noninvasive, it is imperative that women with the disease receive medical treatment because it can be a precursor of invasive cancer. Experts believe that 20 to 50% of women with DCIS will later develop an invasive breast cancer within 10 years of the DCIS diagnosis. The invasive cancer usually develops in the same breast and in the same quadrant of the breast that the DCIS first occurred. Lobular carcinoma in situ (LCIS) is also noninvasive; however, women with LCIS may have a higher chance or developing an invasive breast cancer later on in their life, either in the same breast of the other breast. Invasive lobular carcinoma makes up a small portion of all breast cancers. The most common type of breast cancer begins in the breast ducts (ductal carcinoma). Some breast cancers contain both lobular and ductal cancer cells.

Invasive/Infiltrating ductal carcinoma (IDC) when diagnosed is the most common type of invasive breast cancer among women, accounting for 8 out of 10 invasive breast cancers. IDC is the most common type of breast cancer representing 78% of all malignancies. These lesions appear as stellate (star like) or well-circumscribed (rounded) areas on mammograms. The stellate lesions generally have a poorer prognosis. According to the American Cancer Society (2009), more than 180,000 women in the United States have invasive breast cancer each year. Most of them are diagnosed with invasive ductal carcinoma. Although invasive ductal carcinoma can affect women at any age, it is more common as women grow older, about two-thirds of women are 55 or older when they are diagnosed with an invasive breast cancer (ACS, 2009). Invasive/Infiltrating lobular carcinoma (ILC) is the second most common type of breast cancer after invasive ductal carcinoma it is not as common of an invasive cancer, accounting for about 1 in 10 newly diagnosed invasive breast cancer cases, and may be harder to detect and diagnose from a mammogram, representing 5% of all diagnosis. Although invasive lobular carcinoma can affect women at any age, it is more common as women grow older, two-thirds of women are
55 or older, ILC tends to occur later in life than invasive ductal carcinoma — the early 60s as opposed to the mid- to late 50s as IDC diagnosed individuals (ACS, 2009).

The less commonly diagnosed and acquired types of breast cancer are Triple-negative breast cancer, Inflammatory breast cancer (IBC), Metaplastic carcinoma, Medullary carcinoma, Tubular carcinoma, Mucinous carcinoma, Paget disease of the nipple, Papillary carcinoma, Phyllodes tumor, and Angiosarcoma. Triple-negative breast cancer cells tested negative for estrogen receptors (ER-), progesterone receptors (PR-), and HER2 (HER2-), about 10-20% of breast cancers — more than 1 out of every 10 — are found to be triple-negative. Inflammatory breast cancer (IBC) is a rare and aggressive form of breast cancer, the National Cancer Institute states that about 1-5% of all breast cancer cases in the United States are inflammatory breast cancers. Diagnosis for IBC in the United States is around 57 years of age for white women and 52 years of age for African American women. These ages are about 5 years younger than the average ages at diagnosis for other forms of breast cancer. According to the American Cancer Society, inflammatory breast cancer is more common in African American women. Metaplastic carcinoma of the breast begins when normal cells in the breast begin to change and grow uncontrollably, accounting for less than 1% of all invasive breast carcinomas. Medullary carcinoma can occur at any age, but it usually affects women in their late 40s and early 50s. Medullary carcinoma is more common in women who have a BRCA1 mutation. Studies have shown that medullary carcinoma is also more common in Japan than in the United States. Tubular carcinoma at one time accounted for about 1-4% of all breast cancers by the early 50s, although women can be diagnosed with it at any age. Mucinous carcinoma represents approximately 1% to 2% of all breast carcinoma diagnosed at any age, it tends to affect women after they’ve gone through menopause, average age at diagnosis is in the 60s or early 70s. Invasive papillary carcinomas of the breast are rare, accounting for less than 1-2% of invasive breast cancers. In most cases, these types of tumors are diagnosed in older women who have already been through menopause. Paget's disease of the nipple is a rare form of breast cancer accounts for less than 5% of all breast cancer cases in the United States, 97% of people with Paget's disease also have cancer, either DCIS or invasive cancer, somewhere else in the breast according to the National Cancer Institute. Phyllodes tumors of the breast are benign (not cancerous), some are malignant (cancerous) and some are borderline (in between noncancerous and cancerous) are rare,
accounting for less than 1% of all breast tumors, developing in the women’s 40s - benign diagnosed at a younger age. Angiosarcoma of the breast accounts for about 0.04%, or one in 2,500 cases of all breast cancer diagnoses.

After being diagnosed and determining the specific kind of breast cancer, it is also imperative to know the tumor size, lymph node status, endocrine receptor status (ER, PR status) and HER2 status (human epidermal growth factor receptor 2) in order to determine the best course of therapy. As of today, there are four different molecular subtypes of breast cancer tumors – Erb B2+, basal-like, normal-like, and ER+/luminal-like (of which there is a difference between Luminal A and Luminal B). The level of aggressiveness of tumor formation and the chance of recurrence changes for the different molecular subtypes (Cianfrocca & Gradishar, 2009).

Unfortunately, most breast cancer are either ILC or IDC. The axillary lymph nodes under the arms, to which most of the lymphatic blood vessels in the breast are connected, the internal mammary nodes inside the chest, and the supraclavicular or infraclavicular nodes above and below the collarbone are sites examined when determining if cancer has spread further. The more lymph node involvement, the greater and higher the chance the cancer has spread to the bloodstream and metastasized in other areas within the body. It is important to note, however, that metastases are not contingent upon the spread to lymphatic system, nor does the spread within the lymphatic system indicate that metastases will occur. Earlier detection of cancer within the breast, increases the chance the cancer will be localized to a single site and has the possibility of not spreading or reaching to the lymphatic system or metastatic, indicating a greater chance for treatment success and survival.

**RISK FACTORS FOR BREAST CANCER**

The actual etiology of breast cancer is yet unknown, and many risk factors are still being investigated. Like many complex diseases, there is no single indication that any specific factors are directly causal. Some risk factors, such as poor diet and physical health characteristics, can be modified through lifestyle changes and may help reduce the risk for breast cancer. Other risk factors, such as age, change over time within a women’s life. Although there may be a combination of factors that cause elevated risk, the factors which are found to be highly associated with the increase occurrence of breast cancer are not
modifiable. These non-modifiable risk factors such as gender, age, race, genetics, and family 
history put women at a higher risk for breast cancer. While the presence of risk factors does 
not indicate diagnosis of the disease and development, nor does the absence of apparent risk 
factors indicated the individual will be cancer free. Awareness of the risk factors and 
knowing one’s own personal risk for breast cancer is tremendous to the individual and could 
potentially encourage certain proactive measures in risk reduction and also in behavior and 
approach to screening.

**Gender**

Breast cancer can affect men and women and is not a gender exclusive. While men 
can be diagnosed with breast cancer, it is 100 times more common among women, making 
gender a major risk factor for breast cancer. In 2009, 192,350 women are estimated to be 
newly diagnosed with breast cancer, compared with 1,910 men (Jemal et al., 2009). The sex 
steroid hormone estrogen is a major contributor to why women are more at risk than men for 
breast cancer. While the testes produce tiny amounts of estrogen the majority of estrogen is 
produced by a woman’s ovaries from menarche to menopause. Increased exposure to 
estrogen is therefore important and age at menarche as well as the age of bearing their first 
child and the use of hormone therapy is taken into consideration for determining overall risk. 

Estrogen has many functions including increasing bone density as well as 
proliferation and differentiation of breast epithelium. Specifically, E2 (17B-Estrogen) 
promotes proliferation of normal and transformed epithelial cells by acting as a modifier of 
genes involved in the cell cycle and apoptosis, which if deregulated is the hallmark for 
cancer. There has been mounting evidence that estrogen acts as a promoter of the 
development and progression of breast cancer (Lewis-Wambi & Jordan, 2009). The 
Women’s Health Initiative, a large randomized trial designed to look at the benefits of 
hormone replacement therapy on chronic disease risk in postmenopausal women, was 
stopped early when the number of cases of breast cancer diagnosed in women receiving 
estrogen plus progestin exceeded those in the placebo group. Although hormone therapy 
usage is still considered controversial, this trial showed not only an increase in invasive 
diagnosed breast cancer, but breast cancer diagnosed in later stages of progression in women 
receiving estrogen plus progestin compared to the placebo group (Chlebowski et al., 2003).
The implication of estrogen in breast cancer is further corroborated in the success of treating breast cancer with Tamoxifen, whose mechanism block estrogen, and Aromatase Inhibitors, which blocks estrogen synthesis. Some studies have even shown a benefit in the removal of a woman’s ovaries, an oophorectomy, for reducing breast cancer risk in premenopausal women (Lewis-Wambi & Jordan, 2009).

**Age**

Age is the strongest and most prevalent risk factor for being diagnosed with breast cancer after gender, regardless of all other risk factors. The likelihood of developing invasive breast cancer increases dramatically with every year in age. The probability of developing invasive breast cancer from birth to 39 years of age is 1 in 208, or less than 0.5%. The probability increases substantially among 40 to 59 years old, who have a probability of 1 in 26. Among 60 to 69 year olds the probability is 1 in 29 (Jemal et al., 2009), with the median age of diagnosis for all women being 61 years old. (Mahoney, Bevers, Linos, & Willett, 2008). The probability of developing invasive breast cancer among women 70 years of age and older is 1 in 16; taking all this into account the lifetime risk of a women being diagnosed with any form of breast cancer is 1 in 8, or a 12.5% chance.

**Ethnicity/Race**

Ethnicity and Race are also a strong risk factors for being diagnosed with breast cancer. White females are estimated to have the highest incidence rate per 100,000 among ethnicities (130.6) in 2009, with African American women in a close second (117.5). All other ethnic groups besides African American and White have lower incidences rates across all cancer sites, including breast. The estimated incidence rates per 100,000 for being diagnosed with breast cancer in 2009 was 90.1 for Hispanic/Latinas, 89.6 for Asian Americans and Pacific Islanders, and 75.0 for American Indian and Alaskan Native. The reasoning for higher incidence rates for diagnosed breast cancer in White women compared to other ethnicities could be both due to etiological risk factors, such as having their first child later in life and higher usage of hormonal therapy for menopause, or diagnostic factors, such as better access to health care with regular check-up and screening (Jemal et al., 2009).
Family History

It is estimated that 20-30% of women diagnosed with breast cancer have a family history of breast cancer (Rosman, Kaklamani, & Pasche, 2007). Risk of the individual is known to increase with a family history of diagnosed breast and/or ovarian cancer. While one’s risk increases with a family history of diagnosed breast cancer on both the maternal and paternal sides, its increase is greatest with first degree relatives (biological mother, sister, daughter). Having at least one first degree relative with diagnosed breast cancer can increase breast cancer risk as much as 2-4 times (Eberl, Sunga, Farrell, & Mahoney, 2005). As the number of known relatives with breast cancer increases, so does the risk of the individual. The age of diagnosis of a relative is relevant. Risk of a individual increases the younger the age of the diagnosed relation. The greatest risk is when both the age of diagnosis of the relative and the age of the individual are both below 50 years of age (Collaborative Group on Hormonal Factors in Breast Cancer, 2001).

Genetics

The most well-known genetic culprits in familial breast cancer are the BRCA1 and BRCA2 genes. Among women diagnosed with breast cancer who have a family history of breast cancer, it is common to have BRCA1 or BRCA2 gene mutations. As many as 30% of Ashkenazi Jewish women diagnosed under the age of 40 have a BRCA1 or BRCA2 mutation, making this ethnic group a target for genetic counseling and proactive treatment. While the exact role of BRCA genes in breast cancer is unknown, BRCA1 and BRCA2 genes are associated with double strand DNA break and repair by homologous recombination. This type of mutation can impact treatment resistance and may also increase risk of reoccurrence or new primary breast cancer (Meiser et al., 2008). Although the genes actual function is not known, deleterious BRCA1 mutation is worse than BRCA2 mutations, and increases a women’s lifetime risk of breast cancer to 82%. However BRCA1 and BRCA2 genetic mutations only account for 3-8% of all diagnosed breast cancer cases, which leaves a tremendous gap in the knowledge in the understanding and knowledge of breast cancer genetics (Rosman et al., 2007).
DISPARITIES AMONG WOMEN WHO RECEIVE CLINICAL BREAST EXAMS

There are significant disparities among women who receive cancer screening, which in turn can influence disparities in mortality from breast cancer. Ethnicity/race is often looked at, nevertheless, is not typically significant after adjusting for demographics and personal characteristics (Coughlin et al., 2008). While Latinas are less likely than non-Latinas to have received a CBE, the difference is thought to be due to lack of access to health care and a regular healthcare provider. Some factors that have been shown to influence lower rates of CBE include lower levels of education, lower levels of income, and not having health insurance. Having a regular healthcare provider is associated with having regular CBEs. Age of women receiving CBEs is critical, and a disparity among different age groups is important. In 2005, older women, who have a higher risk of breast cancer, have lower rates of CBE and mammogram usage (where CBE usage was considered as within the last 2 years) compared to younger women (Coughlin et al., 2008). Access to healthcare and where women receive their healthcare may influence how often they receive CBEs. A study using data from 2005 NHIS survey showed women 40 years and older with a regular healthcare provider or who received care at a doctor’s office or HMO were more likely to have had a CBE within the past 2 years compared to other facilities and locations (Coughlin et al., 2008).

BENEFITS OF EARLY DIAGNOSIS AND CLINICAL BREAST EXAM ON SURVIVAL

Early diagnosis is strongly associated with the decrease in mortality from breast cancer. Since 1975, the 5-year survival rate for breast cancer has been increasing, due to an increase in earlier diagnosis, technological advancements, and better treatment. Screening for breast cancer is the best method for early detection and may decrease mortality by as much as 7-23% in the United States (Berry et al., 2005). Between 1996 and 2004, 61% of breast cancer cases were diagnosed at the localized stage, 31% at the regional stage, and only 6% at the distant stage. The survival benefit of having the majority of breast cancer cases diagnosed in the early stage is quite staggering. The 5-year survival rate dramatically decreased between diagnoses at localized stage, which is 96%, to the 5-year survival rate at distant stage which is only 27% (Jemal et al., 2009).
There is a disparity, however, among those who receive early diagnosis, and this could be due to a multitude of reasons that act alone and/or concurrently. For example, African American women are more commonly diagnosed at an advanced stage of breast cancer compared to White women. Only 51% of African American women have breast cancer diagnosed at a localized site compared to 61% of White women. Also, 37% of African American women compared to 31% of White women were diagnosed with regional sites, and 10% of African American women compared to 6% White women at distant sites. Besides ethnicity, social economic status, education, screening history, and health insurance status are also all factors associated with advanced stage of diagnosis. How each factor affects access to health care and screening may be unique to each individual (Hahn et al., 2007). What influences early diagnosis then, such as screening practices, is quite important and disparities in adherence must be addressed.

**TRENDS IN UTILIZATION OF CLINICAL BREAST EXAM**

Trends in utilization of clinical breast exams have shown that with the increased access to mammography, CBE screening has declined among women of all ages, except 50-64 year olds, from 1990 to 2000. While utilization of CBE with the use of mammogram increased during this time, usage of mammogram alone increased the most and was higher than both CBE and mammogram (Meissner et al., 2003). The decrease in CBE is occurring in response to the insufficient evidence to support the use according to USPSTF. Not only could a decrease in CBE usage be harmful for women whom mammogram are not available but findings from CBE can influence what kind of mammogram will be performed. Abnormal findings during a CBE, or the knowledge taken from a personal health history given during a CBE could indicate a more intense and specific mammogram screening versus the normal routine and more frequent health screening for the individual.

**DETECTION**

Early detection of cancer, when it is asymptomatic and localized, usually ensures more treatment options which are likely to be less toxic and more effective, allowing for better cancer survival. Education about breast cancer and screening is important early
detection for women of all ages. Although women with several known risk factors may seek out more proactive techniques, screening in younger women is usually performed by the individual or by their clinician. The presence of a lump can sometimes be seen or felt by the individual, as well as by the clinician; however, some tumors may only be detected by a mammogram (Saslow et al., 2004). It is important to note, than an abnormal finding is not a diagnosis or true confirmation of breast cancer and further diagnostic testing must be performed to determine whether something present is benign or malignant.

The three most common forms of breast cancer preventative screening are the self-breast exam (SBE), the clinician breast exam (CBE), and mammogram. Recommendations for starting age, occurrence, and effectiveness of the different screening techniques vary across different organizations and are a topic of controversy. Guidelines within organizations also change over time, reflecting new data, and the implications of these changes are quite important to the public.

Self-Breast Exam

Self-breast Exams (SBE) are noninvasive, performed by the individual and may detect palpable changes in a women’s breast that she may voice and inform to her clinician for an appointment or even a follow-up examinations. The self-breast exam, if done correctly, is the easiest performed type of screening technique and affords some autonomy to the individual. The effectiveness of its performance is highly disputed, however the United States Preventive Services Task Force (USPSTF), an independent committee made up of experts on primary care and preventative medicine, reviews current research and makes recommendations based on the evidence of the effectiveness of self-screening techniques in reducing mortality from breast cancer (DeAngelis & Fontanarosa, 2010). The USPSTF released its most recent statement in 2009, recommending against clinicians teaching their patients how to perform a self-breast exam. The statement explained that there was no evidence that self-breast exams decreased mortality, and therefore the harms outweigh the benefits in the eyes of this organization. The sensitivity of self-breast exams is rather low and reported by the USPSTF to be between 12-41%. Abnormalities found during self-breast exams that do not lead to a diagnosis of cancer, can create undue stress and anxiety, as well
as increase in the performance of unnecessary and costly procedures (DHHS, USPSTF, 2009).

**Clinical Breast Exam**

The Clinical Breast Exam (CBE) is commonly practiced in the United States despite the divide among different organizations on its effectiveness in reducing mortality from breast cancer. The CBE is composed of the personal history of the patient, visual inspection, and palpation on the breast and nearby lymph nodes. The CBE is also a good opportunity to educate the patient on breast cancer and its symptoms. The clinician might also be able to obtain information on family history and assess risk for the individual that might not otherwise be obtained (Saslow et al., 2004). CBE has a sensitivity of 40-69% and specificity between 88-99% (DHHS, USPSTF, 2009). The low sensitivity of the CBE can be partially attributed to poor technique on the clinician’s part, as well as inaccurate recording of the screening and its findings. The CBE is in need of standardization and proper teaching to clinicians, as well as improvement in the accuracy of recording (Saslow et al., 2004).

In 2002, the USPSTF recommended that women 40 years and older who are at an average risk should have a mammogram every 1 to 2 years and once a year after the age of 50, with or without the addition of a clinical breast exam. Although, they believe there is not enough evidence as to whether a clinical breast exam alone is beneficial, if done correctly they are more sensitive for younger women than a mammogram. In 2009, USPSTF revised their recommendation, but continued that the evidence is not enough to advise women for or against clinical breast exam as a supplement to mammograms. The evidence of the benefit of clinical breast exams alone is insufficient (DHHS, USPSTF, 2009).

ACS released breast cancer screening guidelines in 2009 recommending women 40 years and older who are at an average risk of acquiring breast cancer receive a CBE every year during a routine health care exam, while women between the ages 20 and 40 years of age should receive at least one CBE every 3 years. In 2009, ACS released a review with the same 3 year guidelines for CBE for screening (Smith, Cokkinides, & Brawley, 2009).

The actual benefit of CBE on mortality is hard to estimate since there have been no studies designed to look at mammogram with CBE versus mammogram alone on mortality (USPSTF, 2009). Evidence on the benefit of CBE is insufficient since most studies on the
topic of breast cancer screening are done in countries with available mammography screening, and therefore very few studies have been designed to look at the benefit of CBE alone on breast cancer mortality. There have been studies in India and Egypt, countries not equipped for mammogram screening, that have looked at clinical breast exams versus no screening on breast cancer mortality. These studies are poorly designed, however, are inconclusive and are not applicable to the United States (Nelson et al., 2009).

Women who are at a higher risk than average for breast cancer (which can include a family history of breast cancer and/or ovarian cancer) are generally recommended to start screening at an earlier age. In 2007, ACS (2009) recommended women who have known or suspected BRCA mutations or who have chest radiation for Hodgkin’s disease, receive annual breast mammogram and MRIs for breast cancer screening beginning at age 30 (Smith et al., 2009). Breast MRI has been shown to be significantly more sensitive in high risk, young women than mammogram (Knutson & Steiner, 2007). It is also recognized that screening occurrence and type for high risk women should be unique for their circumstances and decided upon with careful consideration (Ricalde, 2004). Women with high risk for breast cancer should start screening at an earlier age, having routine CBE where risk assessment would be ascertained could be extremely important.

**Mammogram**

Mammography is a widely accepted screening method for the detection of breast cancer, particularly since the machine can detect masses that are otherwise not identified through physical screening (SBE and CBE) methods. Mammography has also been shown to reduce mortality from breast cancer. In 2002, the USPSTF recommended that women aged 40 years and older who are at an average risk and asymptomatic should have a mammogram every 1 to 2 years and once a year after the age of 50 (Knutson & Steiner, 2007). However in 2009, USPSTF revised their recommended guidelines stating women 50 to 74 years old who are of average risk and asymptomatic should get a breast mammogram every 2 years, and women 40-49 are advised against routine screening. The overall benefit for women 40-49 is considered small, and women in this age group are recommended to make the decision of whether to start getting mammograms every 2 years themselves based on their individual
harms and benefits (USPSTF, 2009). The ACS, however, continues to recommend women who are of average risk to have annual mammograms starting at age 40 (Ricalde, 2004).

**MAMMPGRAPGHY WITHIN OUR SOCIETY**

Breast cancer is a leading cause of cancer death among women in the United States, but breast cancer mortality has been steadily declining since 1990. Early detection via screening mammography, coupled with improved therapy, has been credited with reducing the number of breast cancer, deaths in the United States and other countries. Until research determines a way to prevent breast cancer, screening mammography will continue to be the primary tool in efforts to reduce the toll of the disease. Thus, ensuring the quality of mammography is important for women's health.

Mammography is currently the primary tool for detecting breast cancer at an early stage when it is most curable. When coupled with appropriate treatment, early detection can significantly reduce breast cancer mortality. Randomized clinical trials have shown that screening mammography can reduce breast cancer specific mortality by approximately 20 to 30 percent (Institute of Medicine [IOM], 2001, 2005). One evaluation of modern service screening in Sweden suggests mortality reductions as high as 40 to 50 percent are possible among women who actually are screened. Since about 1990, breast cancer mortality has been declining slowly but steadily in the United States (National Center for Health Statistics, 2010), and screening mammography, along with improved therapy, has been credited with reducing the number of breast cancer deaths in the United States and other countries (Anttila, Koskela, & Hakama, 2002; Beckett, Kotre, & Michaelson, 2003; Coburn, Chung, Fulton, & Cady, 2004; Duffy et al., 2002; Jatoi & Miller, 2003; Kobayashi, 2004; Peto, Boreham, Clarke, Davies, & Beral, 2000). But in order to maximize the potential benefits of mammography, high standards of quality assurance are necessary. Many factors contribute to the quality of mammography, including structural features such as the equipment used, the knowledge and skills of the staff providing the services, and the organization of service delivery at a given facility. Many of these factors are regulated by the Food and Drug Administration (FDA) under the Mammography Quality Standards Act (MQSA). Medical technology is constantly evolving. Although mammography is still the only recommended breast cancer screening test for the general population, a number of other breast imaging
technologies are clinically available, and more are in development. Some of the available imaging technologies, including breast ultrasound and MRI, are already commonly used in the diagnosis of breast cancer. Furthermore, there is a suggested potential role for specific technologies in screening some portion of the population, such as high-risk women. Of concern is the adoption of some technologies for screening despite the limited evidence of their effectiveness. There is no mandatory quality oversight of these other technologies, and quality is known to be variable. Thus, the goal to ensure quality breast cancer screening and diagnosis continues to focus solely on mammography.

**IMPROVING INTERPRETIVE PERFORMANCE IN MAMMOGRAPHY**

Breast cancer is a significant cause of morbidity and mortality in the United States. Until it can be prevented, the best approach to the control of breast cancer includes mammography screening for early detection. Mammography however, is not a perfect test, due to the complex architecture of the breast tissue being imaged, the variability of the cancers that may be present, and the technical limitations of the equipment and processing. The technical aspects of mammography are now less variable since the interim Mammography Quality Standards Act (MQSA) regulations went into effect in 1994. At this point, the focus is shifting to the quality of mammography interpretation. The available evidence indicates that interpretive performance is quite variable, but the ambiguities of human decision making, the complexities of clinical practice settings, and the rare occurrence of cancer make measurement, evaluation, and improvement of mammography interpretation a much more difficult task.

**CURRENT STATE OF KNOWLEDGE REGARDING APPROPRIATE STANDARDS OR MEASURES**

Effectively measuring and analyzing interpretive performance in practice presents many challenges. For example, data must be gathered regarding whether a woman has breast cancer diagnosed within a specified timeframe after a mammogram and whether the finding(s) corresponds with the location in which the cancer is found. Other challenges include reaching agreement regarding the definition of positive and negative
interpretation(s), standardizing the patient populations so that comparisons are meaningful, and deciding which measures are the most important reflection of an interpreting skills.

**Table 1. Breast Imaging Reporting and Database System (BI-RADS), Terms Used to Define Test Positivity/Negativity in BI-RADS**

<table>
<thead>
<tr>
<th>Category</th>
<th>Assessment</th>
<th>Follow-up Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Need Additional Imaging Evaluation and/or Prior Mammograms for Comparison</td>
<td>Additional imagining and/or prior images are needed before a final assessment can be assigned</td>
</tr>
<tr>
<td>1</td>
<td>Negative</td>
<td>Routine annual screening mammography (for women over age 40)</td>
</tr>
<tr>
<td>2</td>
<td>Probably Benign Finding(s)</td>
<td>Routine annual screening mammography (for women over age 40)</td>
</tr>
<tr>
<td>3</td>
<td>Probably Benign Finding – Initial Short – Interval Follow-Up Suggested</td>
<td>Initial short-term follow up (usually 6-month) examination</td>
</tr>
<tr>
<td>4</td>
<td>Suspicious Abnormality – Biopsy Should Be Considered</td>
<td>Usually requires biopsy</td>
</tr>
<tr>
<td>5</td>
<td>Highly Suggestive of Malignancy – Appropriate Action Should Be Taken</td>
<td>Requires biopsy or surgical treatment</td>
</tr>
<tr>
<td>6</td>
<td>Known Biopsy-Proven Malignancy – Appropriate Action Should Be Taken</td>
<td>Category reserved for lesions identified on imaging study with biopsy proof of malignancy prior to definitive therapy</td>
</tr>
</tbody>
</table>


Before describing the measures, it is important to clearly define a positive and negative test. The Breast Imaging Reporting and Data System (BI-RADS) was developed by the American College of Radiology (ACR), in collaboration with several federal government agencies and other professional societies in order to create a standardized and objective method of categorizing mammography results. The BI-RADS 4th Edition identifies the most commonly used and accepted definitions, which are based on a standard set of assessments first promulgated by the ACR in 1992 and modified slightly in 2003. Table 1 outlines terms used to define test positivity/negativity as found in the 4th editions of BI-RADS.

The assessments are intended to be linked to specific recommendations for care, including continued routine screening (Category 1, 2), immediate additional imaging such as additional mammographic views and ultrasound or comparison with previous films.
(Category 0), short-interval (typically 6 months) follow-up (Category 3), or biopsy consideration (Category 4) and biopsy/surgical consult recommended (Category 5).

Based on these assessments and recommendations, definitions of a positive mammography interpretation have also been suggested by the ACR BI-RADS as follows:

**Screening Mammography:** Positive test = Category 0, 4, 5  
Negative test = Category 1, 2

**Diagnostic Mammography:** Positive test = Category 4, 5, 6  
Negative test = Category 1, 2, 3

MQSA regulations, in contrast, define a positive mammogram as one that has an overall assessment of findings that is either "suspicious" or "highly suggestive of malignancy."

BI-RADS also now allows a single overall final assessment for the combined mammography and ultrasound imaging. Facilities that perform ultrasound, at the time of diagnostic evaluation for an abnormal mammogram or palpable mass, will not have outcome statistics comparable to facilities where mammograms are reported without including the ultrasound evaluation. For example, a patient with a palpable finding may go to a facility and be found to have a negative mammogram and positive ultrasound, and the assessment will be reported as positive.

While there has been much improvement in mammography reporting since the adoption of BI-RADS, there is still inter- and intra-observer variability in how this reporting system is used (Kerlikowske et al., 2000). Some variability in calculated performance measures can, therefore, be attributed to variance among interpreting physicians on what constitutes an abnormal mammogram. Moreover, though the intent is clear, the linkage between assessment and recommendations is not always maintained in clinical practice. Indeed, Food and Drug Administration (FDA) rules require use of the overall assessments listed in Table 2, but the recommendations associated with each category are not mandated or inspected by FDA. Thus, considerable variability in recommendations exists. For example, 38 percent of women with "probably benign" assessments had recommendations for immediate additional imaging in one national evaluation (Taplin et al., 2002). Some analyses include Category 3 assessments associated with recommendations for performance of additional imaging as positive tests (Barlow et al., 2004). In addition, some women with mammograms interpreted as Category 1 or 2 have received recommendations for
biopsy/surgical consult due to a physical finding not seen on the mammogram because mammography cannot rule out cancer (Poplack, Tosteson, Grove, Wells, & Carney, 2000). Therefore, these standard definitions serve as a starting point, but in practice, adaptations may be needed to accommodate the reality of clinical care.

It is also important to define what constitutes “cancer.” In context of mammography practice, the gold standard source for breast cancer diagnosis is tissue from the breast, obtained through needle sampling or open biopsy. This tissue sample then leads to the identification of invasive carcinoma or noninvasive ductal in situ (DCIS). Breast cancers are labeled invasive because the cells are invading surrounding normal tissue. Invasive cancers account for most (80 percent) of breast cancers found at the time of screening in the United States. DCIS is included as a cancer diagnosis primarily because standard treatment for DCIS currently entails complete diagnosis excision, similar to invasive cancers. Approximately 20 percent of breast cancer diagnosis are DCIS (Ernster et al., 2002). Lobular carcinoma in situ (LCIS) also is occasionally reported in the tissue, but should not be counted as cancer because it is not currently treated.

Interpretive performance can also vary as a function of the time since the prior mammogram (Yankaskas et al., 2005). Recognizing that differences exist among screening guidelines regarding the appropriate screening interval (annual recommended by the American Cancer Society [ACS] and the American College of Obstetricians and Gynecologists [ACOG]) every 1 to 2 years recommended by the United States Preventive Services Task Force [USPSTF] (Smith, Cokkinides, & Eyre, 2005; Smith & D’Orsi 2004; USPSTF, 2002), the specification of the period of follow-up after a mammogram is needed to observe women for the occurrence of cancer and calculate performance indices that can be compared in a meaningful way.

With the above definitions, it is possible to identify several measures of interpretive performance. The measures of performance available to assess interpreting physician’s interpretation all build from a basic 2 x 2 table of test result and cancer outcome as noted in Table 2. A one-year interval should be used to calculate the performance indices so that they are comparable. Standard definitions of these measures are well summarized in the American College of Radiology (2003) BI-RADS 4th Edition, and are highlighted here along with some of the strengths and weaknesses of each measure. Separation of the data of screening
from diagnostic indications for mammography is absolutely essential if performance measures are to be meaningful.

Table 2. Possible Results for a Screening Test

<table>
<thead>
<tr>
<th>Cancer Outcomes</th>
<th>Positive (+)</th>
<th>Negative (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive (+)</td>
<td>TP – True Positive</td>
<td>FP – False Positive</td>
</tr>
<tr>
<td>Negative (-)</td>
<td>FN – False Negative</td>
<td>TN – True Negative</td>
</tr>
</tbody>
</table>

**Sensitivity**

Sensitivity refers to the ability of a test to find a cancer when it is present \( \frac{TP}{TP+FN} \). The challenge with this measure is determining whether a cancer has been diagnosed, particularly if a woman was given a negative mammogram interpretation. Those women are not necessarily seen back in the same facility for their next examination. Therefore it is not possible to know with certainty whether they have cancer or not. This problem is called verification bias. Because only those women sent to biopsy within a facility have their true cancer status known, verification bias may lead to an overestimation of sensitivity (Zheng, Barlow, & Cutter, 2005). Relatively complete ascertainment of cancer cases can be expected only if a mammography facility is able to link its examinations to those breast cancer cases compiled in a regional tumor registry, and this is practical only for a very small minority (fewer than 5 percent) of mammography facilities in the United States.

Because the ultimate purpose of screening is to reduce disease-specific mortality by detecting and treating early-stage cancers, the sensitivity of mammography is important. However, sensitivity is affected by many factors, including whether it is a first (prevalent\(^1\)) mammogram or subsequent (incident) mammogram, the distribution of patient ages and tumor sizes in the population of women being screened by the interpreting physician, the

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\(^1\) The prevalent screen refers to the first time a woman undergoes a screening test. Incident screens refer to subsequent screening tests performed at regular intervals. One useful index of screening mammography performance is that the number of cancers per 1,000 women identified by prevalent screens
length of time since prior mammograms, the density of the breast tissue among women with cancer, and the number of women with cancer found by an interpreting physician (Carney et al., 2003; Yankaskas et al., 2005). Most screening populations have between 2 and 10 cancers per 1,000 women screened, and among women undergoing periodic screening on a regular basis the cancer incidence rate, is 2 to 4 per 1,000 (American College of Radiology, 2003). Estimating sensitivity among such a small set of cancers affects the reliability of the measures. Random variation will be large for some measures, making comparisons among interpreting physicians very difficult, even if the interpreting physician has complete knowledge regarding the cancer status of all the women examined. Because most interpreting physicians do not have that complete information (no linkage to regional tumor registry) or the volumes to create stable estimates, measurement of sensitivity will be of very limited use for individual interpreting physicians in practice.

**Specificity**

Specificity is the ability of the test to determine that a disease is absent when a patient is disease-free \([\text{TN}/(\text{TN}+\text{FP})]\). Because most screened women (990 to 998 per 1,000) are disease free, this number will be quite high even if a poorly performing interpreting physician gives nearly every woman a negative interpretation. But interpreting physicians must interpret some mammograms as positive in order to find cancers, so false-positive examinations occur. Estimates of the cumulative risk of a false-positive mammogram over a 10-year period of annual mammography vary between 20 and 50 percent (Elmore, Wells, & Howard, 1998; Hofvind, Thresen, & Tretli, 2004), and the risk of a negative invasive procedure may be as high as 6 percent (Hofvind et al., 2004). High specificity of a test is therefore important to limit the harms done to healthy women as a result of screening. Although one study of nearly 500 United States women without a history of breast cancer found that 63 percent thought 500 or more false-positive mammograms per life saved was reasonable (Schwartz, Woloshin, Sox, Fischhoff, & Welch, 2000), the cost and anxiety associated with false-positive mammograms can be substantial. Studies have shown that anxiety usually diminishes soon after the episode, but in some women anxiety can endure, and in one study anxiety was greater prior to the next screening mammogram for women who had undergone biopsy on the previous occasion of screening compared with women
who had normal test results (Brett & Austoker, 2001). One study has shown that immediate interpretation of mammograms was associated with reduced levels of anxiety (Barton et al., 2004).

Like sensitivity, specificity is a difficult measure to obtain for most interpreting physicians because it requires knowing the cancer status of all women examined (linkage to a regional tumor registry). Because it is difficult to ascertain the status of all women who undergo mammography with respect to the presence or absence of cancer, it is important to be clear about who is being included in the measure and what the follow-up period is. This has led to three levels of false-positive measurement (FP; Bassett et al., 1994):

1. **FP1**: No known cancer within one year of a Category 0, 4, or 5 assessment (screening).
2. **FP2**: No known cancer within one year of a Category 4 or 5 assessment, (usually diagnostic).
3. **FP3**: No known cancer within one year of a Category 4 or 5 assessment, for which biopsy was actually performed.

If each of these measures is estimated for a year, they can also be called rates. The limitation in choosing only one of the three rates is that there is a trade-off between the accuracy of the measure and the insight it provides regarding an interpreting physician's performance. Although FP3 involves the most accurate measure of cancer status, it reflects only indirectly on the interpreting physician's choice to send women to biopsy. Interpreting physicians' ability to make that choice, and to make the recall versus no-recall decision at screening, are important characteristics. The most accurate estimate of FP (FP3) is therefore not necessarily the measure that provides the best insight into the interpreting physician's performance. Conversely, FP1 includes BI-RADS 0's, a high percentage of which have a low index of suspicion. Furthermore, measuring FP1 involves knowing the cancer status of all women for whom additional imaging was recommended (defined in BI-RADS as Category 0-incomplete, needs additional imaging). This is challenging because results of the subsequent evaluation may not be available. Recommendation are that for women who need additional imaging, mammography facilities must attempt to track these cases until they resolve to a final assessment. Although studies indicate that some interpreting physicians inappropriately assign women who need additional imaging a Category 3 BI-RADS
assessment (Poplack et al., 2000; Taplin et al., 2002), this practice should be discouraged, and all women needing additional imaging should be tracked.

**Positive Predictive Value (PPV)**

There are three positive predictive values (PPV) that can be measured in practice, derived from the three false-positive measures described above. Again, these different measures are used to accommodate the challenges of data collection in practice. For example, though an interpreting physician may recommend a biopsy, it may not be done, and therefore the true cancer status may not be known. Thus, one must clearly state which PPV or PPVs are being monitored (Bassett et al., 1994), as recommended by the ACR.

1. **PPV₁:** The proportion of all women with positive examinations (Category 0, 4, or 5) who are diagnosed with breast cancer \( \frac{TP}{TP + FP₁} \).
2. **PPV₂:** The proportion of all women recommended for biopsy after mammography (Category 4 or 5) that are diagnosed with breast cancer \( \frac{TP}{TP + FP₂} \).
3. **PPV₃:** The proportion of all women biopsied due to the interpreting physician's recommendation who are diagnosed with cancer at the time of biopsy \( \frac{TP}{TP + FP₃} \).

MQSA requires that interpreting physicians have an established mechanism to ascertain the status of women referred for biopsy. With these data interpreting physicians can measure their PPV₂, but it is still subject to verification bias because not all women recommended for biopsy will have it done and because ascertainment of procedures is never 100 percent. The limitation of PPV₂ or PPV₃ is that many more women are referred for additional imaging (8 percent) than biopsy (1.5 percent) (Taplin et al., 2002). An important skill in interpretation involves sorting who needs additional imaging versus biopsy; PPV₂ and PPV₃ do not account for this because they only focus on women referred for biopsy. The ACR recommends that interpreting physicians who choose to perform one of the two types of audits described in the BI-RADS atlas should track all women referred for additional imaging for their subsequent cancer status (PPV₁; American College of Radiology, 2003). Because measuring PPV₁ may not be possible in the absence of an integrated health system and registry, it is recommended to use PPV₂.

Another limitation of PPV that influences its usefulness is that it is affected by the rate of cancer within the population examined. The PPV will be higher in populations with
higher cancer rates. For example, an interpreting physician practicing among older populations of women versus younger will have a higher PPV, just because the risk of breast cancer is higher among older women. PPV₁ will vary depending on the proportion of patients who are having an incident versus prevalent screen. Unfortunately, a high PPV does not necessarily correlate with better performance. For example, the interpreting physician who recommends biopsy for only larger, more classic lesions will have a higher PPV, but will miss the smaller, more subtle, and less characteristic lesions that may be more important to patient outcomes (Sickles, 1992). Therefore recommendations measuring the cancer detection rate in addition to PPV₂ in order to facilitate interpretation of the measure. A higher PPV₂ should occur in a population with a higher cancer detection rate (see section below on Cancer Detection Rate).

**Negative Predictive Value (NPV)**

Negative predictive value (NPV) is the proportion of all women with a negative result who are actually free of the disease \( \frac{TN}{FN+TN} \). Monitoring NPV is not a requirement of MQSA, and in practice, the NPV is rarely used because it involves tracking women with negative examinations.

**Cancer Detection Rate**

Cancer detection rate is the number of women found to have breast cancer per 1,000 women examined. This rate is meaningless unless screening mammograms are assessed separately from diagnostic evaluations. This measure is similar to sensitivity, but includes all examinations (not just cancer cases) in the denominator. The advantage is that interpreting physicians know the total number of examinations they have interpreted and can identify the cancers resulting from biopsies they recommended or performed. The disadvantage is that differences in the cancer detection rate may reflect not only differences in performance, but also differences in the rate and risk of cancer in the population served. A high cancer detection rate relative to other interpreting physicians may simply indicate that the interpreting physician is caring for an older population of women who are at higher risk for cancer, not that he or she is necessarily highly skilled at finding cancer. This difference can
be mitigated by adjusting the cancer rate to a standard population age distribution if adequate numbers exist in each age group to allow rate estimates.

Other factors that could influence the cancer detection rate include the proportion of women having their first (prevalent) screen and the proportion having a repeat (incident) screen, the interval since the prior screen, differing practices with respect to who is included in screenings, whether practices read examinations individually as they are completed or in batches at a later time (mode of interpretation), and how long a physician has been in practice (Harvey et al., 2003; Smith-Bindman et al., 2005; van Landeghem, Bleyen, & De Backer, 2002). Interpretive sensitivity and specificity are higher on first screens compared to incident screens, presumably due to slightly larger tumors being found at prevalent screens (Yankaskas et al., 2005). For incident screens, the longer the time since the prior mammogram, the better interpretative performance appears, again because tumors will be slightly larger (Yankaskas et al., 2005). Some practices offer only diagnostic mammography to high-risk women with a history of breast cancer, while others will offer screening. Excluding such women from the screening population will reduce the number of cancers at the time of screening and affect positive predictive values, but may also change a physician's threshold for calling a positive test. Changes in the threshold for a positive test can affect performance, and this threshold seems to change with experience (Barlow et al., 2004).

**ABNORMAL INTERPRETATION RATE**

The abnormal interpretation rate is a measure of the number of women whose mammogram interpretation leads to additional imaging or biopsy. For screening mammography, the term "recall rate" is often used. The recall rate is the proportion of all women undergoing screening mammography who are given a positive interpretation that requires additional examinations (Category 0 [minus the exams for which only comparison with outside films is requested], 4, or 5). Desirable goals for recall rates for highly skilled interpreting physicians were set at less than or equal to 10 percent in the early 1990s (Bassett et al., 1994). This measure is easy to calculate because it does not rely on establishing the cancer status of women. The disadvantage is that differences in this measure may not reflect differences in skill except when the rate is extraordinarily high or low. Again, this will depend on the proportion of prevalent to incident screens on the availability of previous films.
CANCER STAGING

Cancer staging is performed after a breast cancer is diagnosed. Stage, along with other tumor prognostic indicators (e.g., tumor grade, hormone receptor status, and other factors), is used to determine the patient's prognosis, and the combination of tumor markers and stage influences treatment. Cancer staging takes into account information regarding the tumor histological type and size, as well as regional lymph node status and distant metastases. Staging information, which is generally derived from pathology reports in varying forms, is useful for the mammography audit because women with advanced, metastatic tumors are more likely to die from the disease. However, tumor staging information is not always easily available to the imaging facility, and thus, may be more of a burden to acquire.

Tumor Size

The size of the breast cancer at the time of diagnosis is relevant only for invasive cancers. All patients with only DCIS are Stage 0, despite the extent of the DCIS. An interpreting physician who routinely detects smaller invasive tumors is likely to be more skilled at identifying small abnormalities in a mammogram. The proportion of invasive tumors less than 1.5 or 1.0 cm could be used as one measure.

Using tumor size as a performance measure has several limitations; measurement of a tumor is an inexact science and may vary depending on what is recorded in a patient record or tumor registry (e.g., clinical size based on palpation, size based on imaging, size based on pathology), and who is doing the measuring. Surveillance, Epidemiology and End Results (SEER) registries use a hierarchy to choose which measurement to include. Heterogeneity will occur because not all measurements are available. Furthermore, the proportion of small tumors will be affected by the population of tumors seen by a given interpreting physician; for example, a physician reading more prevalent screens will have a greater proportion of large tumors because there are more large tumors in the population. The screening interval is also important when tumor size is used as a performance measure.
A shift toward smaller tumor size has been noted in screened populations such as those in the Swedish randomized trials of mammography (Tabar et al., 1992). A similar shift is expected in other screened populations. In one study of a National Screening Program, invasive breast cancer tumor size at the time of discovery decreased from 2.1-2.4 cm to 1.1-1.4 cm between 1983 and 1997, within which time period the national screening program had been implemented (Scheiden et al., 2001).

**Axillary Lymph Node Status**

The presence or absence of cancer cells in the axillary lymph nodes is one of the most important predictors of patient outcome. The prognosis worsens with each positive node (containing cancer cells) compared to women with histologically negative lymph nodes. Node positivity, however, is not necessarily a useful surrogate measure of an interpreting physician's interpretive performance because inherently aggressive tumors may metastasize to the axillary lymph nodes early, when the tumor is still small, or even before the tumor becomes visible on a mammogram.

**DOUBLE-READING METHODS AND TECHNICAL TOOLS DESIGNED TO IMPROVE PERFORMANCE**

One approach to improving interpretive performance is double reading. This approach may take several forms, but the two extremes include independent double reading where both readers interpret the films without knowledge of the other's assessment and the most abnormal reading is acted upon, and (2) consensus double reading where both learn the other's interpretation and resolve the differences together (arbitration). Between these two extremes are many blended forms where interpreting physicians may know each other's interpretations and discuss differences, differences are resolved by a third party, or the second reader makes the final assessment. At least half of the organized programs in continental Europe and 88 percent of programs in the United Kingdom use double reading in some form, but in the United States the rate is lower (Shapiro, Venet, Strax, & Venet, 1988). A recent study of community-based mammography practices showed that half (51 percent) of the surveyed screening facilities perform some type of double interpretation of screening mammograms; only 11 percent of the surveyed screening facilities perform double interpretations of all screening mammograms (Hendrick et al., 2005).
Research indicates that two individual interpretations (rather than one) capture a small but not insignificant number of breast cancers (6-15 percent) missed on single interpretation (Anttila, Koskela, & Hakama, 2002; Hendee, Patton, & Simmons, 1999; Thurfjell, Lernevall, & Taube, 1994). However, some studies indicate that increased sensitivity may be accompanied by decreased specificity. In a review of 10 cohort studies of double reading, Dinnes et al. concluded that double reading increases cancer detection by 3-11/10,000 women screened and recall may actually decrease, if consensus arbitration is used (Dinnes et al., 2001). The issue of arbitration is important because acting on the most abnormal interpretation increased recall from 38 to 149/10,000 women. A study of arbitration by a panel of three radiologists who each independently read mammograms in cases where the two radiologists could not come to agreement increased recalls slightly, but still missed some cancers (Duijm, Groenewoud, Hendriks, & de Koning, 2004). No studies have examined the effect of double reading on the interpretations of interpreting physicians over time, or subsequent breast cancer mortality. Double reading increases the costs/cancer detected by approximately $2,185 to $4,177 (Dinnes et al., 2001). It also increases workforce needs. However, double reading is not reimbursed by third-party payers.

**Computer-Aided Detection (CAD)**

Computer-aided detection (CAD) is another method used to supplement a single reader's interpretation of screening mammograms. CAD can be performed on either standard film (analog) images or digitally acquired mammograms. CAD on analog images requires passing the films through a machine that creates a digital version of the images. The digital information is then analyzed by computer software that recreates the image on a monitor and flags areas of concern (e.g., clustered microcalcifications and masses) (Warren-Burhenne et al., 2000). The interpreting physician reads the original films and then looks at an annotated copy of the digitized image. CAD is more likely to mark calcified lesions compared to masses and architectural distortions (Baker et al., 2003; Taplin, Rutter, & Lehman, 2006). Most studies have counted CAD as true positive even if the algorithm marked a finding only on one of the two standard mammographic views. FDA approved the first CAD software in 1998 based on work demonstrating it would mark abnormalities not identified by radiologists (Warren-Burhenne et al., 2000) and it is now being used around the country.
It is important to note that cancers account for less than 1 percent of findings marked by CAD (Freer & Ulissey, 2001). It is up to the interpreting physician to determine if the markings represent actionable findings, and thus, the interpreting physician will routinely disregard many findings. The proper study of CAD, therefore, does not test whether a given lesion is marked by CAD, but rather, whether a given interpreting physician decided to ignore or act on the CAD mark.

Unfortunately, the two published studies of CAD outside a test setting present somewhat conflicting results (Elmore, Armstrong, Lehman, & Fletcher, 2005). Freer and Ulissey (2001) reported an increase of approximately 20 percent in cancer detection rate using CAD versus without the use of CAD. However, the study was done using two radiologists whose characteristics and experience were not reported. Lesions that were judged to require additional evaluation (recall) only because they were marked by CAD were classified as additional detections. The radiologists could only add workups for lesions marked by CAD, and had to act on their own calls even if CAD did not mark the lesion. Although that is the recommended way to use CAD, evidence from a test setting (not actual clinical practice) suggests that radiologists may not act on their own findings if CAD does not mark the lesion (Taplin et al., 2006). In the second published study of CAD in clinical practice, found no overall difference in cancer detection rates among breast imaging specialists in academic practice (cancer detection rate of 3.49/1,000 without CAD versus 3.55/1,000 with CAD). However, the subset of studied radiologists who interpret a relatively low caseload did increase their cancer detection rate by approximately 20 percent (3.05/1,000 without CAD versus 3.65/1,000 with CAD), similar to the result report by Freer and Ulissey 2001 (Feig, Sickles, Evans, & Linver, 2004). More information is needed about CAD in practice-with special attention to how such factors as interpreting physician experience, lesion characteristics, practice settings, and specific CAD algorithms affect CAD performance-before it can be concluded that it will generally improve interpretation. Studies performed in a test setting should be undertaken with a standard set of cases that were not used to train the various CAD systems being tested.

CAD is reimbursed by third-party payers. Adding CAD into clinical practice is not likely to substantially increase the workload of the interpreting physician, but time and
equipment are needed to scan analog films. In comparison, double reading will impact the workforce by increasing the workload for interpreting physicians to a much greater degree.

**INTEGRATING BREAST IMAGING CENTERS OF EXCELLENCE INTO INTERDISCIPLINARY BREAST CARE**

Ideally, Breast Imaging Centers of Excellence will be linked with facilities that offer comprehensive and multidisciplinary treatment and support for breast cancer. The best among such facilities feature interdisciplinary care based on ongoing communication and collaboration among the multiple disciplines involved in diagnosing and treating cancer (Rabinowitz, 2004). This approach to disease management is intended to optimize the broad range of diagnostic techniques and therapies now available to address breast cancer, as well as other diseases (August et al., 1993; Kolb, 2000; Rabinowitz, 2004).

A conceptual framework for improving health outcomes for cancer patients, Quality in the Continuum of Cancer Care (QCCC), recognizes the critical importance of the steps in the process of cancer care from prevention, screening, diagnosis, and treatment to end-of-life care. The implication of this conceptualization is that the transitions between being at risk in the population and coming in for screening, or having an abnormal test and getting treated, are as important as each of the steps (Zapka, Taplin, Solberg, & Manos, 2003). Failures in the transitions are associated with later stage cancer occurrence (Yankaskas et al., 2005). By focusing on the steps and transitions in care where failures can occur, the QCCC framework aims to facilitate more organized systems of interdisciplinary medical practice that improve care, and establish meaningful measures of quality that promote improved outcomes.

Some reports suggest that interdisciplinary breast care may facilitate timelier treatment as well as less invasive surgery and better patient satisfaction (Rabinowitz, 2004). Higher rates of breast-conserving surgery and lower rates of false-negative breast biopsies have been observed in high-volume, specialized settings (Chang et al., 2001; Smith-Bindman et al., 2005) however, it remains to be determined whether care in such facilities is associated with improved rates of recurrence or survival. More specifically, advocates of interdisciplinary breast cancer care stress its advantages in promoting communication between radiologists and pathologists, particularly regarding prospective treatment planning (Rabinowitz, 2004).
The future expansion of interdisciplinary breast cancer care programs is expected to emphasize participation in clinical trials, research and research training, and the use of emerging technologies to promote information sharing and to facilitate the transition between care in urban-based cancer centers and physicians serving medically underserved populations (Garcia, 2004). Such improvements could equally enhance Breast Imaging Centers of Excellence.

**LOW-INCOME LIMITS ACCESS**

Many studies have identified a link between socioeconomic factors and limited access to mammography (Lannin, Mathews, Mitchell, & Swanson, 2002; Lawson, Henson, Bobo, & Kaeser, 2000; Ward et al., 2004). In Florida, the cost of services and the stipulation by most facilities that a woman must obtain a referral for a mammogram from a primary care provider were found to limit access to mammography for low-income women without insurance (Florida Legislature: Office of Program Policy Analysis & Government Accountability [OPPAGA], 2004). For women in Florida's Medicaid Program, reimbursement rates and facility admission criteria can serve as barriers to obtaining mammography services. More than 20 percent of the mammography facilities surveyed reported that they do not provide mammography services for Medicaid recipients; other facilities that accept Medicaid recipients limited the number of recipients served. Low reimbursement rates were cited as a primarily reason for excluding or limiting the number of Medicaid patients. In addition Florida's Medicaid program does not currently reimburse for mammography at mobile facilities, although that restriction is currently under examination.

As a result of such barriers to mammography, while 65 percent of all Florida women aged 40 and older received annual mammograms in 2002, only 42 percent of Florida women over 40 without insurance, and a mere 4 percent of those on Medicaid did so, (OPPAGA, 2004). Nationally, 64 percent of insured women aged 40 and older received insured women aged 40 and older (Centers for Disease Control and Prevention & National Center for Chronic Disease Prevention and Health Promotion, 2002).
INCREASING DEMAND FOR BREAST IMAGING SERVICES

In the absence of a comprehensive measurement of national mammography usage and one that distinguishes between screening and diagnostic examinations - researchers have attempted to estimate mammography use through a variety of means. Most utilize self-report survey data, but a recently developed methodology uses disparate data sources, including screening registry data provided by the Breast Cancer Surveillance Consortium, to obtain a comprehensive model of screening use (Cronin et al., 2005) As one might expect, the specific results of these exercises vary. However, similar trends in year-to-year increases in mammography usage emerge from these disparate estimates. According to GAO, mammography utilization rose 15 percent between 1998 and 2002 (United States Government Accountability Office, 2002). Between 2000 and 2003, mammography rates among privately insured women rose nearly 16 percent (Brice, 2004). The total number of mammography procedures (including an unknown proportion of diagnostic mammograms) reported to FDA has increased by more than 6 percent per year for the past 2 years (between December 2002 and January 2005).

Accordingly, in 2003, 75 percent of breast imaging practices reported increased patient volume over the previous 2 years, according to the SBI (Farria et al., 2005). Ninety-six percent of these practices attributed the upswing to "increased demand," interpreted as a combination of an increase in the number of women eligible for screening mammography, better compliance with examination guidelines by women over age 40, and greater use of a broadening spectrum of services offered by breast imaging practices.

Measures proposed here intended to increase the number of new workers to the field of breast imaging, to retain the current mammography workforce, and to increase productivity of new and existing practitioners could improve future access to mammography. However, a predicted impending shortage of all physicians and the nation's lack of capacity to expand medical class sizes may severely restrict growth in the number of interpreting physicians for several years to come (Cooper, Stoflet, & Wartman, 2003; Radiological Society of North America, 2004). Moreover, the field appears poised to experience a net loss of practitioners because more than half of radiologists interpreting mammograms are older than age 50 (Smith-Bindman et al., 2005). This possibility is alarming, given simultaneous
demographic trends that promise to increase demand for breast imaging over the next two decades.

The availability of sufficient mammography facilities and equipment to meet demand may also be a concern. Although a decline in mammography utilization rates over the next two decades appears unlikely, changes in recommended screening interval could reduce demand. Consensus does not exist as to the optimal screening interval (Smith, Cokkinides, & Eyre, 2003). Several analyses indicate that shorter screening intervals for women aged 40 to 49 improve cancer detection at an earlier stage (which is associated with lower mortality), but offer no such advantage for older women (Aiello, Buist, White, & Porter, 2005; White et al., 2004).

**INCREASING USE OF ADDITIONAL BREAST IMAGING TECHNOLOGIES**

If compliance rates for regular mammograms among women over age 40, estimated at 64 percent in 2002 (Centers for Disease Control and Prevention & National Center for Chronic Disease Prevention and Health Promotion, 2002), increase, not only will demand for mammography rise accordingly, but also for other follow-up breast imaging services and interventional procedures. For example, about half of women recalled for additional imaging are examined by ultrasound. According to the SBI survey, core biopsy and stereotactic core biopsy were offered, respectively, by 89 percent and 79 percent of responding breast imaging practices; 17 percent of practices stated they performed same-day core biopsies (Farria et al., 2005).

In addition, a variety of other breast imaging technologies are increasingly employed to complement mammography. Some facilities are beginning to offer women at high risk other non-mammography screening tests for breast cancer, even though that is not currently recommended as the standard of care in any breast screening guidelines. Initial studies on these technologies are fueling demand. For example, 35 percent of the breast imaging practices that responded to the 2003 SBI survey reported that they offered screening ultrasound-more than twice as many as in 2000 (Farria et al., 2005). Ultrasound imaging is offered in addition to a mammogram and must be correlated with it, and ultrasound images require more elaborate, real-time interpretation than a mammogram. Moreover, small
percentage of ultrasound results lead to additional, time-consuming procedures such as biopsies that might not have been suggested by mammography alone.

The SBI survey also found that 12 percent of breast imaging practices offered MRI screening, and 51 percent offered diagnostic MR (Farria et al., 2005). Like ultrasound, MR images reportedly take significantly longer to interpret than a mammogram; MR also requires additional staffing and frequently leads to second-look ultrasound imaging. Demand for MR is likely to increase in response to recent reports of its superior sensitivity for detecting abnormalities that strengthened the case for its limited use in high-risk" populations of women (Kriege et al., 2004; Liberman, Morris, Benton, Abramson & Dershaw, 2003; Warner et al., 2004). Despite the fact that the value of these technologies for breast cancer screening has yet to be confirmed (Irwig, Houssami, & van Vliet, 2004; Kopans, 2004; Lee, 2004), demand for non-mammographic breast imaging services has driven insurance coverage in some cases. Even the hoped for time savings conferred by digital mammography and computer-aided detection (CAD) appear to be elusive.

**SUMMARY**

Although progress in decreasing breast cancer mortality within the United States is clearly associated with the institution of routine breast cancer screenings. Substantial efforts over the past few decades have been directed toward increasing the proportion of women who receive breast cancer screening, and as a result mammography use has risen yet in recent years has been decreasing over time.

This study investigates and describes what predictors of recent clinical breast cancer screenings and mammography procedures by what specific factors may explain differences in the actual use of CBE and mammography. This study will also test the hypothesis that the higher usage of CBE and mammography in those women with a higher socioeconomic status, positive health behaviors, and whom reside in urban areas will have higher rates will receive both cancer screening exams of CBE’s and mammograms together than those who are in lower socio-economic status.
CHAPTER 3

METHODS

Cross-sectional data was analyzed using information from the 2010 National Health Interview Survey (NHIS; National Center for Health Statistics, 2010), including the family module, adult module, and cancer control topical module. The NHIS is conducted by the National Center for Health Statistics (NCHS) and the Center for Disease Control and Prevention (CDC) and is collected under contract by the United States Census Bureau. The NHIS is a voluntary, person-to-person survey representative of national health and demographic information of the civilian non-institutional United States population. The survey was administered using computer-assisted personal interviewing (CAPI) by Census interviewers (also known as Field Representatives) who are trained annually. The CAPI method employs a computer questionnaire that allows the Interviewer to directly input answers which then determine the next appropriate question. The survey is administered to one child and one adult per household randomly selected.

STUDY POPULATION

The study sample consisted of all females 40 years and older. Women were assessed for the four outcomes of Breast Cancer Screening Exams; 1) never received any exam, 2) a clinical breast exam only, 3) mammogram only, or 4) both exams together. Data was collected from the 2010 NHIS (National Center for Health Statistics, 2010) data set which interviewed 34,329 households, which resulted in 35,177 families and 89,976 individuals. Of those sampled, 27,157 individuals and 378 proxies answered for the Adult and Cancer component (18+ years of age). All together 14,900 women whom were 40 years and older reported to the national survey and were assessed in this study.
DATA COLLECTION
The data for this study was obtained from Centers for Disease and Control and Prevention, the National Health Interview Survey (National Center for Health Statistics, 2010). The data was then put into one data set, providing information on breast cancer screening adherence.

OUTCOME
The outcome of interest are those women whom self-reported receiving Breast Cancer Screening Exams; clinical breast exam only, mammogram only, or both exams. Women who reported they had a breast cancer screening exam to check for lumps or other signs of breast cancer were asked questions regarding what type of screening procedure they received. A clinical breast exam definition was given and explained as an individual who was examined by a doctor/physician to check for any lumps or any other signs of abnormal breast features. A mammogram definition was given and explained as an individual who visited their doctor/physician and were examined by a radiologist who took two x-ray pictures, or images, of each breast to detect any lumps or any other signs of abnormal breast features. Four categories of screening were created; 1) never received any exam, 2) a clinical breast exam only, 3) mammogram only, or 4) both exams together.

RISK FACTORS
Other variables were included in the analysis to identify possible risk/predictive factors associated with breast cancer screening exams in National Health Interview Survey (National Center for Health Statistics, 2010).

Demographic variables included; gender, age, ethnicity/race, and family history of breast cancer. All aggregated variables were obtained from the 2010 National Health Interview Survey (National Center for Health Statistics, 2010) from Center for Disease Control and Prevention.

• Gender: Gender was assessed by the interviewee’s answers that were female.
• Age: Age was measured in years by the population under investigation that was 40 years and older. The variable for age at the time of the survey was collapsed into categories; 40-49; 50-64; and 65 or older.
• **Race/Ethnicity**: Ethnicity/Race was coded as White, African American or Black, Hispanics (non-white), or others (Asians, American Indians, and Alaska Natives).

• **Family History**: Family history for breast cancer was defined as father, mother, sister, brother, daughter, or son who has had breast cancer and was categorized as yes or no.

**COVARIATES**

Covariates that were possibly related to the relationship between breast cancer screening included in this analysis.

• **Education**: Educational attainment was assessed by the percentage of the population of interest with a high school diploma or less.

• **Health Insurance Status**: Health insurance status was assessed by the population that reported current health insurance.

• **Household Income**: Combined family income was collapsed into categories: 0-$34,999; $35,000-$49,999; $50,000-$74,999; $75,000 and above, or alternate answer of unknown for those without detail in income.

• **Geography**: Geographic region was collected as Northeast, Midwest, South, and West.

• **Physicians Visit**: Having visited and seen a healthcare physical in the past year.

**STATISTICAL ANALYSIS**

All analyses were performed using the statistical software SAS, version 9.2 (SAS Institute Inc., Cary, North Carolina). NHIS sampling weights were applied to all results to achieve optimal random samples of each region and different demographic populations. Descriptive statistics were calculated and reported using NHIS sampling weights. Frequencies and descriptive statistics were computed for each independent variable. Chi-square tests were used to assess group differences for categorical covariates. Associations between each independent variable and the outcome of type of breast cancer screening were analyzed using polycholomous logistic regression. Unadjusted odds ratios (OR), 95% Wald confidence intervals (CI), and p-values were reported for each univariate analysis. An alpha level of 0.05 was applied for all analyses. Adjusted ORs were calculated with multiple logistic regression models that included all covariates with \( p \leq 0.15 \) in univariate analysis, and covariates which presented significant group differences. In order to obtain the final reduced logistic regression model, multiple logistic regressions were performed after removal
of each non-significant covariate from the full regression model. If removal of the covariate changed the odds ratio relating the exposure of interest to the outcome of interest by more than 10%, then that covariate was put back into the model. If removal of the covariate did not change the odds ratio relating the exposure of interest to the outcome of interest by less than 10%, then the covariate was removed from the model. The fits of the full logistic regression models and the final reduced models were evaluated by the Hosmer-Lemeshow goodness-of-fit test.
CHAPTER 4

RESULTS

The final study sample consisted of 14,900 women, who were aged 40 years and older. The four outcomes of Breast Cancer Screening included no screening, a clinical breast exam only, mammogram only, or both exams together. Descriptive statistics of the self-reported variables of interest from this study population are found in Table 3. The majority of the women were Caucasian (73.48%) followed by African American (17.1%), Hispanic (1.8%) and lastly (7.6%) Asian American, American Indian, and Alaskan Native. Women who responded within ages 40-49 were 2,997 (20.1%); 50-59 were 4,522 (30.4%); 60-69 were 3,631 (24.3%), and above 70 years were 3,750 (25.2%). Household Income; 7,711 (51.8%) women reported earning less than $34,999; 2,241 (15.0%) reported income ranging from $35,000 to $49,999; 1,354 (9%) reported $40,000 to $74,000, 2,200 (14.8%) greater than $75,000, and 1,394 (9.4%) reported no monetary income. Women who visited their doctor in the last year were 7,337 (49.2%) while 7,563 (50.8%) did not visit the doctor in the past year. Health Insurance was not quite equally distributed within this sample. 6345 (42.6%) of women had some form of health insurance compared to 8555 (57.8%) of women with none.

Table 4 presents cross-tabulations of the variables of interest by the type of Breast Cancer Screening Exam among the sample. Type of breast cancer screening exam; women who had no exam consisted of 3,011 (20.2%), CBE only 3,284 (22.0%), Mammogram only at 938 (6.6%), and 7,622 (51.2%) had both CBE and Mammogram exams. The Pearson’s Chi-square p-values indicate whether there is a significant difference across the responses to each survey question. Based on a 0.05 level of significance, all variables; Age, Family History of Breast Cancer, Health Insurance, Region, and Doctors Visit were significant except Education (p-value = 0.4760), Household Income (p-value = .6676), and marginally significant was Race/Ethnicity at a (p-value = .0669).
Table 3. Descriptive Statistics of Self-Reported Variables of Interest in Breast Cancer Screening from the National Health Interview Survey 2010 (N = 14,900)

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<th>Std. Error %</th>
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<td>20.34</td>
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*a* Includes Asian, American Indian, and Alaska Native.

*b* Did not include monetary detail.
### Table 4. Univariate Associations Between Selected Variables of Women Who Participated in NHIS 2010 Survey and the Type of Breast Cancer Screening Exams

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<th>Mammogram only</th>
<th>CBE and Mammogram</th>
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<sup>a</sup> Includes Asian, American Indian, and Alaska Native.

<sup>b</sup> Did not include monetary detail.

<sup>1</sup> Pearson Chi-square p-value
UNIVARIATE POLYCHOTOMOUS LOGISTIC REGRESSION

Univariate associations between the variables of interest and Breast Cancer Screening Exams with unadjusted odds ratios (OR), 95% confidence intervals (95% CI), and corresponding Wald Chi-square p-values are shown in Table 5.

Within Table 5, significant associations between type of Breast Screening Exams and variables of interest were Age, Family History of Breast Cancer, Health Insurance, and Doctors Visits. Those variables of interest not significant at the 0.05 level included Race/Ethnicity (p-value = 0.0704), Education (p-value = .4766), Household Income (p-value = .6684), and Region (p-value = .1319).

Assessing Age, the unadjusted odds that women receiving a CBE only, mammogram only, or both CBE and mammogram for ages 40-49 are .343 (95% CI .292, .397), .124 (95% CI .100, .155), and .434 (95% CI .387, .487) times greater than the women who are 70 years and older. Women aged 50-59 are 1.06 (95% CI .919, 1.22), .461 (95% CI .358, .552), and 1.99 (95% CI 1.78, 2.44) times greater than the women who are 70 years and older. Women ages 60-69 are 10.5 (95% CI 6.45, 17.3), 6.18 (95% CI 3.35, 10.8), and 8.06 (95% CI 4.86, 13.9) times greater than the women who are 70 years and older. Thus, women ages 40-49 are less likely to receive breast cancer screening than women 70 years and older, while women 50-59 are more likely to receive CBE and mammogram screening and women 60-69 were more likely to receive CBE only screening.

Assessing Family History of Breast Cancer, the unadjusted odds that the woman receiving a CBE only, mammogram only, or both CBE and mammogram are .43 (95% CI 1.77, 1.08), 7.24 (95% CI 4.63, 11.4) and 6.59 (95% CI 4.28, 10.2) times greater than those women who said no or do not have any knowledge of Family History of Breast Cancer.

Assessing Health Insurance, the unadjusted odds that the woman receiving a CBE only, mammogram only, or both CBE and mammogram are 2.15 (95% CI 1.07, 2.44), 2.25 (95% CI 1.73, 2.42), and 2.23 (95% CI 2.04, 2.45) times greater than those women who did not have any type of Healthcare Insurance.
## Table 5. Univariate Associations With Odds Ratios (OR) and Associated 95% Confidence Intervals (95% CI) between Variables of Interest and Breast Cancer Screening Exams

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<th>95% CI</th>
<th>Mammogram only</th>
<th>95% CI</th>
<th>CBE and Mammogram</th>
<th>95% CI</th>
<th>Wald Chi-square</th>
<th>P-value</th>
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<td>1.05</td>
<td>.570–1.92</td>
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Notes:
- OR = 1.0 indicates reference category.
- Includes Asian, American Indian, and Alaska Native.
- Did not include monetary detail.
- The dependent variable is categorized as receiving a CBE exam, mammogram and both CBE and mammogram exams. The reference category is not receiving any breast cancer screening exam.
- OR = 1.0 indicates reference category.

1 The dependent variable is categorized as receiving a CBE exam, mammogram and both CBE and mammogram exams. The reference category is not receiving any breast cancer screening exam.
In the same respects, assessing women whom stated Yes to visiting their Doctor in the past year had an unadjusted odds of receiving a CBE only, mammogram only, or both CBE and mammogram are 2.19 (95% CI 1.97, 2.88), 2.55 (95% CI 1.93, 2.62), 3.83 (95% CI 3.49, 3.19) and times greater than those women who did not visit their Doctor in the past year.

**MULTIVARIATE POLYCHOTOMOUS LOGISTIC REGRESSION**

Table 6 displays results from the polychotomus logistic regression models for the data within this study. Table 6 shows associations between Breast Cancer Screening Exams while controlling for variables of interest; Age, Family History of Breast Cancer, Health Insurance, and Doctor Visit. The associated Wald chi-square p-values, adjusted odds ratios (AOR) and corresponding 95% CI are presented together in Table 6 displaying variables that were significant in the model.

After backwards stepwise exclusion of variables with insignificant p-values at the 0.05 level, the variables of interest that remained in the model included Age, Family History of Breast Cancer, Health Insurance, and Doctor Visit. All these exposure variables that were significantly associated with the breast cancer screening exams (p < .05) were left in the final model.

Adjusted odds that women receiving a CBE only, mammogram only, or both CBE and mammogram in the ages 40-49 are .342 (95% CI .292, .394), .124 (95% CI .100, .154), and .434 (95% CI .388, .487) times greater than the women who are 70 years and older; ages 50-59 are 1.06 (95% CI .914, 1.22), .463 (95% CI .382, .552), and 1.96 (95% CI 1.76, 2.38), times greater than the women who are 70 years and older; and ages 60-69 are 10.2 (95% CI 6.46, 15.5), 6.17 (95% CI 3.36, 10.2), and 8.04 (95% CI 4.84, 13.7) times greater than the women who are 70 years and older.

Among women, the adjusted odds of reporting receiving a CBE only, mammogram only, or both CBE and mammogram for those who had a Family History of Breast Cancer was 3.70 (95% CI 3.38, 4.03), 7.22 (95% CI 4.58, 10.8) and 6.53 (95% CI 4.27, 9.98) times greater compared to those women whom said no to Family History of Breast Cancer.
Table 6. Final Multivariate Polychotomous Logistic Regression Model With Adjusted Odds Ratios (AOR) and Associated 95% Confidence Intervals (95% CI) Between Variables of Interest and Breast Cancer Screening Exams

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<tr>
<th>Characteristics</th>
<th>CBE only AOR</th>
<th>95% CI</th>
<th>Mammogram only AOR</th>
<th>95% CI</th>
<th>CBE and Mammogram AOR</th>
<th>95% CI</th>
<th>Wald Chi-square</th>
<th>P-value</th>
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a Includes Asian, American Indian, and Alaska Native.

1 The dependent variable is categorized as receiving a CBE exam, mammogram and both CBE and mammogram exams. The reference category is not receiving any breast cancer screening exam.

2 AOR = 1.0 indicates reference category.
A strong predictor was Health Insurance with adjusted odds (AOR) that the woman receiving a CBE only, mammogram only, or both CBE and mammogram are 2.13 (95% CI 1.57, 2.52), 2.21 (95% CI 1.83, 2.58), and 2.17 (95% CI 2.02, 2.52) times greater than those women whom did not have any type of Healthcare Insurance. In the same respects, those women whom stated Yes to visiting their Doctor in the past had an adjusted odds (AOR) of receiving a CBE only, mammogram only, or both CBE and mammogram of 2.16 (95% CI 1.94, 2.37), 2.51 (95% CI 1.97, 2.66), and 3.83 (95% CI 3.46, 4.21) times greater than those women whom did not visit their Doctor in the past year.
CHAPTER 5

DISCUSSION

Using data from the 2010 National Health Interview Survey (NHIS), the purpose of this cross-sectional study was to investigate the factors associated with the type of breast cancer screening exams received among women over 40 years of age. Demographic characteristics and personal factors such as family history of breast cancer, region/geographical location, income, and yearly visit with a women’s health doctor were examined. The results from this study may help in gaining a better understandings of what factors encourage women to receive breast cancer screening and the type of screening they receive. Breast Cancer Screening types were evaluated by type of screening exam; no exams, a clinical breast exam only, mammogram only, or both exams. This study contributes to the current body of literature surrounding the issue of breast cancer screening and breast cancer by providing descriptive statistics of variables associated with screening types in a recent sample of nationally representative data of age appropriate women. This study also used multivariate polychotomous logistic regression to assess factors associated with breast cancer screening type controlling for demographic variables.

KEY FINDINGS

The results from this study indicate there were various exposures and risk factors associated with what type of breast cancer screenings women have received including age, family history of breast cancer, health insurance, and visitation to one’s physician. These associations vary in magnitude, some were significantly higher in odds of receiving particular breast cancer screening exam; age and health insurance are key variables and findings in this study. Overall, 79.8% of women within this study received some type of breast cancer screening, leaving 20.2% of women with no screening.
**RACE/ETHNICITY**

The initial hypotheses that there would be health disparities in the specificity of exam by race ethnicity did not hold to be true to what was thought. Similarly, income was not associated with receiving any type of breast cancer screening exam. In other studies Hispanic have been shown to have a lower level of breast cancer screening, especially clinical breast exams (Coughlin et al., 2008; Meisser et al., 2003). These findings within this study, suggest the need for further research about specific ethnic/racial subgroups.

**REGION/INCOME/EDUCATION**

The second hypothesis hypothesized that socioeconomic status (income and educational attainment,) and geography would have been significantly associated with receipt of Clinical Breast Exam and Mammogram Exams. Those within greater resources were more likely to be screened than those with less resources. Women with higher socioeconomic status, positive health behaviors, and that reside in urban areas will have higher adherence to breast cancer screening and will receive CBE’s and mammograms than those who are in lower socio-economic status. These resources include health care, high quality jobs, and educational opportunities. Socioeconomic status (income, educational attainment, and health insurance coverage) and behavioral activities as in choosing to go to the health care facility were used to assess this theory in the study. This sample used and categorized only 4 large and broad regions (geographical locations) limiting the specificity of urban and rural to wide and broad regions. *Resource Deprivation Theory* explains the role that resources play on the impact of health. Specifically, the theory states that minorities live in communities lacking resources that promote a healthy lifestyle (LaViest, 2005). In this study, there was no demonstrated statistically significant associations between the four broad regions and the receiving of breast cancer screening. No significant associations of breast cancer screening exams were reported by income and educational attainment by the women in this study.

**FAMILY HISTORY**

Having a family history of breast cancer was significantly associated with breast cancer screening exams. A women’s risk of breast cancer increases with a family history of diagnosed breast cancer on both the maternal and paternal sides and is increased most with first degree relatives (biological mother, sister, and daughter). Having at least one first degree
relative with diagnosed breast cancer can increase the risk of breast cancer (Eberl et al., 2005).
-- In this study, a family history of breast cancer was strongly associated with receipt of a mammogram only, or both a CBE and mammogram exam. Less than 4% of women with a family history of breast cancer received no breast cancer screening.

**AGE**

Age is the strongest and most prevalent risk factor for breast cancer after gender, regardless of all other risk factors. The likelihood of developing invasive breast cancer increases dramatically with every year in age. Age was significant with associations with breast cancer screening exams among the women in this study. As the aging process continues the probability of developing breast cancer increases substantially among 40 to 59 years old, 60 to 69 year olds (Jemal et al., 2009), with the median age of diagnosis for all women being 61 years old. Women’s age of diagnostic screening for breast cancer is relevant.

Women in this study between ages 50-69 were more likely to receive breast cancer screening and women 50-59 were the most likely to receive CBE and mammogram exam, this follows closely with screening guidelines.

**HEALTH INSURANCE/DOCTOR VISITATION**

Assessing Health Insurance and those who visited their Doctor, showed significant association with breast cancer screening. Those women with health insurance are more likely to obtain breast cancer screening than those women whom did not have any type of Healthcare Insurance. Women who reported visiting their Doctor in the past year also reported receiving a breast cancer screening; CBE only, mammogram only, or both CBE and mammogram were more likely than those women whom did not visit their Doctor in the past year. Screening for breast cancer is the best method for early detection and may decrease mortality in the United States (Berry et al., 2005). Interestingly, 870 (10.2%) of women who had Health Insurance reported not having received any breast cancer screening of any type, indicating that insurance status alone does not fully predict screening.

**STRENGTHS AND LIMITATIONS**

There are a number of limitations in this study that are worth noting. Despite the significant associations found between insurance status, doctor visits, and breast cancer
Accessibility does not always fully predict breast cancer screening. It is important to recognize various factors around personal beliefs about, receiving breast cancer screening, women who know they have a family history of breast cancer, appear to be consistent in obtaining breast cancer screening compared to those who do not. If knowledge of breast cancer comes from within a family, amongst friends, educational endeavors, or shown on media outlets/campaigns they will be more aware and engaged in their health and understanding of the seriousness of breast cancer. Early detection has been shown to decrease mortality rates of those who have been diagnosed with breast cancer (WHO, 2010). The availability of sufficient mammography facilities and equipment to meet demand may improve cancer detection (Aiello et al., 2005; White et al., 2004). Nonetheless, identifying various exposures that appear to influence specific screening exam types will assist with identifying those women least likely to get breast cancer screening.

This cross-sectional study cannot suggest causality. These findings describing the associations between current breast cancer screenings will be helpful for future researchers to develop more rigorous retrospective and prospective studies in areas of disparities, as well as improve evaluation of programs that address breast cancer screening. In addition, the findings of this study may not be completely generalizable to other populations. Although the 2010 National Health Interview Survey (National Center for Health Statistics, 2010) obtained a nationally representative sample of women aged 40 years and older in America, there was a larger proportion of Caucasian’s (73.5%) versus the other Race/Ethnicities (26.5%). Future studies should investigate and address these issues by obtaining a more representative sample of minority populations. In this particular study population, the Asian and Hispanics responses were low. Only 1375 (9.41%) of 14,900 women reported either being Hispanic n=263, 1.77% or Asian (American Indian, and Alaskan Indian) n=1139, 7.63%.

Along the same lines, recall bias may be present in this study due the nature of self-reported health behaviors. It is possible that women who have had a type or types of breast screening exams, but do not report it in the survey, may share common characteristics that may influence them to choose and participate in cancer screening. There is also no way of knowing whether the responses are completely accurate or truthful. Although internal validity and reliability analyses have been conducted on previous National Health Interview Survey’s (NHIS) in order to determine survey quality, some error is inevitably introduced due to recall
bias, misinterpretation of questions, and untruthful responses.

Despite these limitations, this study has strengths that make it a valuable addition to the literature surrounding type of breast cancer screening exams among women 40 years and older. First, the large sample size of this study contributes to the strength of its findings, 79.8% reported receiving a type of breast cancer screening. In addition, this study controlled for the well-established risk factors of breast cancer (race/ethnicity, age, family history, health insurance, and doctor visit). Lastly, by analyzing a polychotomous outcome, this study provides a comprehensive view of associations between the variables of interest not only whether or not breast cancer screening occurred, but type of breast cancer screening.

FUTURE RECOMMENDATIONS

In light of the limitations found in the current study, there are several recommendations for future studies. Future studies should investigate why 20.2% of women did not received any screening type or why 10.2% of women with insurance neglected to get screened. Future studies should also focus on specific ethnicities other than Caucasians. Ethnicities such as African Americans, Hispanic/Latinas, Asian, Pacific Islander/Native Hawaiian, American Indian/Alaska Native, and multi-ethnic populations, which would address the literature gap that currently exists among research addressing which breast cancer screening exams are utilized. Similarly, recommendation that future studies investigate whether there is a significant interaction between ethnicity and exposures and availability of breast cancer screening exams. Due to sparse and missing data for certain ethnic groups’ inquiries arise in the accessibility and participation of specific ethnic groups. Were these ethnic groups already participating in programs available to them or was there other influences surrounding their decisions in obtaining a breast cancer screening test. It is possible that cultural, social, and other policies related to ethnicity influences how women associate and decide which breast cancer screening exam they will receive. It would be also be beneficial for more studies to assess the relationship between exposure and availability of equipment to type of breast cancer screening exam obtained. It is possible that those associations differ from the ones found in the current study.
CONCLUSION

Using data from the 2010 National Health Interview Survey (NHIS), this cross-sectional study investigated the association between demographics and personal factors such as family history and type of breast cancer screening exam. In addition to evaluate the differences between type of breast cancer screening exams; demographic characteristics and personal factors such as family history of breast cancer, region/geographical location, income, visitation with a women’s health doctor and household income. Finally observing what factors and characteristics predicts type of breast cancer screening among women.

Women age range of 60-69 were more likely to report screening exams than those women 70 years or more in age. The women whom had no Family History of Breast Cancer were more likely to report receiving only CBE than those women who had Family History of Breast Cancer. Women having a family member who has been previously diagnosed with Breast Cancer are more likely to receive both exams CBE and Mammography compared to those women whom said no Family History. Woman reporting having coverage in Health Insurance were more likely to be screened than those women who did not have any type of Healthcare Insurance. In the same respects, those women who stated Yes to visiting their Doctor in the past year received more breast cancer screening exams than those women whom did not visit their Doctor in the past year.

These findings contribute and lead to future research into why and how these women can be reached and assessed for breast cancer screening. While there has been significant work to be done over time in the area of decreasing the burden chronic disease in regards to breast cancer, it still is and continues to be a major health concern today (Jemal et al., 2009; WHO, 2010).
REFERENCES


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