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Examining the Role of Electronic Medical Record Generated Provider Reminders On Provider offering of Breast Cancer Screening Services

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EXAMINING THE ROLE OF ELECTRONIC MEDICAL RECORD GENERATED PROVIDER REMINDERS ON PROVIDER OFFERING OF BREAST CANCER SCREENING SERVICES

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DEDICATION

I dedicate my dissertation work to my family and friends. To my loving parents Charles and Belinda Beverley, Sr., thank you both for always being my number one supporters. Without your love and support, I would not have been able to achieve this goal. Most importantly, thank you both for encouraging and believing in my goals and aspirations. To my brother Curtis, thank you for your love and support.

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ABSTRACT

Introduction: Breast cancer affects the lives of millions of women each year in the United States. Early detection by mammography screening can reduce the risk for advanced stages of breast cancer and improve the probability of long-term survival in women. Electronic medical records (EMRs) have been identified as a successful approach for increasing the offering of preventive care in breast cancer. This study examines the impact of EMR usage, and EMR generated provider reminders on physician ordering or providing of mammography screenings.

Methods: This study used survey data from the 2008-2010 National Ambulatory Medical Care Survey (NAMCS). Our sample included non-federal office-based physicians (n=2,785), and women age 45 and older who visited a physician from 2008-2010 (n=8,348). Chi-square analysis, ICD-9 coding and logistic regression analysis were performed to analyze the weighted data.

Results: Physician EMR use was not significantly associated with the odds that a woman would have a mammogram provided/ordered. However, significant findings of the study indicate that women on Medicare/Medicaid/SCHIP (OR=0.633, 95% CI 0.271-0.919) have significantly lower odds of receiving mammography screenings compared to women who have private insurance. In addition, women who visit obstetrics/gynecology (OR = 0.190, 95% CI 0.142-0.254) and internal medicine practices (OR = 0.553, 95% CI 0.393-0.778) have significantly lower odds of receiving a mammography, compared to women visiting general/family practices.

Conclusions: Women age 45 and older who have private are more likely to have a mammogram ordered or provided by a physician, compared to those women who are poor or without insurance. Based on our findings, women are having more general/family physicians providing them with routine care, and that these physicians are experiencing difficulty referring Medicare/Medicaid/SCHIP patients for specialty care. This may be due to patients being reluctant to pay a co-pay for mammography screenings, the short supply of specialists in the area, long waiting lists for specialists, specialists not accepting or limiting the number of patients who are covered by Medicare/Medicaid/SCHIP or self-pay, and low reimbursement rates. Further research is needed to uncover the true reasons as to why physicians are ordering/providing mammography screenings for women who are poor or on Medicare/Medicaid/SCHIP at lower rate than women who have private insurance.

In 2014, the Affordable Care Act is set to expand preventive services under the Medicaid program to cover recommended preventive services and immunizations. The referral process will be less difficult for physicians who refer self-pay and Medicare/Medicaid/SCHIP patients to specialists because patients will no longer have a co-pay for mammography screenings. In addition, we acknowledge that the HITECH statue authorizes incentive payments through Medicare and Medicaid to physicians and hospitals that use EMRs privately and securely to achieve specified improvements in care delivery. The incentive payments will help encourage physicians in all specialties to improve the ordering/providing of mammography screenings to women who are on Medicare/Medicaid/SCHIP in all races, ethnicities, and socioeconomic backgrounds.

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CHAPTER 1

INTRODUCTION

Cancer is a major public health problem that financially burdens people diagnosed with cancer, their families, and society as a whole. In 2007, the National Institutes of Health estimated the overall annual costs for cancer in the United States at $226.8 billion. The direct medical costs for cancer, which are the total of all health expenditures, were estimated at $103.8 billion in 2007. Moreover, the indirect mortality costs, which are the costs of productivity due to premature death, were estimated at 123.0 billion in 2007 (American Cancer Society, 2012).

According to the American Cancer Society one of the major costs of cancer is cancer treatment. A lack of health insurance and other barriers to health care prevent many Americans from getting appropriate health care (American Cancer Society, 2012). The United States Census Bureau estimated about 51 million people were uninsured in 2009. In fact, about 28% of Americans ages 18 to 34 had no health insurance for at least part of 2009, and 10% of children in the United States had no health insurance coverage in 2009 (American Cancer Society, 2012).

The American Cancer Society acknowledges that uninsured patients and those from ethnic minorities are substantially more likely to be diagnosed with cancer at a later stage, where treatment can be more extensive and more costly. In fact, this leads not only to higher medical costs, but also poorer outcomes and higher cancer death rates

(American Cancer Society, 2012). Cancer is the cause of 1 in 4 deaths in the United States each year (Jemal et al., 2009). In women, one of the most commonly diagnosed forms of cancer is breast cancer. Breast cancer ranks first as the most common cause of cancer deaths among women in the United States (American Cancer Society, 2012). In 2011, there were 39,000 deaths from breast cancer, 240,000 new cases of invasive breast cancer, and 57,650 new cases of non-invasive breast cancer (Surveillance Epidemiology and End Results, 2012). In 2012, breast cancer is expected to account for 29% of all new cancer cases among women (Siegel, Naishadham and Jemal, 2012).

Breast cancer is a malignant tumor that starts in the cells of the breast and can spread throughout the body in stages (American Cancer Society, 2012). Stage 0 is used to describe non-invasive breast cancers. In stage 0, there is no evidence of cancer cells or non-cancerous abnormal cells spreading to outside areas of the breast (Mankoff, 2012).

Stage I is used to describe invasive breast cancer cells that have invaded the normal surrounding tissue of the breast. Stage I is divided into subcategories known as IA and IB. In stage IA, cancerous tumors that measure up to 2 centimeters are found in the breast. However, cancer has not spread outside the breast or to the lymph nodes (Mankoff, 2012).

In stage IB, small groups of cancer cells are found in the axillary lymph nodes. These cancer cells may be between 0.2 millimeters and 2 millimeters in size. A tumor may also be found in the breast that is 2 centimeters in size or less, and small groups of cancer cells between 0.2 millimeters and 2 millimeters may be found in the lymph nodes in stage IB (Mankoff, 2012).

Stage II is divided into subcategories, known as IIA and IIB. Stage IIA invasive

breast cancer can exist in any of the following three ways. The first way that stage IIA invasive breast cancer can exist is if cancer cells are found in the lymph nodes under the arm. However, tumors do not have to be present in the breast. The second way that stage IIA invasive breast cancer can exist is if a tumor measuring up to 2 centimeters in size is found in the breast and cancer has spread to the axillary lymph nodes (Mankoff, 2012). Lastly, stage IIA invasive breast cancer can exist if a tumor measuring between 2 centimeters and 5 centimeters in size is found in the breast, and cancer has not spread to the axillary lymph nodes.

For breast cancer to be diagnosed as stage IIB, a tumor measuring between 2 centimeters and 5 centimeters in size must be present in the breast, and the cancer must have spread to the axillary lymph nodes. Stage IIB can also exist if a tumor measuring 5 centimeters in size or larger is found in the breast and cancer has not spread to the axillary lymph nodes (Mankoff, 2012).

Stage III is divided into subcategories known as IIIA, IIIB, and IIIC. Stage IIIA invasive breast cancer exists when: (1) tumors are not found in the breast, cancer is found in axillary lymph nodes, or cancer has spread to lymph nodes near the breastbone; (2) the cancer is any size and it has spread to axillary lymph nodes (Mankoff, 2012). Similarly, stage IIIB can exist in any of the following ways: (1) cancer may be any size and has spread to the chest wall and/or skin of the breast. Cancer may also have spread to axillary lymph nodes; (2) the cancer has only spread to lymph nodes near the breastbone.

For breast cancer to be diagnosed as stage IIIC, there must be no signs of breast tumors. However, if there is a tumor present, it can be any size. The cancer in this stage may spread to the chest wall and/or the skin of the breast, to lymph nodes above or below

the collarbone, and to the axillary lymph nodes or lymph nodes near the breastbone (Mankoff, 2012). Lastly, stage IV is an advanced stage of invasive cancer. In this stage, cancer has spread beyond the breast to nearby lymph nodes and other organs of the body, such as the lungs, distant lymph nodes, skin, bones, liver, or brain

Early detection by screening and treatment can decrease the risk for advanced stages of breast cancer and improve the probability of long-term survival in women. Screening is defined as the identification of individuals among an asymptomatic population who have a specified disease at a time when intervention may result in improvement of prognosis of the disease (Islam and Aziz, 2012). Studies have shown that screening for breast cancer has reduced incidence and mortality since 1996 at a rate of 2% per year (Edwards et al, 2010).

There are three types of breast cancer screenings, a clinical breast exam, mammogram, and breast self-examinations. A clinical breast exam is an exam where the doctor checks the breasts using a finger-touch technique. A mammogram is a low dose x-ray exam of the breasts used to observe changes in breast tissue that cannot be felt during a clinical breast exam (Womenshealth.gov, 2012). Due to the fact that neither clinical breast exams nor mammography is 100% sensitive, breast self-exams have been advised as an important screening method among women older than 20 years of age (Humphrey, Helfand, Chan, and Woolf, 2002).

The American Cancer Society acknowledges the importance of annual breast cancer screenings by recommending that women in their 20's perform breast self-examinations monthly and report any changes to their doctors. Women who choose to do breast self-examinations should have their breast self-examination technique reviewed

during their physical exam by a health professional. The American Cancer Society acknowledges that by doing the exam regularly, women get to know how their breasts normally look and feel and can more readily detect any signs or symptoms if a change occurs, such as development of a lump or swelling, skin irritation or dimpling, nipple pain or retraction, redness or scaliness of the nipple or breast skin, or a discharge other than breast milk (American Cancer Society, 2012).

Breast self-examinations are widely recommended for breast cancer prevention and play a small role in finding breast cancer compared with finding a breast lump by chance or simply being aware of what is normal for each woman. The American Cancer Society believes that some women feel very comfortable performing breast self-examinations regularly, which involves a systematic step-by-step approach to examining the look and feel of their breasts (American Cancer Society, 2012). Other women are more comfortable simply looking and feeling their breasts in a less systematic approach, such as while showering or getting dressed or doing an occasional thorough exam. Sometimes, women are so concerned about performing breast self-examinations correctly that they become stressed over the technique. Performing breast self-examinations regularly is one way for women to know how their breasts normally look and feel and to notice any changes (American Cancer Society, 2012).

Studies have shown that breast self-examinations increase the number of breast biopsies performed because of false-positives (Hackshaw and Paul, 2003; Elmore, Armstrong, Lehman, and Fletcher, 2005). For this reason, it is also recommended for women in their 20's and 30's to receive a clinical breast exam every 3 years and women 40 and over receive a clinical breast exam and mammogram annually (American Cancer

Society, 2012). Studies have shown that clinical breast examinations detect some cancers that are missed by mammography (Elmore, Armstrong, Lehman, and Fletcher, 2005). Women who are 40 and over are recommended to schedule their annual clinical breast exam shortly before their annual mammogram so that any suspicious areas found during their clinical breast exam can be reviewed in the mammogram (American Cancer Society, 2012).

The American Cancer Society recommends that women at high risk, greater than 20% lifetime risk, should get an MRI and a mammogram every year. An MRI should be used in addition to a mammogram, and not instead of a mammogram screening. An MRI is a more sensitive test that is more likely to detect cancer than a mammogram. However, it may still miss some cancers that a mammogram would detect. Women who are at high risk include those who have a known BRCA1 or BRCA2 gene mutation; have a first-degree relative (parent, brother, sister, or child) with a BRCA1 or BRCA2 gene mutation but have not had genetic testing themselves; have a lifetime risk of breast cancer of 20% to 25% or greater, according to risk assessment tools that are based mainly on family history; have had radiation therapy to the chest when they were between the ages of 10 and 30 years; have Li-Fraumeni syndrome, Cowden syndrome, Bannayan-Riley-Ruvalcaba syndrome, or have first-degree relatives with one of these syndromes (American Cancer Society, 2012).

Women at moderately increased risk, 15% to 20% lifetime risk, should speak with their doctors about the benefits and limitations of adding MRI screening to their yearly mammogram. Women at moderately increased risk include those who have a lifetime risk of breast cancer of 15% to 20%, according to risk assessment tools that are based mainly

on family history; have extremely dense breasts or unevenly dense breasts when viewed by mammograms; or have a personal history of breast cancer, ductal carcinoma in situ (DCIS), lobular carcinoma in situ (LCIS), atypical ductal hyperplasia (ADH), or atypical lobular hyperplasia (ALH) (American Cancer Society, 2012).

Yearly MRI screening is not recommended for women whose lifetime risk of breast cancer is less than 15%. Screening with MRI and mammograms should begin at age 30 years for women at high risk and continue for as long as a woman is in good health (American Cancer Society, 2012). The American Cancer Society acknowledges that the evidence is limited regarding the best age at which to start screening. This decision should be based on shared decision-making between patients and their health care providers, taking into account personal circumstances and preferences.

It has been the primary objective of Healthy People 2010 to increase breast cancer screening procedures for ethnic and racial minority groups. Research has found that Caucasian women age 40 to 74 years reported having lower breast cancer preventive care (mammography and clinical breast exams) than African American, Cuban, and Puerto Rican women. Within the past year, Caucasian women reported using mammograms and clinical breast exams 59.8% and 66.0%, respectively. In comparison, the following racial/ethnic groups reported using mammograms and clinical breast exams at a higher rate: African American (60.6%), Cuban (65.1%), and Puerto Rican (62.5%) women. Women of Mexican origin lag far behind all of these racial and ethnic groups in breast cancer screening rates with only 47.8% using mammograms and 54.5% performing clinical breast exams (Miranda, Tarraf, & Gonzalez, 2011).

Studies have shown that racial and ethnic disparities exist in breast cancer. In a

study conducted in 2005, evidence revealed a lower incidence of breast cancer among African American women than Caucasian women, corresponding to 29 cases and 44 cases per 10, 000 person years for African American and Caucasian women, respectively (Chlebowski, Chen, Anderson, Rohan, Aragaki, Lane, Dolan, Paskett, McTiernan, Hubbell, Adams-Campbell, and Prentice, 2005). However, among women who developed breast cancer, African Americans had higher mortality than white women, corresponding to 9 and 6 deaths per 10,000 person-years from diagnosis in African American and white women, respectively.

Several factors have been suggested that contribute to higher breast cancer mortality in African American women than in Caucasian women. The factors include poorer socioeconomic status with reduced access to health care, a lower frequency of mammography with delayed diagnosis, and reduced chemotherapy dosage related to underlying neutropenia (Newman, Mason, Cote, Vin, Carolin, Bouwman et al., 2002; Henson, Chu, Levine, 2003; Li, Malone, Daling, 2003; O'Malley, Le, Glaser, Shema, West, 2003). However, a disparity in survival between Caucasian and African American women with breast cancer treated in the same health care systems, as well as in the same cancer clinical trial group suggests that factors other than access to health care or mammography/treatment differences play a role in this process. These factors include differences in obesity and high-grade cancers, which among African American women was twice that of Caucasian women (Jatoi, Becher, Leake, 2003; Albain, Unger, Hutchins et al., 2003).

For these reasons, it is important for women of all racial and ethnic backgrounds to receive mammography screenings. To improve the offering of mammography

screening, the use of electronic medical records (EMRs) with provider reminders may be helpful. Research has shown that provider reminders may be a successful approach for increasing the offering and delivery of preventive care for diseases such as breast cancer (Dexheimer et al., 2008).

EMRs with provider reminders allow physician practices to improve clinical efficiency and pursue more powerful quality improvement programs than is possible with paper-based records (Miller and Sim, 2004). It is necessary for health care providers to recognize the importance of provider reminders and use them to offer patients preventive care for breast cancer. This dissertation contributes to the literature by investigating the impact of provider reminders on provider offerings of mammography screening using the 2008-2010 National Ambulatory Medical Care Surveys.

CHAPTER 2

LITERATURE REVIEW

2.1 BREAST CANCER INCIDENCES AND MORTALITY

Breast cancer is one of the 3 most commonly diagnosed types of cancer among women in 2012 (Yasmeen, Romano, Tancredi, Saito, Rainwater and Kravitz, 2012). From 1975 to 1990, breast cancer mortality in women slowly increased by 0.4% per year. However, breast cancer mortality has decreased by 2.2% per year from 1990 to 2007 (Altekruse, Kosary, Krapcho et al., 2010). The percentage decline was larger among younger women. From 1990 to 2007, mortality rates decreased by 3.2% per year among women younger than 50, and by 2.0% per year among women 50 and older (Altekruse, Kosary, Krapcho et al., 2010). The decline in breast cancer mortality has been attributed to both improvements in breast cancer treatment and early detection (Berry, Cronin, Plevritis et al., 2005). More specifically, from 1998 through 2007, breast cancer death rates declined annually by 1.9% in Hispanics/ Latinas, 1.8% in non-Hispanic whites, 1.6% in African Americans, 0.8% in Asian Americans/Pacific Islanders, and it has remained unchanged among American Indian/Alaska Natives (Altekruse, Kosary, Krapcho et al., 2010).

Breast cancer mortality rates have decreased annually in African American women, but more slowly than in white women which has resulted in a growing disparity. Between 2003 and 2007, African American women had a higher death rate than white

women (Surveillance, Epidemiology and End Results (SEER) Program, 2010). The factors that contribute to higher death rates among African American women include differences in access, utilization of early detection and treatment, and differences in tumor characteristics (Berry, Cronin, Plevritis, et al., 2005; Menashe, Anderson, Jatoi, Rosenberg, 2009; Komenaka, Martinez, Pennington et al., 2010). This dissertation addresses the utilization of early detection by examining the effect of provider reminders on the offering mammography screening by physicians. An increase in the utilization of early detection/screenings lowers the risk of death among African American women because breast cancer is more treatable when it's found early (Surveillance Epidemiology and End Results, 2012).

It is estimated that 226,870 women will be diagnosed with breast cancer in 2012. (Surveillance Epidemiology and End Results, 2012). Approximately 1 in 8.2 women will receive a diagnosis of breast cancer during her lifetime (Cancer Facts and Figures, 2001). From 2005-2009, the following percentages of women in the United States were diagnosed with breast cancer: 0.0% under age 20; 1.8% between 20 and 34; 9.9% between 35 and 44; 22.5% between 45 and 54; 24.8% between 55 and 64; 20.2% between 65 and 74; 15.1% between 75 and 84; and 5.7% of women 85 and older. The median age at diagnosis for breast cancer from 2005 to 2009 was 61 years of age (Surveillance Epidemiology and End Results, 2012).

In 2012, it is estimated that 39,510 women will die of breast cancer (Surveillance Epidemiology and End Results, 2012). Between 2005 and 2009, the median age at death for breast cancer was 68 years of age. The following percentages of women died of breast cancer from 2005 to 2009: 0.0% under age 20; 0.9% between 20 and 34; 5.6% between

35 and 44; 14.8% between 45 and 54; 21.4% between 55 and 64; 19.9% between 65 and 74; 22.0% between 75 and 84; and 15.5% of women 85 and older (Surveillance Epidemiology and End Results, 2012).

To save one life from breast cancer, eighty-four women need to be screened annually between 40 and 84 years. In addition, 5.3 women need to be screened annually for breast cancer to gain one full year of life (Hendrick and Helvie, 2012). Breast cancer alone accounts for 30% of all new cancer cases among women in the United States and it accounts for 53% of cancer cases in all women (Siegel, Ward, Brawley, and Jemal, 2011).

2.2 BREAST CANCER SCREENING

Identification of the breast cancer at the earlier phases of progression improves prognosis. Screening for breast cancer has been found to be beneficial because studies have shown that screening by mammography reduces breast cancer by 25% and can significantly reduce mortality from breast cancer (Islam and Aziz, 2012).

Research has shown that breast cancer screening reduces breast cancer death among women 40 to 74 years of age (Humphrey, Helfand, Chan, and Woolf, 2002). In women aged 40 to 49, breast cancer screening allows for early detection of high-risk lesions, which may prompt advanced treatment and a lower subsequent breast cancer risk (Kremer, Downs-Holmes, Novak, Lyons, Silverman, Pham, and Plecha, 2012). In addition, biennial breast cancer screenings for women aged 50 to 69 years has resulted in earlier breast cancer detection, and decreased breast cancer mortality (Grimshaw, Russell, 1993; Jemal et al., 2009).

The value in breast cancer screening for these age groups has helped physicians to make diagnoses at earlier stages and as a result these patients have smaller tumors

(Yasmeen, Romano, Tancredi, Saito, Rainwater and Kravitz, 2012). Research has shown that the majority of physicians recommend annual breast cancer screening for women aged 40 through 79 years, including women with short life expectancy (Yasmeen, Romano, Tancredi, Saito, Rainwater and Kravitz, 2012).

Studies have shown that breast cancer incidence increases with age and more than 50% of cases occur in women without known major predictors (Cancer Facts and Figures, 2001). To this end, a study performed by Humphrey et al. (2002) revealed that women older than 70 years of age have the highest incidence of breast cancer in the United States. For this reason, Warner (2012) recommends that women between 40 and 74 receive a breast cancer screening every 2 years to reduce risk of death from breast cancer. When women are screened every two years, breast cancer risk is reduced by 15%. However, based on findings from Warner (2012) there is about a 40% chance that patients will be called back for further imaging tests and a 3% chance that patients will undergo biopsy, with a benign breast cancer finding.

Many professional societies are uncertain of the appropriateness and cost-effectiveness of breast cancer screenings in women younger than 50 and older than 74 years of age. This has caused many professional societies to issue conflicting recommendations (Woolf, 2009). The USPSTF recommends against routine screening mammography for women ages 40 to 49. However, they suggest biennial mammography screenings from age 50 to 74 (Nelson et al., 2009). The American College of Obstetricians and Gynecologists (ACOG) recommends mammography every one to two years in women from 40 to 50 years of age and annually after age 50 with no specific age for stopping. The American Cancer Society (ACS) differs slightly from both of these

organizations. The ACS provides no specific age for discontinuing breast cancer screening and believes that co-morbidity is the only qualifying factor for exclusion from screening (Barbieri, 2010). The American Geriatrics Society recommends mammography screening for older women unless they are unlikely to survive in the next 5 years or have significant co-morbidities that would preclude breast cancer treatment (Raikand Fins, 2004). However, studies have shown that there is a small benefit in screening the elderly, which may be outweighed by harms such as, anxiety, additional testing, and unnecessary treatment (Rich and Black, 2000).

The prevalence of mammography screenings is a major concern for health care providers because breast cancer is the second leading cause of cancer deaths among all women in the United States (MMWR, 2010). Data from the 2008 Behavioral Risk Factor Surveillance System were examined to determine the prevalence of mammography screenings in the United States. The survey reported that there was a small reduction in screenings among U.S. women aged 50-74 from 81.5% in 2006 to 81.1% in 2008. The lowest prevalence of screenings were among those women aged 50-59 (79.9%), women who did not finish high school (72.6%), American Indian/Alaska Natives (70.4%), women with an annual income of less than $15,000 (69.4%), and women without health insurance (56.3%). The highest prevalence of mammography screening was among women in the Northeast region of the United States (MMWR, 2010). In fact, mammography screening has been found more prevalent among African American women than white and Hispanic women (Peek and Han, 2004; Bennett, Probst, and Bellinger, 2011).

On the contrary, studies have shown that white women are more likely than African American or Hispanic women to be diagnosed earlier and have mammograms at academic facilities, facilities with digital mammography services, and facilities that rely exclusively on breast imaging specialists to conduct and read mammograms (Sassi et al, 2006). In comparison, research has shown that women with private insurance were more likely than women without private insurance to have mammograms at facilities with these same characteristics. Likewise, uninsured women and those with no usual source of care have the lowest rates of reported mammogram use (Peek and Han, 2004).

Disparities in mammography screening are decreasing among medically underserved populations but still persist among racial/ethnic minorities, rural populations, and low-income women. According to a study done using the 2008 Behavioral Risk Factor Surveillance System (BRFSS), there are cancer screening and treatment disparities in rural minority populations. Research revealed that people who live in rural areas of the United States are less likely to have breast cancer screenings than urban residents (Bennett, Probst, and Bellinger, 2011).

In a study conducted on 2007 data from a mammography facility survey for the metropolitan region of Chicago, Illinois, African American, Hispanic women and women without private insurance were less likely to be diagnosed early for breast cancer when compared to white women (Rauscher et al., 2012). However, they were more likely to obtain mammography services from facilities that did not offer digital mammography, but did offer film-screen mammography. The Digital Mammographic Imaging Screening study conducted in 2005 has shown that film-screen and digital mammography are equally accurate in screening for breast cancer (Pisano, Gatsonis, Hendrick, Yaffe, Baum,

Acharyya, Conant, Fajardo, Bassett, D'Orsi, Jong, and Rebner, 2005).

2.3 BENEFITS OF ELECTRONIC MEDICAL RECORDS

EMR adoption is a major concern for health care organizations because of the American Recovery and Reinvestment Act that was signed into law by President Barack Obama in 2009. A primary objective of the statute is to modernize the nation's infrastructure by requiring all health care organizations to adopt EMRs by the year 2014 (American Recovery and Reinvestment Act, 2012; Fishman, 2011). EMR adoption has increased from 105,000 physician practices to 130,000 physician practices since 2003 (Reardon and Davidson, 2007). This increase in EMR adoption represents only 20% of the physician population in the United States. Moreover, the National Ambulatory Medical Care Survey of 2005 revealed that only 17.6% of physicians reported using EMRs in their practices (Burt and Sisk, 2005). This represented a 3% decrease in EMR adoption from 2003 to 2005, as well as a major concern for health care organizations in the United States.

Although EMR usage has declined in recent years, physicians who do use EMRs have still made improvements in healthcare. Adams et al. (2003) found that EMR usage in pediatric primary care offices resulted in children between 9 and 23 months 1.19 times more likely to have a lead screening during their visit. In addition, Furukawa (2011) found that EMR usage by U.S. office-based physicians was associated with 11.2% more diagnostic/screening services provided per 20-minute period for chronic problems in patients.

In 2009, Congress and President Obama also signed into law the Health Information Technology for Economic and Clinical Health Act (HITECH), which

authorized incentive payments through Medicare and Medicaid to providers and hospitals when they use EMRs privately and securely to achieve specified improvements in care delivery. HITECH promotes the "meaningful use" of EMRs, which is the usage of EMRs by providers to achieve significant improvements in care, and then awards payments to these providers for their improvements. Through this legislation, the federal government will make available incentive payments totaling up to $27 billion over 10 years, or as much as $44,000 through Medicare and $63,750 through Medicaid per provider. This funding will provide important support for the creation of a nationwide system of EMRs (Blumenthal and Tavenner, 2010).

Research has shown that primary care physician offices with EMRs provide more accurate documentation of mammography screenings than paper based records (Clark et al., 2009). However, evidence has shown that physician organizations are not using their EMRs to their full potential. 39% of physician organizations in the United States are not using their EMRs to send provider reminders to prompt providers to offer preventive care, such as preventive care screenings (Schmittdiel et al., 2004).

Provider reminders can remind providers to offer services during routine visits and remind patients to schedule care. A recent study found that 50% of health care organizations use provider reminders to offer mammography screenings (Schmittdiel et al., 2004). Patient visits to these types of organizations revealed that EMRs with provider reminders were associated with 13.2% improvement in mammography screening rates (Mandelblatt and Yabroff, 1999). Likewise, studies have found that the usage of provider reminders resulted in an overall 13% improvement in preventive screenings (Balas et al., 2000; Dexheimer et al., 2008). The results of these studies reveal that with the usage of

EMR provider reminders, physicians are providing more preventive care to patients.

Provider reminders have improved clinical processes for a variety of conditions, including ordering tests to determine hemoglobin and lipid levels, foot examinations, counseling smokers, and diabetic eye examinations (Demakis, Beauchamp, Cull et al., 2000). Fourteen of 19 studies on provider reminders used in preventive care showed improvements in provider processes of care. These studies found that provider reminders improve clinical processes for diabetes care, immunization, blood pressure screening, and Pap smear tests, although the improvements often diminish if the reminders are stopped (Mitchell and Sullivan, 2001).

Research has not been conducted to determine if the overall level of provider reminder usage among physician offices improve the offering of mammography screening (Schmittdiel et al., 2004). However, studies have shown that Americans support the usage of provider reminders in physician offices. 78% of Americans favor the use of provider reminders and believe that they could improve health care (Gaylin et al., 2011). Additionally, more than 59% of Americans support health care information sharing among providers and believe that provider reminders can reduce health care costs (Gaylin et al, 2011).

In the outpatient setting, a challenge exists for providers and patients in follow-up of abnormal mammography test results. Follow-up actions often have to be performed in the future because of poor patient-provider communication for follow-up appointments (Poon, Haas, Puopolo, Gandhi, Burdick, Bates, and Brennan, 2004). While good patient-doctor communication has long been recognized as a cornerstone for good-quality medical care, provider reminders may be a form of communication to ensure that patients

with abnormal test results receive the appropriate follow-up care (Billings and Stoeckle, 1999).

Systematic reviews have coincided in concluding that provider reminders have been proven effective in improving follow-up care and increasing provider adherence to preventive care standards and prescribing guidelines (Davis, Thomson, Oxman, & Haynes, 1995; Hulscher, Wensing, Grol, van der Weijden, & van Weel, 1999; Wensing & Grol, 1994). Grimshaw and Russell (1994) reported improvements in performance according to standards in both hospital and general practice settings in several studies where guidelines were imbedded in medical record cards and other forms. However, Solomon, Hashimoto, Daltroy, and Liang (1998) cautioned that not all trials of provider reminders have demonstrated effects. The effects of reminders often disappeared after the reminders were stopped, suggesting that to be effective, reminders must be applied continuously and incorporated into daily routines. Research has shown that asking health providers to respond to reminders appears to boost effectiveness (Solomon, Hashimoto, Daltroy, and Liang, 1998).

Axt-Adam, van der Wouden, and van der Does (1993), performed a review of interventions that influenced physician test ordering. Findings from the review showed that the effect of a provider reminder was enhanced when physicians noted a response as to whether the reminder was followed. Both manual and computerized provider reminders have been found to be similarly effective in inducing physicians in primary care settings to perform various preventive services, such as immunization and mammography screenings.

Computer-based provider reminders go beyond generic reminders about practice

guidelines to integrate patient-specific information from a computer database to generate patient-specific assessments or recommendations. A review of controlled trials of clinical decision support systems found positive effects on physician performance for preventive services and positive results with computer-based provider reminders (Hunt, Haynes, Hanna, & Smith, 1998).

2.4 HOW PROVIDER REMINDERS WORK

Provider reminders are prompts given to a provider to cue them to perform a desired action for a patient's care at the time of the encounter (Riley, Galang, and Green, 2011). These prompts notify providers to offer services such as exams, tests, or medical procedures during routine visits. Provider reminders may consist of a note in a patient's chart, a computer print-out, a message appearing on a computer screen, a verbal cue from an assistant, a checklist, wall poster, flowchart, or other paper or computer-based job aids that guide the health provider through the appropriate steps in a process.

The Task Force for Community Preventive Services reviewed studies focused on influenza and pneumococcal polysaccharide vaccines. Based on the review, the Task Force recommended the use of provider reminders in healthcare settings on the basis of strong evidence of effectiveness in improving targeted vaccination coverage (Task Force on Community Preventive Services, 2005). Although the review did not include an evaluation of the effectiveness of provider reminders when implemented alone in increasing targeted vaccination for Hepatitis B, the Task Force acknowledges that this recommendation should be considered applicable to the Hepatitis B vaccine.

Overall, the Task Force recognized that their findings in the review were applicable to providers and staff in most healthcare settings where improvements in

coverage are needed (Task Force on Community Preventive Services, 2005). The major assumption underlying provider reminders is that provider forgetfulness or lack of awareness are major barriers to performance in accordance with standards, as opposed to deficiency in knowledge or skill.

A Cochrane review from 2009 found that provider reminders generally achieve small to modest improvements in provider behavior, with a trend toward larger improvements for reminders that require a user to enter a response (Shojania, Jennings, Mayhew, Ramsay, Eccles, and Grimshaw, 2009). In addition, provider reminders have been shown to be an effective tool to increase immunization rates, adherence to recommended diabetes and coronary artery disease care, and increase colorectal cancer screening rates (Sequist, Gandhi, Karson, et al., 2005; Fiks, Grundmeier, Biggs, Localio, and Alessandrini, 2007; Nease, Ruffin, Klinkman, Jimbo, Braun, Underwood, 2008; Seres, Kirkpatrick, Tierney, 2009).

2.5 CONCEPTUAL FRAMEWORK

Studies have consistently found that individuals are more likely to have preventive screenings when offered by providers (McPhee, Bird, Davis, Ha, Jenkins, and Le, 1997). Grady et al. (1992) found that provider offering of mammography screening had a stronger association with mammography participation compared with demographic variables, health care utilization, attitudes, or health status. In contrast, patients with no recent mammography screening reported the lack of a provider recommendation or offer as a common barrier to getting a screening (Mamon, Shediac, Crosby, Sanders, Matanoski, and Celentano, 1990; Kelly and Shank, 1992; Ruchlin, 1997; Brenes and Pasket, 2000; Weitzman, Zapka, Estabrook, and Goins, 2001). Based on these studies, it is important that provider reminders are in place to increase provider offering of

preventive screenings for patients.

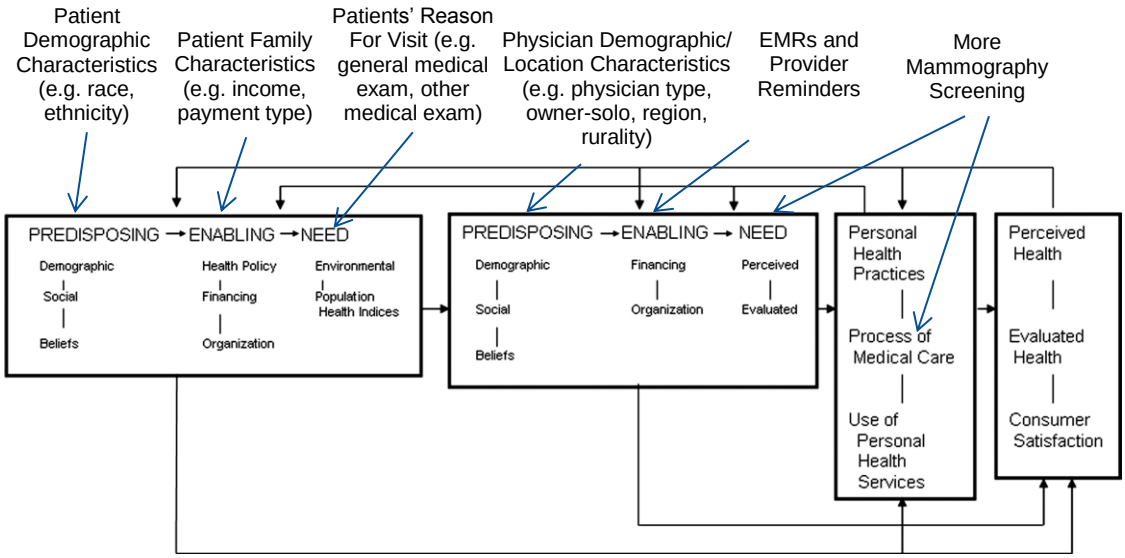
Physician offering of appropriate preventive screenings represents an intricate part in the receipt of healthcare. Additionally, it provides important clues regarding the success or failure of an intervention. Studies have acknowledged that physician offering of preventive screenings, tests, or medications are legitimate outcome measures in the implementation of an intervention to improve preventive health (Bastani, Yabroff, Myers, Glenn, 2004).

The Behavioral Model of Health Services Use (Figure 2.1) explains that understanding health services use is best achieved by focusing on social and individual determinants (Andersen, 2008). Although the model has evolved over time, revisions resulted mainly in additions to the model and did not change the fundamental base of the model (Andersen, 2008). The first model suggested people's use of health services is a function of their predisposition to use services, factors which enable or impede use and need for care (Andersen, 2008).

For the purposes of this study, predisposing variables were patient and physician demographic/location characteristics. Patient demographic characteristics include race and ethnicity. Physician demographic/location characteristics include physician type, employment status of physician, owner of the practice, and practice type, region, and metropolitan statistical area. Other variables in the model included, enabling as patient family characteristics and EMRs and provider reminders. Patient family characteristics include income and payment type. Perceived needs refer to patients' reason for visit. Patients' reason for visit includes general medical exams and other medical exam. Lastly,

more mammography screening ordered or provided by physicians represents perceived needs and the process of medical care in the model.

Figure 2.1. Andersen's Health Services Use Model: Variables influencing mammography screening ordered or provided by physicians



Dexter et al. (2001) supports the principles in figure 1. In this study, research was conducted over an 18-month period to examine the impact of provider reminders on preventive screenings. Provider reminders were sent to healthcare providers to identify eligible patients for preventive screenings that had not been ordered by the admitting physician. For eligible patients, provider reminders resulted in higher ordering rates for pneumococcal vaccination, prophylactic heparin, and prophylactic aspirin at discharge.

Figure 2.1 also shows that EMRs and provider reminders enable the need for diagnostic screenings, such as mammography in patients. Specifically, EMRs assist in keeping an accurate record of a patient's diagnostic/screening records and provider reminders notify physicians when patients are required to have a screening. Research

conducted by Yabroff et al. (2010) strengthens and reinforces these principles illustrated in the conceptual framework. Yabroff et al. (2010) found that healthcare providers in practices with a full EMR system or in transition of installing/replacing an EMR system were more likely than physicians in practices with paper charts to make more guideline-consistent recommendations for diagnostic screenings (Yabroff, Klabunde, Yuan, McNeel, Brown, Casciotti, Buckman, Taplin, 2010).

2.6 KNOWLEDGE GAP

As mentioned previously, there have not been any studies that examine provider EMR usage, and the impact of provider reminders on offerings of mammography screenings to patients. To fill this knowledge gap, this study contributes to the literature by using recent, nationally representative, and racially diverse data from the 2008, 2009, and 2010 National Ambulatory Medical Care Surveys. This study examines the following (2) main hypotheses:

1. Mammography screenings will more likely be ordered or provided by physicians who use EMR systems with reminders compared to physicians who do not use EMR systems.
2. Mammography screenings will more likely be ordered or provided by physicians who use EMR systems with reminders turned off or no reminders, compared to physicians who do not use EMR systems.

CHAPTER 3

METHODOLOGY

3.1 STUDY DESIGN

The National Ambulatory Medical Care Surveys (NAMCS) is a national survey that collects information from non-federally employed office-based physicians about the provision and use of ambulatory medical care services in the United States (CDC, 2012). The CDC established NAMCS in 1973, and has conducted the survey from 1973-1981, in 1985, and annually since 1989. Participating physicians, with the exception of anesthesiologists, pathologists, and radiologists who are excluded from the survey, complete a one-page questionnaire for each patient visit sampled during a one-week reporting period. Data is used to statistically describe the patients that utilize physician services, and to make physician estimates as well as visit estimates based on the conditions most often treated and the diagnostic and therapeutic services rendered. Moreover, public health policy makers, health services researchers, and epidemiologists use the data to describe and understand the changes that occur in medical care requirements and practices.

In this study, the 2008, 2009, and 2010 National Ambulatory Medical Care Surveys were merged or combined by a common identifier. 2,785 physicians are represented in the study sample after excluding anesthesiologists, pathologists, radiologists, and surgical care specialists. In addition, 8,348 women age 45 and older

represent the patient study sample.

3.2 DATA ANALYSIS

The chi-square test is commonly used in quantitative analyses to examine independence and goodness of fit (Chegg, 2012). In many national studies the chi-square test has been used to assess EMR usage for quality improvement in health care, perceived barriers to EMR adoption, and family practice residents' perceptions regarding EMRs (Aaronson, Murphy-Cullen, Chop, Frey, 2001; Burt, Sisk, 2005; DesRoches, Campbell, Rao, Donelan, Ferris, Jha, Kaushal, Levy, Rosenbaum, Shields, Blumenthal, 2008).

In this study, chi-square testing was used to analyze physician ordering or providing of mammography screenings by physician EMR usage and EMR reminder usage. P-values less than 0.05 from the chi-square analyses determined the significance of the variables of interest.

Logistic regression was used to estimate adjusted odds ratios and 95% confidence intervals. For purposes of this study, the likelihood of mammography screening was modeled in the logistic regression models for all hypotheses. The information from the resulting analyses was used to summarize the associations between each variable of interest.

ICD-9 coding was used to define two covariates used in the analyses, General Medical Exam (IDC-9: 3100.0) and Other Medical Exam (ICD-9: 3240.0). All analyses for this study incorporated sampling weights and were carried out using SAS version 9.3 (SAS, 2012).

3.3 DEPENDENT VARIABLES

Based on the literature review, a dependent variable from the 2008-2010 NAMCS was critical to the study. Question 7 from the NAMCS Patient Record Form was used as a dependent variable in the analyses. Question 7 asks, "Mark (X) all ordered or provided at this visit; (4). "Mammography" is among the alternatives. A missing category was also created to account for the "No answer" responses in this question.

3.4 INDEPENDENT VARIABLES

Based on the literature review, several independent variables from the 2008-2010 NAMCS were key in this study. These variables include Question 17 (2008-2009) and 18g from the Electronic Medical Record Supplement of the 2008-2010 NAMCS. Question 17 (2008-2009) asks, "Does the reporting location use an electronic medical record (EMR) or electronic health record (EHR) system? – (1) Yes, all electronic; (2) Yes, part paper and part electronic; (3) No; (-8) Don't know; or (-9) Blank?" The response categories '(1) Yes, all electronic and (2) Yes, part paper and part electronic' were combined into one category labeled "Yes" due to a low response rate in the response categories (1) and (2) separately. A missing category was also created to account for the "Don't know", and "Blank" responses in this question.

Question 18g asks, "Does the reporting location have a computerized system for reminders for guideline-based interventions or screening tests – (1) Yes; (2) No; or (3) Unknown?" A missing category was created to account for the "Unknown" responses in this question. Both question 17 (2008-2009) and 18g from the Electronic Medical Record Supplement of the 2008-2010 NAMCS were combined to form the variable Physician EMR Use. Physician EMR Use was classified into three groups: No EMR, EMR no

reminder, and EMR with reminder. Due to low response rates, the group EMR no reminder includes EMR with turned off reminders and EMR with no reminders.

3.5 COVARIATES

3.5.1 PHYSICIAN COVARIATES

Based on the literature review, several covariates from the 2008-2010 NAMCS were key in describing the characteristics of the physicians' and their practices. The covariates that describe the location of the physician practices include region and metropolitan statistical area. Region was classified into four groups: Northeast, Midwest, South and West. Metropolitan statistical area was classified into two groups: Metropolitan area and Non-Metropolitan area.

The covariates that describe physician and practice type include employment status of the physician and owner-solo. Employment status of the physician was classified into three groups: owner, employee, and contractor. Due to low response rates in the categories of physician practice type and owner of practice, both categories were combined to form the Owner-solo category. The Owner-solo category was classified into three groups: Physician, Health Maintenance Organization/other practices, and Community Health Centers. The response groups Community Health Centers and Academic Health Centers both had low response rates, and therefore were combined into one group labeled Community Health Centers. The response group Health Maintenance Organization/ other practices was created to include responses to Health Maintenance Organization, Other hospital, Other health care corporation, and Other, due to low response rates in all of these groups.

The covariates that describe physician appointments include same day

appointments, and the time it takes to get an appointment for a routine medical exam. Same day appointments were classified into two groups: Yes and No. Lastly, the time it takes to get an appointment for a routine medical exam was classified into two groups: Within 1 week and 1week - 1 or more months. The response group 1 week – 1 or more months was created to include responses to 1-2 weeks, 3-4 weeks, 1-2 months, and 3 or more months due to low response rates in each of these groups.

The covariate that describes the year that the survey was conducted is survey year. Survey year was classified into three groups: 2008, 2009, and 2010.

3.5.2 PATIENT COVARIATES

Based on the literature review, several covariates from the 2008-2010 NAMCS were crucial in describing the characteristics of patients. These variables include race, ethnicity, Rurality, payment type, income quartile of the ZIP Code or Census tract where patient lives (income), patients' reason for visit, and survey year. Race was classified into three groups: White, Black, and Other. The response group "Other" was created to include responses to "Asian", "Pacific Islander", "American Indian", and "Multiracial", due to low response rates in each of these categories. Ethnicity was classified into two groups: Hispanic and Non-Hispanic. Rurality was classified into two groups: urban and rural.

Payment type was classified into three groups: Private insurance, Medicare or Medicaid/SCHIP, and Self-pay or other form of payment. The response category "Medicare or Medicaid/SCHIP" was created to include responses to "Medicare" and "Medicaid/SCHIP", due to low response rates in each of these categories. The response group "Self-pay or other form of payment" was created to include responses to

"Worker's Compensation", "Self-pay", "Other", and "No charge/charity", due to low response rates in each of these groups.

The income quartile of the ZIP Code or Census tract where patient lives (income) was classified into four groups: $32,793 or less, $32,794-$40,626, $40,627-$52,387, and $52,388 or more. Patient's reason for visit was classified into two groups: general medical exam (ICD-9: 3100.0) and Other Medical Exam (ICD-9: 3240.0). Lastly, survey year was classified into three groups: 2008, 2009, and 2010.

3.6 CONTROL VARIABLES

3.6.1 PHYSICIAN COVARIATES

Based on the literature review, one control variable from the 2008-2010 NAMCS was critical to describing physician characteristics in the study. Physician specialty was selected as a control variable in this study, and it was restricted to general/family practice, internal medicine, obstetrics/gynecology, and dermatology/oncology. Due to low response rates in dermatology and oncology, both groups were combined to form dermatology/oncology.

3.6.2 PATIENT COVARIATES

Based on the literature review, several control variables from the 2008-2010 NAMCS were crucial in describing patient characteristics in the study. These variables include age and sex. Sex was restricted to female, and age was restricted to 45 and over.

3.7 LIMITATIONS

A limitation in this study is that physicians from the Indian Health Service are not included in the NAMCS survey. In addition, there was a high percentage of item non-response in questions used in the analyses. As a result, biased estimates and

underestimated standard errors are calculated, particularly since the NAMCS uses a single imputation algorithm.

A second limitation for this study was the fact that question 7 from the 2008-2010 NAMCS Patient Record Form, should be reworded into two separate questions. The first question should ask: "Were any diagnostic/screening services ordered at this visit?" and the second question should ask: "Were any diagnostic/screening services provided at this visit?" By separating the question, more specific analyses can be performed on the data. Researchers will have the ability to determine the amount of diagnostic/screening services ordered and the amount provided to each patient.

A third limitation for this study is that it cannot be determined from the check-mark response choices listed for question 7, whether mammography services ordered or provided are routine or abnormal follow-up. Also, it cannot be determined from NAMCS the type of EMR systems physicians are using. Providing these distinctions will allow for more exact or specific analyses as it relates to mammography services and physician EMR use.

CHAPTER 4

RESULTS

4.1 DESCRIPTION OF THE PHYSICIAN POPULATION

The organizational and geographical characteristics of physicians who could order or provide mammography screenings are presented in Table 4.1. More than half of the physicians are in the general/family practice specialty (55.3%). Many are owners (56.1%) who own health care clinics (73.9%) and provide appointments to their patients within 1 week (47.0%) and between 1 week and 1 or more months (53.0%). Likewise, more than half of physicians provide same day appointments (57.8%) to their patients. The physicians are evenly distributed throughout the four regions of the United States, mainly in metropolitan areas (90.1).

4.2 PHYSICIAN EMR AND PROVIDER REMINDER USE

The use of EMR and provider reminders by physicians is presented in Table 4.2. Significant findings in this table indicate that no EMR was more common among physicians located in the Northeast (56.9%), Midwest (55.4%), Western (53.2%) and Southern (51.9%) regions of the United States. No EMR was also more common among community health centers (61.9%), HMO/other practices (77.4%), and physicians (47.7%) who own health clinics, and by physicians who are contractors (67.6%), employees (53.9%), and owners (53.0%) of health care organizations. In addition, significant

findings indicate that no EMR was more common among 50.3% of physicians who provide same day appointments, and 59.1% of physicians who do not provide same day appointments to their patients. The following physician characteristics were not significant: specialty, metropolitan statistical area, the time it takes to get an appointment, and survey year.

4.3 PHYSICIAN ORDERING OR PROVIDING OF MAMMOGRAPHY

Table 4.3 presents physicians who ordered or provided a mammography screening for a patient during a visit. Significant findings in this table indicate that ordering or providing mammography screenings was more common among physicians in the obstetrics/gynecology (9.3%) specialty, than in internal medicine (2.8%), general/family practice (1.8%), and dermatology/oncology (1.3%). Moreover, the likelihood of physicians not ordering or providing mammography screenings to their patients was more common in the dermatology/oncology (98.7%), general/family practice (98.2%), and internal medicine (97.2%) specialty, than in obstetrics/gynecology (90.7%).

4.4 THE CHARACTERISTICS OF WOMEN WHO VISITED A PHYSICIAN

Table 4.4 describes the characteristics of women aged 45 and older who visited a physician in one of the specialties included in this study, and it also indicates the EMR use of the physician visited. The women are mostly white (70.0%) and Non-Hispanic (89.2%) who live in urban (83.8%) areas of the United States. Many of these women have private insurance (44.7%) or Medicare/Medicaid/SCHIP (44.5%) and make visits to physicians for general medical exams (54.3%).

Visits to physicians who have EMR and use reminders were more common

among white (36.8%), black (35.8%), other (31.9%), Non-Hispanic (39.7%), and Hispanic (37.4%) women, than visits to physicians who have EMR and do not utilize reminders. In addition, visits to physicians who have EMR and use reminders were more common among women in the income quartile $32,794-$40,626 (43.6%). There were several patient characteristics that were not significant in this table, which include reason for visit, and survey year.

4.5 RELATIONSHIP BETWEEN PHYSICIAN CHARACTERISTICS AND LIKELIHOOD THAT A MAMMOGRAM WOULD BE ORDERED/PROVIDED

Table 4.5 presents the proportion of women for whom a mammogram was ordered or provided. Physician EMR use was not associated with ordering or providing a mammogram. A mammogram being ordered or provided by a physician was more common among women who have private insurance (12.4%) in the income quartile $52,388 or more (12.3%) and who live in urban (9.7%) areas of the United States. There were several physician and patient characteristics that were not significant in this table, which include physician EMR use, race, ethnicity, reason for visit, and survey year.

4.6 PERSONAL FACTORS ASSOCIATED WITH THE LIKELIHOOD THAT A WOMAN WOULD HAVE A MAMMOGRAPHY ORDERED/PROVIDED, ADJUSTED ANALYSIS

In table 4.6, three logistic regression analyses were conducted to understand the adjusted odds of a woman receiving a mammography. The first analysis adjusts for the personal characteristics of women, the second analysis adds physician EMR use, and the final analysis adjusts for all physician and patient characteristics. There were only two factors that were significant: payment type and survey year. Significant findings in the table indicate that women on Medicare/Medicaid/SCHIP (OR = 0.676, 95% CI 0.374-0.944) and who self-pay for health care (OR = 0.540, 95% CI 0.434-0.975) had

significantly lower odds of receiving a mammography, than women who had private insurance. In addition, women in survey year 2008 (OR=0.687, 95% CI 0.556-0.848) had significantly lower odds of receiving a mammography, than women in 2010.

Table 4.7 presents the odds of a woman receiving a mammography screening, based on physician EMR use and patient characteristics. Significant findings in table 7 were found in the income quartile of the zip code or census tract, survey year, and payment type for the sample of women. These findings indicate that women in 2008 (OR = 0.695, 95% CI 0.555-0.870) and in the income quartile $52,388 or more (OR = 0.782, 95% CI 0.616-0.993) who are on Medicare/Medicaid/SCHIP (OR=0.709, 95% CI 0.385-0.910) or self-pay for health care (OR = 0.845, 95% CI 0.325-0.956) have significantly lower odds of receiving mammography screenings compared to women in the income quartile $40,627-$52,387 with private insurance in 2010.

In table 4.7, physician EMR use was not significantly associated with the adjusted odds that a mammogram would be ordered/provided. This finding is inconsistent with the hypothesis that mammography screenings will more likely be ordered or provided by physicians who have EMR and use reminders and by physicians that have EMR but do not utilize reminders, compared to physicians who do not use EMR systems.

Table 4.8 presents the odds of a woman receiving a mammography based on physician EMR use, patient characteristics, and physician practice characteristics. Significant findings indicate that women who visit obstetrics/gynecology (OR = 0.190, 95% CI 0.142-0.254) and internal medicine practices (OR = 0.553, 95% CI 0.393-0.778) have significantly lower odds of receiving a mammography, compared to women visiting general/family practices. Women on Medicare/Medicaid/SCHIP (OR=0.633, 95% CI

0.271-0.919) have significantly lower odds of receiving mammography screenings compared to women who have private insurance. In addition, women have significantly lower odds of receiving mammography screenings at physician offices that provide same day appointments (OR= 0.777, 95% CI 0.605-0.999) and appointments between 1 week – 1 or months (OR = 0.753, 95% CI 0.581-0.976), compared to physician offices that do not provide same day appointments and appointments within 1 week.

In table 4.8, physician EMR use was not significantly associated with the odds that a woman would have a mammogram provided/ordered. These findings are inconsistent with the hypothesis that mammography screenings will more likely be ordered or provided by physicians who use EMR systems with reminders turned off /no reminders, compared to physicians who do not use EMR systems.

Table 4.1. Physicians who could Order or Provide Mammography Screenings by Organizational and Geographical Characteristics, 2008-2010 National Ambulatory Medical Care Surveys

	(Unweighted Estimates = 2,785)		
Variables	(%)	(n)	S.E. (%)
Specialty			
General/Family Practice	55.3	1,539	1.9
Internal Medicine	20.9	583	2.1
Obstetrics/gynecology	17.9	498	1.3
Dermatology / oncology	5.9	165	0.4
Region			
Northeast	20.0	555	1.6
Midwest	23.7	661	1.1
South	31.1	866	1.4
West	25.2	703	1.1
Metropolitan Statistical Area			
Metropolitan Area	90.1	2,508	1.1
Non-Metropolitan Area	9.9	277	1.1
Employment Status of Physician[1]			
Owner	56.1	1,563	1.9
Employee	39.1	1,089	1.9
Contractor	4.8	133	0.6
Owner-Solo[2]			
Physician	73.9	2,057	1.6
HMO / Other Practices	16.9	473	1.5
Community Health Center	9.2	255	0.6
Time It Takes To Get Appointment			
Within 1 week	47.0	1,308	1.6
1 week – 1 or more months	53.0	1,477	1.6
Same Day Appointments			
Yes	57.8	1,609	1.3
No	42.2	1,176	1.3
Survey Year			
2008	31.7	884	1.8
2009	33.8	941	1.6
2010	34.5	960	1.6

[1] Employment Status of Physician refers to a physician who is employed as an owner; or an employee or contractor in a healthcare organization.

[2] Owner-Solo refers to the physician or healthcare organization that owns a clinic.

Table 4.2. Distribution of physician's EMR Reminder use by physician characteristics (MD level), 2008-2010 National Ambulatory Medical Care Surveys

	Have EMR (n=1,279)		No EMR (n=1,506)	P-value
	Use reminders	Do not use reminders/ Turned off reminders		
Variables	% (n)	% (n)	% (n)	
Specialty				0.35
General/Family Practice	36.4 (560)	15.7 (242)	47.9 (737)	
Internal Medicine	25.2 (147)	13.7 (80)	61.1 (356)	
Obstetrics/gynecology	25.1 (125)	10.2 (51)	64.7 (322)	
Dermatology/oncology	24.2 (40)	20.6 (34)	55.2 (91)	
Region**				0.01
Northeast	30.5 (169)	12.6 (70)	56.9 (316)	
Midwest	29.8 (197)	14.8 (98)	55.4 (366)	
South	34.1 (295)	14.0 (121)	51.9 (450)	
West	28.9 (203)	17.9 (126)	53.2 (374)	
Metropolitan Statistical Area				0.46
Metropolitan Area	32.4 (813)	15.5 (388)	52.1 (1,307)	
Non-Metropolitan Area	14.4 (40)	13.7 (38)	71.8 (199)	
Employment Status of Physician[1]**				< 0.00
Owner	36.4 (569)	10.6 (165)	53.0 (829)	
Employee	28.2 (307)	17.9 (195)	53.9 (587)	
Contractor	24.1 (32)	*8.3 (11)*	67.6 (90)	
Owner-Solo[2]**				0.01
Physician	33.2 (683)	19.1 (392)	47.7 (982)	
HMO / Other Practices	14.6 (69)	8.0 (38)	77.4 (366)	
Community Health Center	17.3 (44)	20.8 (53)	61.9 (158)	
Time It Takes To Get Appointment				0.26
Within 1 week	31.8 (416)	20.9 (273)	47.3 (619)	
1 week – 1 or more months	22.7 (336)	17.2 (254)	60.1 (887)	
Same Day Appointments**				
Yes	25.1 (403)	24.6 (396)	50.3 (810)	< .00
No	25.3 (297)	15.6 (183)	59.1 (696)	
Survey Year				0.39
2008	30.1 (266)	9.2 (81)	60.7 (537)	
2009	31.9 (300)	17.7 (167)	50.4 (474)	
2010	27.3 (262)	21.1 (203)	51.6 (495)	

[1] Employment Status of Physician refers to a physician who is employed as an owner; or an employee or contractor in a healthcare organization.

[2] Owner-Solo refers to the physician or healthcare organization that owns a clinic.

** = Chi-Square Analysis significant $p < .05$

Table 4.3. Physicians who Ordered or Provided a Mammography Screening for a patient during a Visit, 2008-2010 National Ambulatory Medical Care Surveys

	No Mammography (n = 1,434)		Mammography ordered/provided (n = 47)			P-value
Variables	%	n	%	n	S.E.	
Specialty						< 0.01
General/Family Practice	98.2	612	1.8	11	0.1	
Internal Medicine	97.2	279	2.8	8	0.2	
Obstetrics/gynecology	90.7	233	9.3	24	0.1	
Dermatology/oncology	98.7	310	1.3	4	0.3	

** = Chi-Square Analysis significant p < .05

Table 4.4. Women age 45 and older who visited a physician, by physician EMR Reminder use, 2008-2010 National Ambulatory Medical Care Surveys

	All women (n = 8,348)	Physician EMR Use			P-value
		Have EMR (n = 4,660)		No EMR (n = 3,688)	
		Use reminders	Do not use reminders/ Turned off reminders		
Variables	% (n)	% (n)	% (n)	% (n)	
Race**					0.04
White	70.0 (5,844)	36.8 (2,153)	18.3 (1,068)	44.9 (2,623)	
Black	18.4 (1,536)	35.8 (550)	22.5 (346)	41.7 (640)	
Other	11.6 (968)	31.9 (309)	24.2 (234)	43.9 (425)	
Ethnicity**					0.05
Hispanic	10.8 (899)	37.4 (336)	16.3 (147)	46.3 (416)	
Non-Hispanic	89.2 (7,449)	39.7 (2,958)	16.4 (1,219)	43.9 (3,272)	
Income**					0.03
$32,793 or less	24.5 (2,042)	35.4 (723)	18.9 (385)	45.7 (934)	
$32,794 -$40,626	24.0 (2,005)	43.6 (875)	17.2 (344)	39.2 (786)	
$40,627-$52,387	25.0 (2,085)	36.7 (766)	16.6 (347)	46.7 (972)	
$52,388 or more	26.5 (2,216)	38.8 (859)	16.3 (361)	44.9 (996)	
Rurality**					0.01
Urban	83.8 (6,995)	38.6 (2,702)	16.7 (1,169)	44.7 (3,124)	
Rural	16.2 (1,353)	40.9 (554)	17.4 (235)	41.7 (564)	
Payment Type**					< 0.01
Private Insurance	44.7 (3,730)	42.4 (1,581)	14.3 (535)	43.3 (1,614)	
Medicare or Medicaid/SCHIP	44.5 (3,717)	37.1 (1,379)	18.9 (702)	44.0 (1,636)	
Self-pay/other form of payment	10.8 (901)	33.6 (303)	17.8 (160)	48.6 (438)	
Reason for Visit					0.12
General Medical Exam	54.3 (4,533)	39.1 (1,773)	18.4 (832)	42.5 (1,928)	
Other Medical Exam	45.7 (3,815)	33.5 (1,279)	20.3 (776)	46.2 (1,760)	
Survey Year					0.08
2008	24.4 (2,039)	29.6 (603)	18.1 (370)	52.3 (1,066)	
2009	33.0 (2,751)	43.6 (1,199)	12.4 (342)	44.0 (1,210)	
2010	42.6 (3,558)	41.9 (1,492)	18.4 (654)	39.7 (1,412)	

** = Chi-Square Analysis significant p < .05

Table 4.5. Proportion of women for whom a mammogram is ordered or provided, by physician characteristics, 2008-2010 National Ambulatory Medical Care Surveys

	No mammography (n = 7,562)		Mammography ordered/provided (n = 786)		P-value
Variables	%	(n)	%	(n)	
Physician EMR Use					0.66
No EMR	90.8	(3,349)	9.2	(339)	
EMR, no reminder	91.1	(1,244)	8.9	(122)	
EMR, with reminder	90.1	(2,969)	9.9	(325)	
Race					0.75
White	90.4	(5,284)	9.6	(560)	
Black	90.9	(1,397)	9.1	(139)	
Other	91.4	(885)	8.6	(83)	
Ethnicity					
Hispanic	89.4	(804)	10.6	(95)	0.23
Non-Hispanic	90.6	(6,752)	9.4	(697)	
Income**					
$32,793 or less	92.4	(1,887)	7.6	(155)	0.01
$32,794 – $40,626	90.8	(1,821)	9.2	(184)	
$40,627-$52,387	91.6	(1,910)	8.4	(175)	
$52,388 or more	87.7	(1,944)	12.3	(272)	
Rurality**					0.01
Urban	90.3	(6,319)	9.7	(676)	
Rural	92.5	(1,252)	7.5	(101)	
Payment Type**					< 0.01
Private Insurance	87.6	(3,267)	12.4	(463)	
Medicare or Medicaid/SCHIP	93.4	(3,472)	6.6	(245)	
Self-pay/other form of payment	91.5	(824)	8.5	(77)	
Reason for Visit					
General Medical Exam	92.3	(4,185)	7.7	(348)	0.32
Other Medical Exam	91.7	(3,498)	8.3	(317)	
Survey Year					0.18
2008	90.6	(1,847)	9.4	(192)	
2009	90.9	(2,502)	9.1	(249)	
2010	90.3	(3,213)	9.7	(345)	

** = Chi-Square Analysis significant p < .05

Table 4.6. Odds that a woman will receive a mammogram, adjusting for patient characteristics, 2008-2010 National Ambulatory Medical Care Surveys

(n = 8,348)			
Adjusted Odds Ratio			
Variables	OR	95% CI	S.E.
Race			
White	1.000	ref	0.0
Black	0.984	(0.749-1.291)	0.3
Other	1.389	(0.891-2.165)	0.2
Ethnicity			
Hispanic	1.271	(0.950-1.784)	0.2
Non-Hispanic	1.000	ref	0.0
Income			
$32,793 or less	1.054	(0.801-1.387)	0.1
$32,794 – $40,626	0.901	(0.703-1.154)	0.1
$40,627-$52,387	1.000	ref	0.0
$52,388 or more	0.834	(0.664-1.047)	0.2
Rurality			
Urban	0.810	(0.623-1.053)	0.1
Rural	1.000	ref	0.0
Payment Type			
Private Insurance	1.000	ref	0.0
Medicare or Medicaid/SCHIP**	0.676	(0.374-0.944)	0.1
Self-pay/other form of payment**	0.540	(0.434-0.975)	0.2
Reason for Visit			
General Medical Exam	0.851	(0.639-1.096)	0.2
Other Medical Exam	1.000	ref	0.0
Survey Year			
2008**	0.687	(0.556-0.848)	0.1
2009	0.979	(0.803-1.194)	0.1
2010	1.000	ref	0.0

** = Logistic Regression Analysis significant, 95% CI does not include 1

Table 4.7. Odds that a woman will receive a mammogram, adjusting for physician EMR use and patient characteristics, 2008-2010 National Ambulatory Medical Care Surveys

(n = 8,348)			
Adjusted Odds Ratio			
Variables	OR	95% CI	S.E.
Physician EMR Use			
No EMR	1.000	ref	0.0
EMR, no reminder	0.858	(0.663-1.112)	0.1
EMR, with reminder	0.839	(0.690-1.019)	0.1
Race			
White	1.000	ref	0.0
Black	0.894	(0.677-1.182)	0.1
Other	1.443	(0.905-2.302)	0.2
Ethnicity			
Hispanic	1.344	(0.922-1.959)	0.2
Non-Hispanic	1.000	ref	0.0
Income			
$32,793 or less	1.029	(0.771-1.374)	0.1
$32,794 – $40,626	0.969	(0.743-1.265)	0.1
$40,627-$52,387	1.000	ref	0.0
$52,388 or more**	0.782	(0.616-0.993)	0.1
Rurality			
Urban	0.875	(0.662-1.156)	0.1
Rural	1.000	ref	0.0
Payment Type			
Private Insurance	1.000	ref	0.0
Medicare or Medicaid/SCHIP**	0.709	(0.385-0.910)	0.1
Self-pay/other form of payment**	0.845	(0.325-0.956)	0.2
Reason for Visit			
General Medical Exam	0.918	(0.787-1.076)	0.1
Other Medical Exam	1.000	ref	0.0
Survey Year			
2008**	0.695	(0.555-0.870)	0.1
2009	1.013	(0.823-1.247)	0.1
2010	1.000	ref	0.0

** = Logistic Regression Analysis significant, 95% CI does not include 1

Table 4.8. Odds that a woman will receive a mammogram, adjusting for physician EMR use, patient characteristics, and physician practice characteristics, 2008-2010 National Ambulatory Medical Care Surveys

(n = 8,348)			
Adjusted Odds Ratio			
Variables	OR	95% CI	S.E.
Physician EMR Use			
No EMR	1.000	ref	0.0
EMR, no reminder	0.777	(0.553-1.092)	0.2
EMR, with reminder	1.058	(0.816-1.372)	0.1
Physician Practice Characteristics			
Specialty			
General/Family Practice	1.000	ref	0.0
Internal Medicine**	0.553	(0.393-0.778)	0.2
Obstetrics/gynecology**	0.190	(0.142-0.254)	0.1
Dermatology/oncology	0.889	(0.474-1.668)	0.3
Region			
Northeast	1.000	ref	0.0
Midwest	1.368	(0.924-2.026)	0.2
South	0.945	(0.671-1.332)	0.2
West	0.908	(0.633-1.305)	0.2
Metropolitan Statistical Area			
Metropolitan Area	0.564	(0.335-0.952)	0.3
Non-Metropolitan Area	1.000	ref	0.0
Employment Status of Physician[1]			
Owner	1.000	ref	0.0
Employee	0.889	(0.646-1.224)	0.1
Contractor	0.868	(0.357-2.111)	0.4
Owner-Solo[2]			
Physician	1.000	ref	0.0
HMO / Other Practices	1.109	(0.733-1.676)	0.2
Community Health Center	1.234	(0.581-2.618)	0.3
Time It Takes To Get Appointment			
Within 1 week	1.000	ref	0.0
1 week – 1 or more months**	0.753	(0.581-0.976)	0.1
Same Day Appointments			
Yes**	0.777	(0.605-0.999)	0.1

No	1.000	ref	0.0
Patient Characteristics			
Race			
White	1.000	ref	0.0
Black	0.827	(0.563-1.216)	0.2
Other	1.723	(0.976-3.039)	0.3
Ethnicity			
Hispanic	1.063	(0.636-1.778)	0.2
Non-Hispanic	1.000	ref	0.0
Income			
$32,793 or less	0.969	(0.648-1.450)	0.1
$32,794 – $40,626	0.957	(0.681-1.345)	0.2
$40,627-$52,387	1.000	ref	0.0
$52,388 or more	0.750	(0.553-1.018)	0.3
Rurality			
Urban	1.002	(0.630-1.594)	0.2
Rural	1.000	ref	0.0
Payment Type			
Private Insurance	1.000	ref	0.0
Medicare or Medicaid/SCHIP**	0.633	(0.271-0.919)	0.1
Self-pay/other form of payment	0.747	(0.661-1.989)	0.2
Reason for Visit			
General Medical Exam	0.989	(0.893-1.125)	0.1
Other Medical Exam	1.000	ref	0.0
Survey Year			
2008	1.087	(0.664-1.780)	0.2
2009	1.039	(0.816-1.323)	0.1
2010	1.000	ref	0.0

[1] Employment Status of Physician refers to a physician who is employed as an owner; or an employee or contractor in a healthcare organization.

[2] Owner-Solo refers to the physician or healthcare organization that owns a clinic.

** = Logistic Regression Analysis significant, 95% CI does not include 1

CHAPTER 5

DISCUSSION

5.1 CONCLUSIONS

This study examines the relationship between EMRs and provider reminders and the likelihood that mammography screenings will be ordered or provided by physicians. Overall, there were not any significant findings regarding woman having a mammography ordered or provided by a physician that has an EMR system with reminders, EMR system with no reminders, and no EMR system. More than half of physicians who could order or provide mammography screenings were general/family practice physicians who were owners of solo clinics. These physicians are evenly distributed throughout the four regions of the United States, mainly in metropolitan areas. Most physicians who actually ordered or provided a mammography were in the obstetrics/gynecology specialty. However, the odds of a woman having a mammography ordered or provided by an obstetrician/gynecologist were significantly lower compared to a general/family physician. Based on these findings, women past childbearing age have more general/family physicians providing them with routine care.

Research from the 2000 and 2005 National Health Interview Survey found that women ages 50 to 64 were more likely to report a recent screening mammogram if they reported talking to a physician within the past 12 months and were covered by private insurance (Breen et al., 2011). Similarly, our research concluded that women on

Medicare/Medicaid/SCHIP and those who self-pay for healthcare were less likely to have a mammography ordered or provided compared to women who have private insurance. We speculate that general/family physicians experience difficulty referring self-pay and Medicare/Medicaid/SCHIP patients for specialty care, such as mammography screenings. This may be due to patients being reluctant to pay a co-pay for mammography screenings, the short supply of specialists in the area, long waiting lists for specialists, specialists not accepting or limiting the number of patients who are covered by Medicare/Medicaid/SCHIP or self-pay, and low reimbursement rates. Our speculations are supported by research conducted in 2007 by Hurley, Felland and Lauer which acknowledges that community health centers in Seattle, Washington are facing serious challenges referring both uninsured and Medicaid patients because there are fewer specialists relative to the population (Hurley, Felland and Lauer, 2007).

The Affordable Care Act is set to expand preventive services under the Medicaid program for the low-income and disabled. Beginning in 2014, Medicaid will be required to cover recommended preventive services and immunizations. The federal government will contribute an additional 1% of the cost of those services if they are provided by the states with no cost sharing for patients. Overall, this will make the referral process less difficult for physicians who refer self-pay and Medicare/Medicaid/SCHIP patients to specialists because patients will no longer have a co-pay for mammography screenings.

Although our findings indicated there was no association between physician EMR use and women receiving a mammogram, it is still important that physicians who have EMRs with or without reminders "meaningfully use" EMRs to achieve improvements in mammography screening. The Health Information Technology for Economic and Clinical

Health Act (HITECH) of 2009 promotes the "meaningful use" of EMRs, which is the usage of EMRs by providers to achieve significant improvements in care, and then awards payments to these physicians for their improvements. This is important because our findings indicate that physicians are ordering/providing mammography screenings for women who self-pay and on Medicare and Medicaid at lower rate than women who have private insurance. To address this problem, the HITECH statue authorizes incentive payments through Medicare and Medicaid to physicians and hospitals that use EMRs privately and securely to achieve specified improvements in care delivery. The federal government awards incentive payments totaling up to $27 billion over 10 years, or as much as $44,000 through Medicare and $63,750 through Medicaid per provider. This funding will help encourage physicians in all specialties to improve the ordering/providing of mammography screenings to women who are on Medicare/Medicaid/SCHIP in all races, ethnicities, and socioeconomic backgrounds.

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