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Urban Versus Rural Patterns of Mammography Use: An Analysis of Two Southeastern States

Valerie Miranda Bycott

URBAN VERSUS RURAL PATTERNS OF MAMMOGRAPHY USE: AN ANALYSIS OF TWO SOUTHEASTERN STATES

By

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ABSTRACT

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Mammography is widely recognized as the best method to detect breast cancer. This study examined the screening rate differences among women who live in urban and rural counties in Georgia and North Carolina. Data on the mammography screening rates was obtained from the Behavior Risk Factor Surveillance System (BRFSS) for 2002 and 2004. To assess the availability of mammography facilities, data was obtained from the Mammography Facility Database provided by the FDA. Multivariate logistic regression showed that having a usual source of care in urban counties was a positive predictor of women 40-59 years of age getting screened in both states; having a personal doctor and health care coverage was significantly associated with women ages 60 and above getting screened. Getting screened was negatively predicted for women 60 years of age and older who had only a high school education. Data pertaining to mammography screening rates at the state level needs to be made publicly available to compare differences that exist among states. To better address an individual's access to mammography facilities, a survey should be developed by the American Cancer Society which addresses the facility's hours of operation, populations served from neighboring counties, translation services available and number of mobile versus permanent facilities in each county.

INDEX WORDS: mammography, screening, breast cancer, urban, rural, barriers, access, state cancer plan, metropolitan, non metropolitan

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CHAPTER I
INTRODUCTION

Breast cancer is the second leading cause of cancer death and the second most common form of cancer in the United States (Lemon, Zapka, Clemow, Estabrook, & Fletcher, 2006). More than 182,000 women were diagnosed with breast cancer in 2002, and 41,000 women died from the disease in that same year. Currently 63.7% of breast cancer is diagnosed at the localized stage (before the tumor has metastasized and spread to other parts of the body) with a survival rate of 97.9% (American Cancer Society, 2006a). Early detection of breast cancer can be attributed to utilization of mammography screening and the high awareness of breast cancer symptoms in the population.

In the United States, more than seven billion dollars per year has been estimated to have been spent on the treatment of breast cancer (Centers for Disease Control and Prevention, 2006/2007). The reason for the high amount of money spent on researching breast cancer is that earlier detection saves lives and medical expenses. Yet, despite the overwhelming endorsement of mammography screening as an effective means of combating breast cancer, universal adherence to routine screening is still a distant goal.

Mammography screening has been universally recognized as the best method effectively to detect breast cancer (Anderson, Smith, Meishchke, Bowen, & Urban, 2003). *Mammography* is defined as "an x-ray of the breast taken by a machine that presses against the breast while the picture is taken" (O'Malley et al., 2001). According to a study by Anderson et al. (2003), "*Screening* refers to the testing of asymptomatic individuals for the detection of occult disease." Mammography is performed for two

primary purposes: screening and diagnosis. Screening mammography is used to detect a breast abnormality before it can be detected by physical examination in a woman without breast cancer symptoms. Diagnostic mammography is a procedure a woman undergoes if she has exhibited a symptom such as a lump, which may indicate the presence of breast cancer or whose screening mammogram indicated a possible cancerous growth.

The latest American Cancer Society Guidelines recommend that women at average risk should begin annual mammography at age 40 and should continue for as long as a woman is in good health (American Cancer Society, 2006a). Concordantly, the National Cancer Institute recommends that women should begin mammography screening at age 40 and be screened every one or two years, unless they are at higher than average risk. The higher risk may be due to a personal history of breast cancer, family history, genetics, long term use of hormone therapy, body weight, physical activity level, breast density and alcohol use (National Cancer Institute, 2006). Despite these recommendations, many women neglect to adhere to the recommendation of annual screenings.

Ethnicity plays an important role in breast cancer. White women are more likely to be diagnosed with breast cancer than are women of any other race or ethnicity in the United States (Ries et al., 2005; U.S. Department of Health and Human Services, 2005). However, African American women are more likely than other women in the country to die from the disease. According to recent trends, new cases of breast cancer diagnosed each year (incidence) have remained stable or decreased significantly during the past ten years for white, African American, Hispanic and Native American Women (Centers for Disease Control and Prevention, 2006/2007). The two subgroups which have the lowest

prevalence of mammography in the past two years are women who lack health insurance (40.2%) and immigrant women who have lived in the U.S. for less than ten years (52.3%) (American Cancer Society, 2006a). Lower participation in mammography screening among poorer women is very disconcerting, for these women are more likely to have their breast cancers initially detected at an advanced stage when treatment is less effective.

Past studies have examined factors which influence mammography screening rates. These factors include physician recommendation (O'Malley et al., 2001), a woman's specific cancer worry and its impact on mammography adherence (Diefenbach, Miller, & Daly, 1999), perceived barriers to screening among different demographic groups (Austin, Ahmad, McNally, & Stewart, 2002; O'Malley et al., 2001), the influence of a first degree family relative breast cancer diagnosis on other family members (Lemon et al., 2006), and the associated risks and costs of screening (Humphrey, Helfand, Chan, & Woolf, 2002). Menck and Mills (2001) identified elderly (65 years of age and older), Hispanic, and African American females; as well as those women residing in non-urban areas as high-risk groups who do not elect to use mammography screening (Menck & Mills, 2001). There has been little research that compares the pattern of mammography screening rates in female populations living in either urban or rural counties.

The purpose of this study is threefold. The first is to provide a comprehensive literature review of mammography which includes the following information: history of its use as a breast cancer prevention strategy; how specific populations are targeted for its use; and the factors that impact a woman using mammography screening. The second purpose is to examine the literature for studies on the availability or accessibility of

mammography facilities in Georgia and North Carolina. The final purpose is to assess whether there are differential mammography screening rates in either urban or rural counties located in Georgia and North Carolina and, if so, how state cancer plans address this finding.

The objectives of this project are:

- To review the literature on mammography screening rates and the factors which impact the use and success of mammography screening interventions;
- To analyze data on mammography screening and determine rates of use in both urban and rural counties in the states of Georgia and North Carolina;
- To compare the mammography use rates in both urban and rural counties in Georgia and North Carolina. This study will use the chi square test to determine if any differences are statistically significant where a value of .05 or less is significant;
- To determine the number of certified mammography facilities in both urban and rural counties of Georgia and North Carolina; and
- To review the state cancer plans of the eight states included in Health and Human Services Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) to see if they identify living in a rural county as a risk for not getting screened.

The aim of this study is to test the null hypothesis: There is no significant difference between mammography screening rates of women in either urban or rural counties of Georgia and North Carolina. The alternative hypothesis is: There is a

significant difference between the mammography screening rates of women living in either urban or rural counties of Georgia and North Carolina.

Successfully determining mammography use rates will assist different health organizations strategically target at-risk groups and develop more effective interventions. The prospective data and information gathered will allow modifications in program design and function so that positive contributions can be maximized and negative effects minimized or avoided entirely. The implications of this study could be applied to other cancers in which the success of treatment depends on early detection from screening. The reduction of late-stage cancer diagnosis and prevention of breast cancer mortality is a worthy public health goal.

CHAPTER II
REVIEW OF LITERATURE

The discussion and examination of mammography screening use rates in either urban or rural counties, as well as the subsequent development of an intervention to target at-risk groups, would be incomplete without full exploration of all major content areas included in a comprehensive literature review. Topics include: 1) A brief historical overview of the development and use of mammography screening as a preventative health tool 2) An exploration of factors which impact mammography screening use 3) a detailed look at studies examining the effect of rural location on mammography use 4) Studies examining the availability or accessibility of certified mammography facilities and implications for future use of mammography screening.

History of Mammograms

The current use of mammography as a screening tool for breast cancer would not have been possible without the following milestones. The first individual to contribute to the development of mammography as a screening device was Albert Salomon, a surgeon who used radiography to detect the spread of a breast tumor to auxiliary lymph nodes in 1913 (Gold, Bassett, & Widoff, 1990). Mammography was later pioneered by Stafford L. Warren, a radiologist at Rochester Memorial Hospital, New York, who used it with 119 patients in combination with a "new" fine grain double-emulsion Kodak film which helped clarify the presence of tumors or abnormal cell growth in breast tissue in 1930 (Bassett, 1991; Gold et al., 1990). As a result of using the new film in the mammography process, Warren only made interpretative errors in eight of the 119 cases he examined.

At a conference in May of 1963, sponsored by the Cancer Control Program of the U.S. Health Service at M.D. Anderson Hospital, a report was released on the usefulness and reproducibility of mammography. Robert L. Egan, working at the M.D. Anderson Hospital developed a direct film mammography technique (Bassett, 1991) which was presented at this conference. His new technique was used in a nationwide mammography study in which 24 institutions participated. The results of the study confirmed that 1) The technique of mammography, as developed and taught by Egan, could be learned by other radiologists 2) X-rays of acceptable quality could be produced 3) Using mammography one would be able to discriminate between benign and malignant lesions and finally, 4) Mammography could be used to screen for cancer in asymptomatic women (Clark, Copeland, & Egan, 1965). The ability to screen for breast cancer in asymptomatic women, or those that appear to have no breast problems (American Cancer Society, 2006b), is crucial for catching breast cancer at an early stage. When breast cancer is detected at an early stage, the five year survival rate is 98% (American Cancer Society, 2006c).

The first mammography machine was developed in 1966. Prior to this time, mammographic images were produced by simply using a standard x-ray machine (GE Healthcare, 2006). During this same time period, 1963-1966, Philip Strax, Louis Venet, and Sam Shapiro conducted the first randomized controlled study of breast cancer screening under the auspices of the Health Insurance Plan (HIP) of New York (Bassett, 1991; Gold et al., 1990). Of the 60,000 women who participated, half of them underwent annual screening with mammography and physical examination for a period of four consecutive years. The mortality rate of the women who had undergone screening was

decreased by 30% seven years after the study began. The long term benefits of screening were also made apparent for participants who received annual screens and experienced a 24% reduction in breast cancer mortality after 14 years (Bassett, 1991; Gold et al., 1990).

Soon afterwards in 1967, the first commercial model of the "Senographe" (French for picture of the breast) became available (GE Healthcare, 2006). It was the first "dedicated" mammography unit, or the first unit manufactured strictly for mammography (Gold et al., 1990). An improved model was introduced in the late seventies which resulted from the marriage of both patient and doctor generated ideas as well as advances in technology.

Another worthy contributor to mammography was a surgeon named Edward A. Sickles, who revolutionized mammography screening by lowering the cost and creating efficient ways in which to be screened. He lowered mammography costs by streamlining radiologic and office operations to maximize patient throughput and reducing cost. (Sickles, Webber, & Galvin, 1986). Sickles also championed the idea of using mobile vans as sites for mammography screening situating them near large downtown office buildings or at supermarkets so that working and nonworking women could undergo screening rapidly and conveniently incorporate it into their day.

Not only was screening improving in cost and ease, but also in standards guaranteeing its quality. In 1999, the Mammography Quality Standards Act (MQSA) was passed. MQSA regulates the quality of mammography equipment. In order to legally operate in the U.S.; all operational systems must pass MQSA requirements, ensuring the quality of all systems on the market (GE Healthcare, 2006).

Mammography has evolved from simple radiography of mastectomy specimens to the foremost method of breast cancer screening due to the endeavors of leaders in the field who researched, wrote and lectured about it constantly. Because of their efforts, many individuals after undergoing mammography screening are able to detect breast cancer at an early stage and fully recover.

Barriers to Mammography Screening

Mammograms are not something that many women routinely receive, for it is estimated that only 70% of women aged 40 and older have had a mammogram within the past two years (Breen, Wagener, Brown, Davis, & Ballard-Barbash, 2001). Mammography is underused by certain groups of women, in particular poor and minority women. These two groups are particularly at-risk due to barriers they face. However, some of the barriers that poor and minority women face are common barriers with which many women struggle. Studies have examined many of these barriers which include fear of pain, cost, transportation, perceived susceptibility, older age and, education level. These barriers overshadow the many positive benefits that mammography screening affords such as reducing breast cancer morbidity and mortality, by detecting cancer at an earlier stage, and the positive reassurance a negative mammogram provides.

To identify those individuals who are at-risk for a poor screening profile, it is essential to study non-modifiable structural and demographic factors such as age, income, marital status, and ethnicity. Breast cancer incidence is increasing in white women age 50 years and older, stabilizing for African American women age 50 years and older and decreasing for African American women under age 50 years (Smigal et al., 2006). Women with lower levels of education, without health insurance and recent immigrants

are less likely to receive mammograms than other populations. From 1992 through 2002 other racial and ethnic groups have experienced varying trends in mammography screening. Mammography rates have increased among Asian Americans/ Pacific Islanders (by 1.5% per year) and decreased among American Indians/Alaska Natives (by 3.5% per year) and have not changed significantly among Hispanics/Latinas (Smigal et al., 2006). It is important to acknowledge that trends vary by age, race, and socioeconomic status.

In order to structure an intervention that will be successful and effective in convincing more women to seek mammography screening, it is important to identify these perceived barriers. One of the most common barriers to scheduling a mammogram is fear. However in some cases fear may act as a motivator for screening. The fear of the mammogram is associated with fear of the medical establishment, and of the potential pain associated with mammography. Fear of mammography may even be evoked by horror stories told by friends and family (Engleman, Cizik, & Ellerbeck, 2005). One suggestion for helping women cope with this type of fear comes from Engleman, Cizik & Ellerbeck (2005) who recommend that a television be included in the waiting room and that it should play an instructional video about the procedures involved with a mammography so patients would know what to expect. This would help alleviate the fear that a woman experiences waiting for the mammogram, particularly a woman who has never had one.

Other fears women may have concerning mammography include the fear of radiation, the fear that the procedure may prove embarrassing, and the fear that the diagnosis of breast cancer (Consedine, Magai, Krivoshekova, Ryzewicz, & Neugut,

2004). The fear of receiving a diagnosis of breast cancer can be exacerbated by the time spent waiting for results. In order to minimize or alleviate this fear, new ways of obtaining mammography results quicker and with greater certainty must be devised.

While fear may deter some women from getting mammograms, it can also motivate others to engage in regular screenings. Women who are more aware of their health problems and risks for disease are more likely to adhere to screening guidelines. For example, if cancer runs in an individual's family, the individual is more likely to have negative attitudes towards cancer and think their risk of getting cancer is greater (Hailey, Carter, & Burnett, 2000). Even though studies suggest that women with a family history of breast cancer are more likely to comply with breast screening guidelines compared to those without a family history, screening in this group is still underutilized (Anderson, Smith, Meishchke, Bowen, & Urban, 2003; Hailey et al., 2000; Rahman, Dignan, & Shelton, 2003; Spyckerelle, Kuntz, Giordanella, & Ancelle-Park, 2002). This may be because women with a relative or family member with cancer fear being diagnosed with cancer themselves and neglect to get screened.

Differential access to mammography screening is an additional barrier that is essential to address. Women who live in rural areas may have a more advanced stage of disease when diagnosis finally occurs. The group most at risk for late stage diagnosis due to ineffective screening is older women age 70 years and up. Transportation issues, psychosocial barriers, low literacy levels and institutional barriers are all contributing factors to low screening rates. The mortality rate among women age 70 years and older is twice that for women of 55 years of age (Peek, 2003). Screening among the elderly is still controversial. Even though they are at higher risk for breast cancer than younger

women, elderly women are also more likely to have competing mortality risks from cardiovascular disease and other illnesses. Many early studies, even after adjusting for comorbidity, age, race and quality of life, found that it was still more cost effective to screen all women with mammography (Eddy, 1987; Mandelbalatt et al., 1992). These studies contributed to the passage of the 1991 Congressional decision to fund biennial mammograms for women without setting an upper age limit (Peek, 2003). Another benefit to screening women age 70 years and older is that the sensitivity of mammography increases with age and ranges between 70% and 95% accuracy (Shen & Zelen, 2001).

One way to assure adequate medical access to women age 70 years and older is using in-reach activities, which are defined as interventions held within the primary care setting, to increase screening mammography (Champion & Skinner, 2003). Some examples of in-reach activities include displaying posters, or playing videotapes in patient waiting rooms, having a reminder system for mammography appointments in place for patients and physicians, and using targeted incentives such as gas and food coupons to encourage screening. One other way to solve the issue of limited access of mammography screening among the elderly is to use patient navigators, who help patients make appointments, arrange transportation, locate facilities and even accompany patients to their mammogram screening.

Another barrier to mammography use is encouraging physicians to make the recommendation to receive a mammogram. Due to the nature of the physician/client relationship, physicians have the ability to pass along vital health information and recommendations for future care including the recommendation for a mammogram.

However, many women do not get such a recommendation from their physician. To determine the level of impact physician recommendations have had on mammography screening, past studies have examined what influences physician recommendations for mammography (Nutting et al., 2001). Factors which may affect the willingness of a patient to follow through with a physician recommendation include the physician's area of expertise (Chamot & Perneger, 2003), the physician's communication skills with their patients (Lane, Messina, & Grimson, 2001), the sex of the physician (Lurie et al., 1993), the use of physician recommendation in addition with reminder methods (Taplin, Anderman, Grothaus, Curry, & Montano, 1994), the patient's insurance type (Gorin et al., 2006), and the physicians' impact on underserved communities (Gorin et al., 2006).

Having a physician make a recommendation is still better than not having a recommendation at all which can be common depending on the type of health insurance an individual possesses. Whether or not a patient has fee for service versus a managed care organization can have consequences on the type of preventative care an individual receives. A managed care organization (MCO) is defined as being the type of health care plan an individual purchases through a health maintenance organization (HMO), in which the plan requires that the individual receive care from specified HMO physicians or physicians referred by that HMO physician. There is also a stipulation that the policy holder designate a primary care doctor, group of doctors, or a specific clinic that the policyholder must go to for all routine, non-emergent care (Miller & Luft, 1994). In contrast, an individual is classified as being enrolled in a fee for service (FFS) plan if he or she is privately insured and does not meet the criteria for enrollment in a MCO plan (Monheit, Wilson, & Arnett, 1999). Regardless of racial or ethnic group, it was found

that persons belonging to MCOs had access to more preventative services (which included physical examination, blood pressure measurement, cholesterol testing, Pap testing, clinical breast examination, mammography and prostate examination) than those in FFS (DeLaet, Shea, & Carrasquillo, 2002). Also, among Hispanics the difference between MCO and FFS enrollees and use of preventative services was greatest among those of the lowest income and education level. African Americans in MCOs received more preventative services than those in FFS (DeLaet et al., 2002). The delivery of preventative health services in MCOs can be attributed to the emphasis that MCOs place on preventative services. In fact, it was found that Hispanic women in FFS plan were less likely than non-Hispanic whites to report having Pap smears, mammograms and breast examinations. This is reflective of the fact that MCOs have undertaken initiatives to improve the care of patients from different ethnic backgrounds through culturally appropriate community outreach activities.

The Effect of Urban or Rural Residency on Mammography Use

A newer barrier that has been studied recently is the whether the location in which a woman lives affects her frequency of mammography screening. The location in which a woman lives can be tied to other barriers such as transportation. Traveling a long distance may produce an additional burden and mammography screening may be less accessible in certain geographical areas. In a study conducted by Engelmann et al. (2002) it was found that mammography screening rates were lower in counties that only had mobile facilities and that mammography screening rates were higher in counties that had permanent facilities. The distance one has to travel to go to a permanent mammography facility can also have an impact on the stage of the woman's cancer once it is detected.

This trend was determined by a study conducted in Georgia where it was found that rural patients who had breast cancer were more likely to have an advanced form of the disease at diagnosis as compared to urban patients (Liff, Chow, & Greenberg, 1991). Rural areas may also be disadvantaged when it comes to mammography screening because of their smaller populations. A study by Marchick & Henderson (2005) found a strong association between population size and the total number of mammography facilities.

Determining geographical disparities in health services, specifically mammography, can be an important tool for policymakers trying to decide where to focus limited resources and can be helpful when developing purposeful research regarding interventions. A study conducted by Leger et al. (2002) found that health behaviors may be related to particular locales. They hypothesized this may be due to the fact that hard-to-reach populations "may remain outside the focus of intervention research" (Legler, Breen, Meissner, Malec, & Coyne, 2002). In fact they found that of the southeastern states, no intervention research targeting African Americans mammography use had occurred in Tennessee, Mississippi, Louisiana, Alabama, South Carolina, or Florida (Legler, Breen, Meissner, Malec, & Coyne, 2002). They concluded that states without studies were largely rural and had relatively little research infrastructure. Legler et al. also found that a common predictor of mammography screening use was education and income and that, "Counties with large percentages of white-collar workers were associated with higher mammography use and counties with higher proportions of persons with less formal education (ninth grade or less) correspond to lower use" (Legler et al., 2002, p.938).

In conjunction with urban or rural residence, ethnicity has been found to have an impact on mammography screening use. Coughlin et al. (2001) found that women in metropolitan areas were more likely than women in rural areas to have had a recent mammogram and the association with either rural or nonrural residence was even stronger with African American and Hispanic women as compared to White women (Coughlin, Thompson, Hall, Logan, & Uhler, 2002). Urban residents may use preventative services more often because they may have a greater availability of medical services in urban areas. Another contributing factor could be that women living in rural areas have limited access to health care practitioners and to fewer preventative health care services (Coughlin et al., 2002).

Georgia and North Carolina's current mammography programs

In 1990, to improve women's access to screening for breast and cervical cancers, Congress passed the Breast and Cervical Cancer Mortality Prevention Act. This act guided the CDC's creation of the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) which provides support in all 50 states, the District of Columbia, four U.S. territories, and thirteen American Indian/Alaska Native tribes or tribal organizations. The purpose of the program is to help low-income, uninsured, or underinsured women gain access to breast and cervical cancer screening and diagnostic services (Centers for Disease Control and Prevention, 2006/2007).

Since 1991, more than 2.7 million women have been served by NBCCEDP, which provided more than 6.5 million screening examinations, and diagnosed more than 26,000 women as having breast cancer. NBCCEDP was responsible for screening 391,968 women for breast cancer using mammography in 2004 (Centers for Disease

Control and Prevention, 2006/2007). The CDC estimates that only 20% of eligible women aged 50 to 64 years are currently taking advantage of the NBCCEDP program (American Cancer Society, 2006a). To achieve a greater impact on populations who are neglecting to get mammography screenings, in 2000 Congress passed the Breast and Cervical Cancer Prevention and Treatment Act which gives states the option to offer women in NBCCEDP access to treatment through Medicaid. Currently all fifty states and the District of Columbia have approved this Medicaid option. American Indians/Native Alaskans are also eligible for health services provided by the Indian Health Service or by a tribal organization with the passage of the Native American Breast and Cervical Cancer Treatment Technical Amendment Act of 2001 (Centers for Disease Control and Prevention, 2006/2007).

NBCCEDP provides an array of strategies to reach underserved women including program management, screening and diagnostic services, data management, quality assurance and quality improvement, evaluation, partnerships, professional development and recruitment (Centers for Disease Control and Prevention, 2006/2007). To be eligible for the NBCCEDP program a family's income must be below 250% of the federal poverty level. In 2003, the annual income levels for a family of four at 200% and 250% of poverty were approximately $37,000 and $46,000, respectively (United States Department of Health and Human Services, 2007; US Census Bureau).

A study conducted by Tangka et al. (2006) examined the NBCCEDP to determine whether it served the screening needs of underserved women. They found that in 2002-2003, of all U.S. women aged 40-64 years (who are eligible for free mammography through the program), four million (8.5%) had no health insurance and a family income

below 250% of the federal poverty level and of those women, only 528, 622 (13.2%) received a Program funded mammogram. The ethnic group that constituted the largest number of women eligible for the Program was white women, of which there were two million in total. The ethnic groups who had the greatest number of women screened were American Indians and Alaska Natives. States varied in percentages of eligible women screened from 2% to 79% and the amount of women eligible were greater in heavily populated states such as California, Texas, New York, and Florida than in other states. The state with the greatest number of eligible women for the NBCCEDP Program was New Mexico. In Georgia, only 6.8% of 95,000 eligible women got screened. The poverty criterion for Georgia was 200%, or earning an income for a family of four equaling $37,000 per year. In North Carolina only 10.3% of 137,000 eligible women got screened, the poverty criterion was also 200% (Tangka et al., 2006).

A new law to try to increase eligible women to participate in the NBCCEDP program is called the Patient Navigator, Outreach and Chronic Disease Prevention Act of 2005 (HR 1812/S898) which was signed by President George W. Bush on June 29, 2005. To help alleviate the barriers to quality health care that medically underserved individuals face, the bill provides grants to help set up navigator programs, which in turn help improve access to prevention screenings and other services. The navigator systems will also encourage increased screening participation of women who lack a consistent source of care, and help alleviate the difficulty of navigating the health care system, so that more women will participate in breast and cervical cancer screening, diagnosis, and treatment.

A program specific to North Carolina was the FoCaS Project, a breast and cervical cancer screening intervention, which took place over four years as a

demonstration project designed to test interventions to increase rates of screening in low-income women. It was conducted in two North Carolina counties, Forsyth and Guildford, one of which served as a control group among residents of low-income housing communities. The intervention city encouraged screening by chart reminders, exam room prompts, as well as staff and patient education. The community outreach component included educational sessions and literature distribution at community events and church activities. As a result of the intervention, the proportion of women who received mammography within the last two years increased from 31% to 56% (American Cancer Society, 2004).

There remains a need for services among low income underserved populations. In 2003, there were more than 2.3 million uninsured, low income women aged 40-64 years who did not receive recommended mammograms from either the Program or other sources. It is important to figure out how to increase efficiencies of the NBCCEDP Programs and how to serve more women with existing resources. A study found that the average cost of screening a woman through the Program was lower for greater numbers of women because as average cost decreased, the number of women screened increased (Mansley, Dunet, May, Chattopadhyay, & McKenna, 2002). One suggestion to increase the number of eligible women screened through NBCCEDP Programs includes improving collaboration and coordination with other providers that serve a similar client population (Tangka et al., 2006). Besides examining the numbers of women getting screened, an additional key component to examine is whether or not mammography facilities and trained specialists are available in the specific county.

Assessment of Availability of Mammography Services

Additional barriers that have been a focus in the failure of women to obtain a mammogram include the closure of mammography facilities and service curtailments, which contribute to making it more difficult for women to schedule and to obtain the procedure, within a reasonable amount of time. The primary concern is that women are not receiving mammograms due to limitations in access. The Food and Drug Administrations (FDA's) database of mammography facilities show 9,512 certified domestic operations as of June 2001. In other years, there were 9,558 certified facilities (46 more) in January of 2000 and 9,314 facilities (198 fewer) on January 1, 1999. In comparison to 1994, there were 10,119 facilities were open and 9,956 in 1997.

Table 1: Changes in Numbers of Mammography Facilities, Machines, Radiologic Technologists, and Interpreting Physicians from October 1, 2001, to October 1, 2004

	2001	2004	Percentage Change
Facilities	9,906	9,769	-6
Machines	13,995	13,400	-4
Radiologic technologists who perform Mammography	31,402	90,503	-9
Physicians who interpret mammograms	19,575	18,690	-5

Source: Government Accountability Office analysis of Food and Drug Administration's (FDA) Mammography Program Reporting and Information System database on mammography capacity elements.

Nationally, the number of mammography facilities has declined by 4.5% since 1997 and 6.0% by 1994 (Eastern Research Group Inc., 2001). However recent FDA analysis of the mammography facility database found that the 1994 estimates of mammography facilities were inflated due to duplicate listings of facilities that had received more than one accreditation (Eastern Research Group Inc., 2001).

Besides the reduction in mammography facilities in states, the number of facilities per 10,000 females 40 years of age or older has also declined in most states. The number

of females who are referred for a mammogram or seek screening or diagnostic mammograms determine the actual demand for mammography services. The FDA statistics of demand are based on submittals of data by facilities at the time of their accreditation and due to that fact, may underestimate the current level of services if demand is increasing over time. The report conducted by the Eastern Research Group (2001) found that the number of mammography facilities in Georgia decreased from 289 in 1994 to 268 in 2001 and that the number of mammography facilities in North Carolina increased from 242 in 1994 to 253 in 2001 (Eastern Research Group Inc., 2001). This may reflect the study's findings which concluded that any problems with mammography access were localized rather than widespread.

Another study conducted in 2006 by the United States Government Accountability Office examined mammography facilities and whether the nationwide capacity was adequate. The key elements as defined by the Government Accountability Office (GAO) that make up mammography capacity are the total numbers of mammography facilities, machines, and radiologic technologists (United States Government Accountability Office, 2006). To determine the nation's current mammography capacity GAO asked mammography experts for estimates of the amount of time it takes to perform both a screening mammogram and to perform a diagnostic mammogram. Then, GAO used those estimates, combined with the FDA data on the number of machines available in 2003, to calculate the number of mammograms that could have potentially been performed in 2003. From 2001 to 2004 the number of mammography facilities nationwide decreased from 9,306 to 8,768. There was a net loss of 538 facilities (or decrease of 6%) because 1,290 facilities closed white 752 began

providing services (United States Government Accountability Office, 2006). Most facilities closed due to financial considerations. Adding to the financial difficulty of mammography facilities were retaining and recruiting radiologic technologists to perform mammography and other specialty physicians to interpret mammograms.

It was observed that access problems may have resulted from the loss of facilities, particularly for women who were medically underserved such as those who have a low income, or lack health insurance. Contributing to the access problems were the lengthy weight times and the increased distances individuals had to travel when a facility in their county closed. Those women who were medically underserved inherited a significant burden by having to take extra time away from work or family responsibilities. In addition, these women were of particular concern because those who lack health insurance or have low incomes are the same women with lower than average screening mammography rates.

Interestingly, a study conducted in 2002 by GAO found that most availability problems occurred in certain metropolitan areas like Houston and Los Angeles, but the greatest loss in capacity occurred in rural counties of Baltimore including the counties of Anne Arundel, Baltimore, Baltimore City, and Prince George's. The loss of mammography machines was calculated as a 25% decrease and 121 counties, most of them rural, were most affected (Government Accountability Office, 2002). Another surprising find by the same study was that during their follow up at 55 rural and metropolitan counties where reductions occurred in facilities or machines, lengthy appointment waiting times were primarily found in metropolitan locations. The study found that the counties that lost services were able to draw on increased resources in a

neighboring county with the result being that the longest waiting time was one month or less, which was considered to be reasonable. The travel distance a woman had to travel from one county with decreased resources to a neighboring one was less than 40 miles, which officials considered common in rural areas. Another option rural county's had for women was offering mobile mammogram facilities that traveled to their area.

The study conducted by GAO (2006) did find that the number of mammograms performed by U.S. machines was substantially lower than the maximal numbers that could be performed. They estimated that one machine and one radiologic technologist could perform three mammograms per hour or 24 mammograms in an eight hour day. Therefore, there was a potential maximal capacity of 6,000 mammograms per machine per year and that there is unused capacity nationwide. Of most concern was the dwindling numbers of radiologists and radiologic technologists entering the field every year which may not be adequate to serve the increasing population of women 40 and older. This may lead to future access problems. Findings from a 2004 survey of community-based mammography facilities in three states indicated that 44% of facilities reported experiencing a shortage of radiologists and 46% reporting had some level of difficulty in maintaining adequate numbers of qualified technologists (D'Orsi & et al, 2005).

Since the main access issues that exist in certain geographical areas pertain to long wait times and traveling great distances to get mammography screenings, most experts in the study conducted by GAO (2006) recommended that it was best if the wait time for screening mammography did not exceed 30 days and if the wait time for diagnostic mammography did not exceed two days. Besides working on issues of access

and capacity relevant to mammography screening, another important way to encourage women to get screened is to promote the importance of breast cancer screening in state cancer plans and take steps to eliminate the factors which may prevent a woman from getting screened.

Comprehensive Cancer Control-State Cancer Plans

Comprehensive Cancer Control (CCC) is a collaboration among key national organizations including: the Centers for Disease Control and Prevention, the National Cancer Institute, the American Cancer Society, C-Change, the Chronic Disease Directors, the Intercultural Cancer Council, North American Association of Central Cancer Registries and the American College of Surgeons, the Lance Armstrong Foundation, and the National Association of County and City Health Officials (Centers for Disease Control and Prevention, 2006). Working together, they integrate and coordinate anti-cancer efforts, pool resources to promote cancer prevention, improve cancer detection, increase access to health and social services, and reduce the burden of cancer. The main way this is done is through the formation and implementation of state CCC plans. In 2000, only twelve states had plans, but that has increased to 34 in 2004 due to state cancer coalitions which create enthusiasm and momentum by developing, implementing and evaluating CCC plans (Black, Alvarado-Cowens, Gershman, & Weir, 2005). Currently there are 49 states that have cancer plans as well as four tribes and eight territories (American Cancer Society, 2007).

One of the reasons CCC was started was to help states overcome barriers to reduce the burden of cancer incidence and mortality. One such barrier is that of categorical funding (Centers for Disease Control and Prevention, 2004; Lorentz, 2005).

It is the tendency in the United States to direct money to programs for specific forms of cancer, like lung or colorectal, or to risk-factor programs like smoking or sun exposure. Through CCC, states and private organizations, as well as non-profit partners, collaborate on an ongoing basis to maximize the impact of limited resources and in turn do a better job of preventing cancer and saving lives. Other barriers that states encounter when developing and implementing state plans are; ineffective use of data (Black et al., 2005), lack of community ownership, programmatic change (Kerner et al., 2005), sustainability, limited resources, competition (True, Kean, Nolan, Haviland, & Hohman, 2005), lack of coordination, disparities in knowledge, and insufficient information due to a lack of evaluation (Given, Bruce, Lowry, Huang, & Kerner, 2005).

The state cancer plans are specific to the health needs of the particular state, but generally have a section on each of the following cancers; breast, cervical, colorectal, prostate, skin, and testicular. They examine particular health behaviors and living and working conditions which may put an individual more at increased risk for particular cancers.

This study examined the eight states in HHS Region IV (United States Department of Health and Human Services, 2004). These states include Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina and Tennessee. The Comprehensive Cancer Control Plans of these eight states were examined to determine if the plans listed whether living in a rural county can be a risk factor for neglecting to get a mammography screening.

CHAPTER III
METHODS AND PROCEDURES

IRB and Data Management

The protocol for this study was reviewed and approved by the Georgia State University Institutional Review Board (IRB) on March 23, 2007 under the exempt review process. Data that are used for this research came from the Behavior Risk Factor Surveillance System (BRFSS). BRFSS is a state-based telephone survey administered by the Centers for Disease Control and Prevention (CDC). The data is published with the removal of personal identifiers in electronic format and is publicly accessible via the CDC website. There was no sensitive context data used in the original data collection.

Research Design

This study was designed to: (1) determine whether there is a statistically significant difference in urban or rural mammography screening rates, (2) assess the availability of mammography screening facilities and (3) examine whether eight state cancer plans in Health and Human Services (HHS) Region IV address differential mammography screening rates in rural counties.

Data from the years 2002 and 2004 BRFSS were used to calculate mammography screening rates in Georgia and North Carolina for both urban and rural areas. The population of the respective states' urban and rural counties was obtained from the 2005 American Community Survey (ACS) provided by the U.S. Census, which is a nationwide survey of approximately three million households and which is designed to provide data on how communities are changing. The estimated population counts used

are the most recent estimates from the Census Bureau's Population Estimates Program. The U.S Census breaks down population estimates for the 2005 ACS into metropolitan or micropolitan statistical areas. A metropolitan statistical area contains at least one population nucleus with a population of 50,000 or more. Rural counties fall under the classification of micropolitan statistical areas, meaning they have at least one population nucleus with 10,000 to 49,999 people. Population estimates for women 18 to 65 years of age in each county were used (U.S. Census Bureau, 2006).

The BRFSS data was crucial in determining if a difference exists among urban or rural mammography screening rates. The BRFSS contains information on mammography screening rates for Georgia and North Carolina for years 2002 and 2004. The BRFSS is a cross-sectional, state-based telephone survey of adults aged 18 years or older to track health conditions and risk behaviors. The BRFSS has been administered by the Centers for Disease Control and Prevention annually since 1984 (Centers for Disease Control and Prevention, 2006).

The Centers for Disease Control and Prevention conduct at least 4,000 interviews per state yearly. Telephone numbers are randomly selected by region within each state. Bias is removed from the sample by using standard weighting which affects both the point estimate (bias) and confidence intervals (precision). The CDC developed a standard core questionnaire that allows comparison data across states. Georgia and North Carolina were chosen for this study based on proximity and comparability in size and population. The BRFSS mammography screening data for the years 2002 and 2004 is available for both states.

Each state employs a BRFSS state coordinator, who provided the raw state level data for Georgia and North Carolina for this study. The North Carolina BRFSS state coordinator provided the data for years 2002 and 2004 on a CD-ROM. The Georgia BRFSS state coordinator sent the data for Georgia's 2002 and 2004 BRFSS via e-mail.

The 2002 and 2004 data for Georgia and North Carolina were checked for accuracy and matching variables. The data then were merged together for ease of analysis. The mammography screening rates for women who lived in urban counties by state were calculated and recorded, and the same was done for rural counties by state.

To determine the availability of mammography screening facilities in Georgia and North Carolina, data from the U.S. Food and Drug Administration's (FDA) was utilized to obtain the address of the facilities. The FDA 2005 data was used because that is the most recent year the U.S. Census population estimates were available at the county level. In addition, FDA 2005 data was used to best measure availability of mammography facilities at the time of the BRFSS survey. Zip code information was used to determine the county location of each certified mammography facility. As described previously, each county in Georgia and North Carolina was designated as either urban or rural utilizing the USDA Rural/Urban Continuum Codes. Each facility's name, address, city, state, zip code, county and its urban or rural designation was entered into an excel spreadsheet. At the study author's request, the Georgia Division of Public Health and the North Carolina Division of Public Health utilized the facility spreadsheet to map the Georgia and North Carolina mammography facilities. Using the data provided by the FDA, the number of urban and rural facilities for each state was calculated. The FDA

2007 data also was used to measure whether there had been a change in availability of mammography facilities and was mapped using the same process as the 2005 data.

The State Comprehensive Cancer Plans for the eight states in Health and Human Services (HHS) Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) were reviewed to determine if the plans address differential screening rates among women who live in rural counties. A search of the documents for the terms "urban, rural, metropolitan, non-metropolitan, county and residence" was made and the frequency of the terms used in the plans and how they were used were recorded into tables.

Research Variables

Variables for the specific state STATE (1=Georgia, 2=North Carolina) were created and variables for the data year YEAR (1=2002, 2=2004) were created to ensure that data could be analyzed individually by state and year. The variable for either urban or rural county was created by looking up the state Federal Information Processing Standards (FIPS) codes (Georgia=13, North Carolina=37), county FIPS codes by state (see Appendices A, B). Each county in each state is given a three digit FIPS code. Urban or rural classification was determined using Rural-Urban Continuum Codes compiled by the United States Department of Agriculture (USDA) in 2003. A "rural" county was defined as a county located in a "non metropolitan" area and an "urban" county was defined as a county located in a "metropolitan" area. The variable for urban or rural county classification was CTYCODE (county code) recoded as (1=urban, 2=rural). There was also a variable for SEX (1=male, 2=female) which was filtered for females only to be used in data analysis. Other variables included: number of women in the household

NUMWOMEN (1=0, 2=1, 3=2 or more);, whether the participant had health coverage HLTPLAN (1=yes, 2=no); if the participant had a personal physician PERSDOC (1=yes, 2=no); the age of the participant AGE (1=18-39, 2=40-59, 3=60+); level of education EDUCA (1=less than high school, 2=high school, 3=more than high school); employment status EMPLOY (1=employed, 2=unemployed); income level INCOME2 (1=above the poverty level, 2=below the poverty level); if the participant ever had a mammogram HADMAM (1=yes, 2=no); how long since the participant's last mammogram HOWLONG (1=within the past year, 2=within the past 2-3 years, 3=five years or more); and the participants race RACE2 (1=white, 2=African American, 3=other, 4=Hispanic). Ages 40 years and above were the only examined age groups covered by screening standards, so ages 18-39 were excluded in the analysis.

The BRFSS questions that were used in this study included:

1. What is the number of adult women in the household?
2. Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMO's, or government plans such as Medicare?
3. Do you have one person you think of as your personal doctor or health care provider? (If no, ask "Is there more than one or no person that you can think of?)
4. What is your age?
5. Are you currently…? Employed for wages, self-employed, out of work for more than 1 year, out of work for less than 1 year, a homemaker, a student, retired, or unable to work?

6. Is your annual income from all sources- less than $10,000, less than $15,000, less than $20,000, less than $25,000, less than $35,000, less than $50,000, less than $75,000, $75,000 or more?
7. A mammogram is an x-ray of the breast to look for breast cancer. Have you ever had a mammogram?
8. How long has it been since your last mammogram?
9. Which one of these groups would you say best represents your race? White, black or African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian, Alaskan Native, Other, do not know/not sure, multiracial?

Statistical Analysis

Statistical programs that are available in SPSS® 15.0 were used in this study. Initially, descriptive statistics were calculated to establish prevalence of independent health variables (i.e., income level, education level, employment, having had a mammogram, etc.) in urban or rural counties. Subsequently, statistical significance was established by using chi-square tests and calculating 95% confidence intervals and P values. The chi-square tests examined the relationship between the dependent variable (mammography screening) and the independent variables (income, employment, education, number of females in the household, etc.). The larger the chi-square, the less likely it is that difference is due to chance. A P value less than five percent means that the probability is not due to chance.

The data retrieved from 2002 and 2004 were compared using logistic regression analysis. "Logistic regression allows you to test models and predict categorical outcomes with two or more variables" (Pallant, 2005). Binary regression was conducted initially

with the dependent variable being the question, “Have you had a mammogram?” after controlling for the state, year and county code (urban or rural). The last statistical test performed was the multivariate logistic analysis. This statistical test was conducted to determine if all confounding variables were equally accounted for, which independent variables had a significant association with mammography.

Multivariate logistic regression also was used to determine at what age women obtain mammography screenings in Georgia or North Carolina in 2002 and 2004, and differences that might exist at the county level. This statistical test was used after controlling for state, year, county code and age. Using this regression model a series of independent variables were tested in order to determine if mammography screening is positively or negatively associated with various outcomes.

CHAPTER IV
FINDINGS

An examination of all relevant data (as described in Chapter III) indicated that residence in an urban or rural county did not significantly impact mammography use. However, age, education level, employment status, income level and race were significantly associated with mammography use as indicated by the chi square statistical test and calculated P values of .05 or less. There were a number of variables tested using the 2002 Georgia and North Carolina data that were not statistically significant for mammography screening rates when comparing residence in an urban versus a rural county. These variables were the number of women in the household, the time period since the woman's previous mammogram and the time period from previously having had a mammogram. Health care coverage was found to be significantly associated with mammography use only for North Carolina in both rural and urban counties for 2002.

Although there was not a predominate pattern of difference in mammography usage in the urban and rural counties of Georgia and North Carolina, the statistical tests and relationships established between mammography usage and associated variables echoed the findings of the literature review. Mainly, these findings demonstrated that women who obtain regular medical care and have health insurance are more likely to get screened than women who are less educated (i.e., have a high school diploma or less schooling).

Of the 5,065 subjects who participated in the Georgia Behavior Risk Factor Surveillance System (BRFSS) in 2002, 3,213 (63.4%) were female. Out of the 6,712 participants of the North Carolina BRFSS survey in 2002, 4,112 (61.3%) were female. For the BRFSS in 2004, there were 5,044 total participants in Georgia of which 3,140 (62.3%) were female. In North Carolina, 15,053 participants engaged in the 2004 BRFSS study, of which 9,495 (63.1%) were female.

As shown in Figure 1, the women who lived in Georgia and participated in the 2002 BRFSS survey, 2,200 (68.5%) women lived in urban counties and 1,013 (31.5%) lived in rural counties. In the 2004 Georgia BRFSS survey, 1,913 (61%) of women surveyed lived in urban counties and 1,227 (39%) of women surveyed lived in rural counties. For the 2002 BRFSS in North Carolina, 3,046 (71.4%) women lived in urban counties and 1,066 (25.9%) lived in rural counties. The data from the 2004 North Carolina BRFSS reported 6,043 (63.6%) women living in urban counties and 3,452 (36.4%) women living in rural counties.

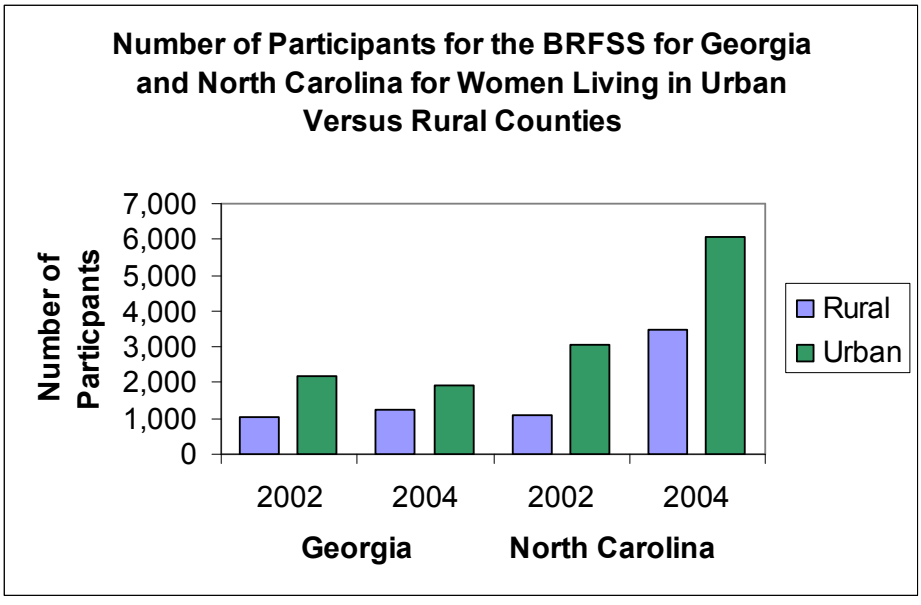

Figure 1. Participants who answered the BRFSS, county of residence in GA and NC in 2002 and 2004

In the 2002 Georgia BRFSS survey, 3,184 (99.1%) females in total answered the question “Have you ever had a mammogram?”. Of the respondents, 2,157 (67.7%) females in Georgia answered ‘Yes’ to the question and 1,027 (32.3%) answered ‘No’. Of those females who responded ‘Yes’ on the Georgia 2002 BRFSS survey to having had a mammogram, 1,474 (68.4%) lived in urban counties and 683 (31.6%) lived in rural counties. Of those who answered ‘No’ to having had a mammography screening, 709 (69%) lived in urban counties and 318 (31%) lived in rural counties. Of those females who responded ‘Yes’ to having had a mammogram in Georgia in 2002, 977 (45.3%) were sixty and above, 547 (25.4%) were of screening age (40-59 years of age) and 569 (26.3%) did not report their age and were omitted from the data set.

In North Carolina in 2002, 2,882 (70.1%) females responded ‘Yes’ and 1,213 (29.9%) responded “No” to having had a mammogram. Of those who had a mammogram, 2,115 (73.4%) lived in urban counties and 767 (26.6%) lived in rural counties. Of the participants who answered ‘No’ to having had a mammogram in North Carolina in 2002, 920 (75.8%) lived in urban counties and 293 (24.2%) lived in rural counties. The age stratum of women who received a mammogram in North Carolina in 2002 included 1,305 (45.3%) age sixty and above, 620 (21.5%) of screening age (39-59 years of age), and 662 (23%) who declined to give their age or were unaccounted for in the study data set.

For the Georgia BRFSS survey in 2004, 3,140 (100%) of females answered the question, “Have you ever had a mammogram?”. Of the respondents 2,240 (71.3%) answered ‘Yes’ and 28.7% (870) said ‘No’. Of women who had a mammogram, 60.3%

(1,350) lived in urban counties and 39.7% (890) lived in rural counties. Of the respondents who had not had a mammogram, 543 (62.4%) lived in urban counties and 327 (37.6%) lived in rural counties. Of respondents who answered 'Yes', 1,050 (46.9%) were 60 years of age and older, 499 (22.3%) were of screening age (40-59 years of age) and 654 (29.1%) had absent data or neglected to state their age.

According to the 2004 North Carolina BRFSS survey, 9,495 (100%) of the females answered the question "Have you ever had a mammogram?". Of those respondents, 6768 (71%) responded 'Yes' and 2,711 (29%) answered 'No'. Of the participants who responded 'Yes', 4,250 (62.8%) lived in urban counties and 2,518 (37.2%) lived in rural counties. In the sample of participants who responded 'No', 1,786 (65.9%) lived in urban counties and 925 (34.1%) lived in rural counties. The age breakdown of women who answered 'Yes' to mammography screening was as follows: 3,082 (45.5%) were 60 years of age and older and 1,342 (19.8%) were of screening age (40-59 years of age). See Figure 2 below for a graphical representation of the age breakdown.

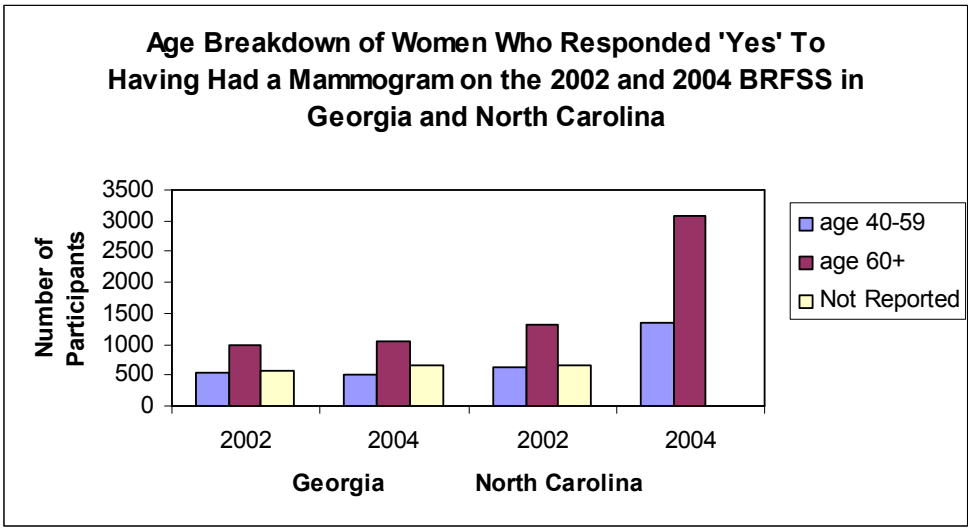

Figure 2. Number of women who had a mammogram according to GA and NC BRFSS in 2002 and 2004.

On the 2002 Georgia BRFSS survey, 2,091 (66.4%) of the respondents who answered the question about having had a mammogram were white, 900 (28.6%) were African American, 92 (3%) identified themselves as "other" races and 68 (2.15%) were Hispanic. The 2002 North Carolina BRFSS survey had the following demographic: 3,051 (75%) were white, 655 (16%) were African American, 222 (5.5%) were other and 138 (3.4%) were Hispanic, for a total of 4,064 survey participants. In 2004, the demographic make-up of Georgia's BRFSS' respondents was 2,149 (69.5%) white, 799 (25.8%) African American, 86 (2.8%) other, and 59 (1.9%) were Hispanic. On the 2004 North Carolina BRFSS, the demographic make-up was: 6,926 (73.5%) white, 1,755 (18.6%) African American, 373 (4%) other, and 368 (4%) Hispanic for a total of 9,422 survey participants. See below in Figure 3 a graphic display of race distribution.

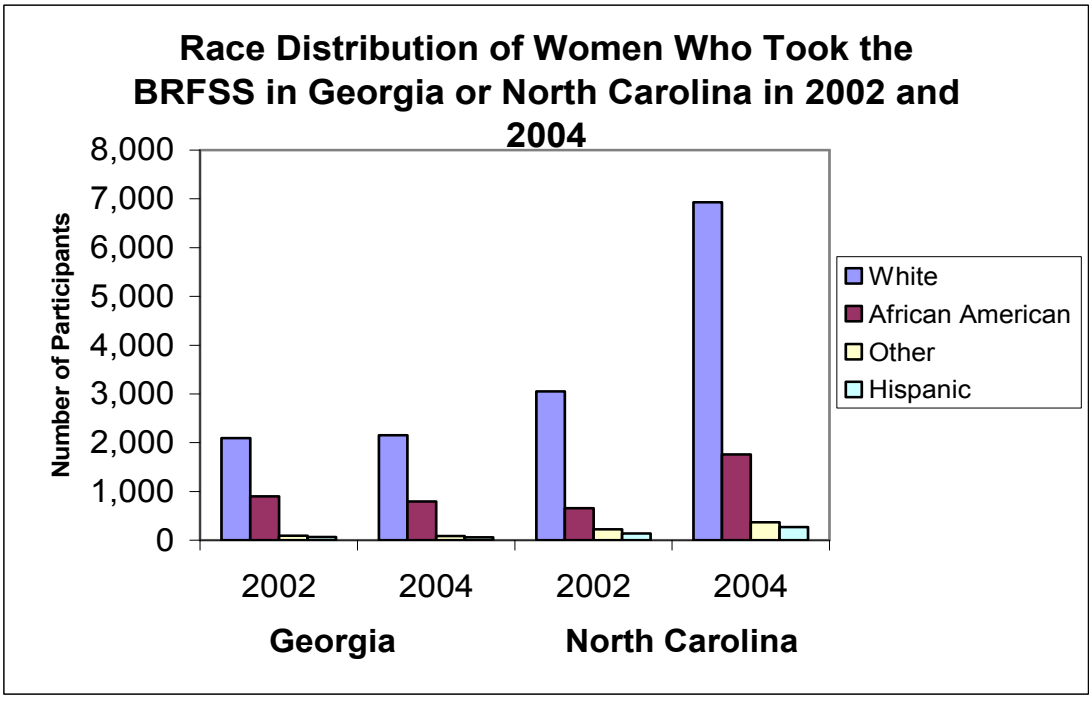

Figure 3. Race distribution of Women who took the BRFSS in Georgia and North Carolina in 2002 and 2004.

Table 2 and Table 3 illustrate which variables are typically associated with mammography use and which are significant when studying the 2002 and 2004 BRFSS data sets of Georgia and North Carolina. Table 2 shows the BRFSS data for women living in urban counties in both states and Table 3 represents the BRFSS data for women living in rural counties.

Chi square statistical tests were conducted separately on the 2002 and 2004 Georgia and North Carolina BRFSS data for urban counties and rural counties. As presented in Tables 4 and 5, mammography use was significantly associated with educational level, employment status, income level, and race for both urban and rural counties. In 2002, health care coverage was found to be statistically significant only in North Carolina in both rural and urban counties; in 2004 it was found to be significantly associated with mammography use in both Georgia and North Carolina in rural and urban counties. Having a usual source of care and the period of time since the last mammogram screening were found to be statistically significant only in Georgia's urban and rural counties in 2004. In North Carolina, age was a characteristic significantly associated with mammography use in both urban and rural counties. The only variable not found to be statistically significant in regards to mammography use in either state and in both urban and rural counties was the number of women living in the household.

Odds ratios (OR) with 95% confidence intervals were calculated to determine the magnitude and direction of the associations of the independent variables and mammography screening. "An odds ratio of 1 indicates that the condition or event under study is equally likely in both groups. An odds ratio greater than 1 indicates that the

Table 2. Descriptive Statistics Associated with Mammography Use in Urban Counties in Georgia (GA) and North Carolina (NC), 2002

Variable	n=3213	n	GA (%)	P Value	n=4112	n	NC (%)	P Value
Women in household				**.65**				**.37**
0		2750	85.6			3610	87.8	
1		402	12.5			448	10.9	
2		55	1.7			45	1.10	
3		6	.2			12	.3	
Health care coverage				**.71**				**<.001**
Yes		2786	86.7			3627	88.2	
No		427	13.3			485	11.8	
Personal doctor				**.14**				**.14**
Yes, only one		2374	73.9			2771	67.4	
More than one		337	10.5			855	20.8	
No		501	15.6			486	11.8	
Age (years)				**.01**				**.03**
40-49		745	23.2			954	23.2	
50-59		874	27.2			999	24.3	
60-69		758	23.6			1024	24.9	
70+		506	15.8			757	18.4	
Education level				**<.001**				**<.001**
< High school		418	13.0			539	13.1	
High school		912	28.4			1118	27.2	
> High school		1883	58.6			2455	59.7	
Employment status				**<.001**				**<.001**
Employed		1864	58.0			2282	55.5	
Unemployed		646	20.1			736	17.9	
Retired/Disabled		704	21.9			1094	26.6	
Income level*				**<.001**				**<.001**
Below the poverty level		424	13.2			530	12.9	
Above the poverty level		2789	86.8			3582	87.1	
Race				**<.001**				**<.001**
White		2053	63.9			3156	76.7	
African American		964	30.0			679	16.5	
Hispanic		112	3.5			140	3.4	
Other		74	2.3			137	3.3	
Had a mammogram				**.69**				**.101**
Yes		2169	67.5			2866	69.7	
No		1044	32.5			806	19.6	
Last mammogram				**.13**				**.34**
1 Year		2117	65.9			2981	72.5	
2-3 Years		723	24.0			806	19.6	
5 years or more		373	11.6			325	8.1	

*Poverty level indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007

Table 3. Descriptive Statistics Associated with Mammography Use in Rural Counties in Georgia (GA) and North Carolina (NC), 2002

Variable	n=3213	n	GA (%)	P Value	n=4112	n	NC (%)	P Value
Women in household				**.65**				**.37**
0		2802	87.2			3590	87.3	
1		357	11.1			475	11.5	
2		45	1.5			47	1.10	
3		9	.3			0		
Health care coverage				**.71**				**<.001**
Yes		2773	86.3			346	84.2	
No		440	13.7			650	15.8	
Personal doctor				**.14**				**.09**
Yes, only one		2477	77.1			2973	72.3	
More than one		311	9.7			728	17.7	
No		425	13.3			411	10.0	
Age (years)				**.01**				**.03**
40-49		679	21.1			752	18.3	
50-59		761	23.7			966	23.5	
60-69		775	24.1			1094	26.6	
70+		685	21.3			881	21.5	
Education level				**<.001**				**<.001**
< High school		675	21.0			925	22.5	
High school		1099	34.1			1447	35.2	
> High school		1439	44.8			1740	42.4	
Employment status				**<.001**				**<.001**
Employed		1709	53.2			1986	48.3	
Unemployed		569	17.7			703	17.1	
Retired/Disabled		935	29.1			1423	34.7	
Income level*				**<.001**				**<.001**
Below the poverty level		678	21.4			925	22.5	
Above the poverty level		2525	78.6			3187	77.5	
Race				**<.001**				**<.001**
White		2294	71.4			287	69.8	
African American		826	25.7			637	15.5	
Hispanic		48	1.5			136	3.3	
Other		45	1.4			46	11.4	
Had a mammogram				**.69**				**.10**
Yes		2169	68.2			3306	72.4	
No		1044	32.5			806	19.6	
Last mammogram				**.13**				**.34**
1 year		1973	61.4			2874	69.9	
2-3 years		867	27.0			904	22.0	
5 years or more		373	11.6			335	8.1	

*Poverty level indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007.

Table 4. Descriptive Statistics Associated with Mammography Use in Urban Counties in Georgia (GA) and North Carolina (NC), 2004

Variable	n=3140	n	GA (%)	P Value	n=9495	n	NC (%)	P Value
Women in household				**.49**				**.37**
0		2675	85.2			8365	88.1	
1		399	12.7			1035	10.9	
2		57	1.8			67	1.1	
3		9	.3			28	.3	
Health care coverage				**.04**				**<.001**
Yes		2741	87.3			8318	87.6	
No		399	12.7			1177	12.4	
Personal doctor				**.04**				**.40**
Yes, only one		2255	71.8			6884	72.5	
More than one		449	14.3			1377	14.5	
No		436	13.9			1234	13.1	
Age				**.16**				**<.001**
40-49		634	20.2			2117	22.3	
50-59		772	24.6			2440	25.7	
60-69		807	25.7			2241	23.6	
70+		644	20.5			2013	21.2	
Education level				**<.001**				**<.001**
< High school		414	13.2			1339	14.1	
High school		870	27.7			2611	27.5	
> High school		1856	59.1			5545	58.4	
Employment status				**<.001**				**<.001**
Employed		1774	56.5			4880	51.4	
Unemployed		609	19.4			1747	18.4	
Retired/Disabled		757	24.1			2868	30.2	
Income level*				**<.001**				**<.001**
Below the poverty level		405	12.9			1377	14.5	
Above the poverty level		2735	87.1			8118	85.5	
Race				**<.001**				**<.001**
White		2242	71.4			6628	69.8	
African American		807	25.7			1472	15.5	
Hispanic		47	1.5			313	3.3	
Other		44	1.4			1082	11.4	
Had a mammogram				**.27**				**.005**
Yes		2119	71.3			6684	70.4	
No		1021	32.5			1861	19.6	
Last mammogram				**.02**				**.32**
1 year		2041	65.0			6276	66.1	
2-3 years		760	24.2			2260	23.8	
5 years or more		339	10.8			959	10.1	

Poverty level indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007

Table 5. Descriptive Statistics Associated with Mammography Use in Rural Counties in Georgia (GA) and North Carolina (NC), 2004

Variable n=3140	n	GA (%)	P Value	n=9495	n	NC (%)	P Value
Women in household			**.49**				**.25**
0	2726	86.8			8489	89.4	
1	367	11.7			902	9.5	
2	44	1.5			95	1.0	
3	3	.1			9	.1	
Health care coverage			**.04**				**<.001**
Yes	2660	84.7			7900	83.2	
No	480	15.3			1595	16.8	
Personal doctor			**.04**				**.40**
Yes, only one	2368	75.4			6998	73.7	
More than one	449	14.3			1320	13.9	
No	323	13.9			1177	12.4	
Age (years)			**.16**				**<.001**
40-49	590	18.9			1833	19.3	
50-59	700	22.3			2146	22.6	
60-69	807	25.7			2611	27.5	
70+	779	24.8			2241	23.6	
Education level			**<.001**				**<.001**
< High school	703	22.4			1852	19.5	
High school	1137	36.2			3257	34.3	
> High school	1300	41.4			4386	46.1	
Employment status			**<.001**				**<.001**
Employed	1510	48.1			4463	47.0	
Unemployed	631	20.1			1557	16.4	
Retired/Disabled	999	31.8			3475	36.6	
Income level*			**<.001**				**<.001**
Below the poverty level	804	25.6			2013	21.2	
Above the poverty level	2336	74.4			7482	78.8	
Race			**<.001**				**<.001**
White	2336	74.4			6628	69.8	
African American	707	22.5			1927	20.3	
Hispanic	44	1.4			361	3.8	
Other	53	1.7			579	6.1	
Had a mammogram			**.27**				**.005**
Yes	2295	73.1			6941	73.1	
No	845	26.9			2554	26.9	
Last mammogram			**.02**				**.32**
1 year	1909	60.8			6295	66.3	
2-3 years	769	24.5			2146	22.6	
5 years or more	462	14.7			1054	11.0	

*Poverty level indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007.

condition or event is more likely in the first group. And an odds ratio less than 1 indicates that the condition or event is less likely in the first group. The odds ratio must be greater than or equal to zero" (Le, 2001). Odds ratios were calculated to determine if mammography screening was more prevalent with common characteristics such as income, educational attainment employment and then if these characteristics were found more significantly in women who live in urban or rural counties and is used as a means of expressing the results abbreviated as "OR." In order to accurately capture any differences that may exist within the states, data was analyzed using univariate logistic regression taking into account the county code (urban or rural) in which the woman surveyed lived, the state (Georgia or North Carolina) and the year (2002 or 2004).

As shown in Tables 6 and 7, in Georgia and North Carolina in 2002 there were statistically significant decreased odds of having a mammogram if the woman was of screening age (40-59 years old). In the rural counties of Georgia a woman was 80% more likely to get a mammogram if she had a usual source of care (OR=1.8, 95% CI 1.3-2.5). Having only a high school education decreased odds of mammography use for women living in rural counties of Georgia. In the rural counties of North Carolina a woman who either had sisters or her mother living with her in the household (two or more women) was 18 times more likely to get screened (OR=18.1, 95% CI .95-343.5) in 2002.

Having health care coverage in Georgia in 2002 increased a woman's odds of having a mammogram in both urban and rural counties from 10% to 60% (OR=1.1, 95% CI .75, 1.5 and OR=1.6, 95% CI .98, 2.7.) In urban counties in North Carolina women had increased odds of having a mammogram if they had a personal doctor as shown in

Table 6. Association Between Selected Independent Variables and Mammography Stratified by Residence in Georgia, 2002

Variable	URBAN		RURAL	
N=3123	**OR**	**95%CI**	**OR**	**95%CI**
No. of women in the household				
1	.97	.66 – 1.4	1.3	.74 – 2.3
2 or more	.87	.35 – 2.2	.34	.08 – 1.5
Has health care coverage				
Yes	1.1	.75 – 1.5	1.6	.98 – 2.7
Has a personal doctor				
Yes	1.8	1.3 – 2.5	1.4	.78 – 2.4
Age (years)				
40-59	.02	.01 - .04	.03	.01 - .07
Education level				
Less than High school	1.1	.67 - 1.8	.60	.32 – 1.2
High School	.90	.56 – 1.5	.55	.29 – 1.1
Employment status				
Employed	1.0	.78 – 1.4	1.2	.78 – 1.9
Income level*				
Below the poverty level	1.3	.72 – 2.2	1.0	.48 – 2.1
Race				
White	.77	.59 – 1.0	.75	.49 – 1.2
African American	1.1	.61 – 2.0	.36	.10 – 1.4
Other	1.0	.51 – 2.0	.46	.12 – 1.8

^OR; odds ratio from univariate logistic regression analysis
*Poverty level is indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007.

Table 7. Association Between Selected Independent Variables and Mammography Stratified by Residence in North Carolina, 2002

Variable	URBAN		RURAL	
N=4112	**OR**	**95%CI**	**OR**	**95%CI**
No. of women in the household				
1	.89	.56 – 1.4	.88	.35 – 2.2
2 or more	.75	.23 – 2.5	18.1	.95 – 343
Has health care coverage				
Yes	1.1	.69 – 1.6	1.6	.79 – 3.2
Has a personal doctor				
Yes	1.0	.67 – 1.6	.54	.21 – 1.4
Age (years)				
40-59	.02	.01 - .03	.03	.01 - .10
Education level				
< than High school	1.8	.93 – 3.4	1.6	.62 – 4.3
High school	1.6	.90 – 3.1	1.4	.52 – 3.6
Employment status				
Employed	1.1	.78 – 1.6	1.4	.72 – 2.6
Income level*				
Above the Poverty level	.87	.39 – 2.0	1.3	.44 – 3.7
Race				
White	.84	.58 – 1.2	.47	.20 – 1.1
African American	1.2	.57 – 2.3	.57	.24 – 1.3
Other	1.1	.54 – 2.4	.81	.19 – 3.5

^OR; odds ratio from univariate logistic regression analysis
*Poverty level is indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007.

Table 9. Interestingly, decreased odds of having a mammogram were associated with women of recommended screening age (40-59 years and younger). As shown by Tables 8 and 9, in the rural counties of both Georgia and North Carolina in 2004, having two or more women in the household decreased a woman's odds of getting a mammogram.

Univariate logistic regression was conducted with the 2004 BRFSS data for Georgia and North Carolina to try to determine if the same independent variables were associated with odds of mammography use or if they changed with time and if a pattern could be established among women who lived in urban or rural counties. After taking note of the different independent variables significantly associated with increased or decreased odds of obtaining a mammogram, multivariate logistic regression was used to determine if, after adjusting for confounding factors, the independent variables predicted the likelihood of getting a mammogram, or if getting a mammogram predicted one of the the independent variables tested. Decreased odds of mammography use were associated with women of screening age (40 years of age and older) in Georgia and North Carolina in both urban and rural counties in 2002 and 2004 (as shown in Tables 10 and 11). Table 10 illustrates how having a personal doctor living in an urban county in Georgia predicted frequent mammography use in 2002.

The screening age of women 40-59 years of age predicted the behavior of neglecting to get screened. In Georgia and North Carolina, having a usual source of care predicted mammography use regardless of whether the woman lived in either an urban or rural county. In the rural counties of both Georgia and North Carolina, having healthcare coverage predicted mammography usage. Women living in the rural counties of North

Table 8. Association Between Selected Independent Variables and Mammography Stratified by Residence in Georgia, 2004

Variable	URBAN		RURAL	
n=3140	**OR**	**95%CI**	**OR**	**95%CI**
No. of women in the household				
1	.66	.43 – 1.0	.84	.49 – 1.4
2 or more	.74	.28 – 2.0	.18	.03 - .98
Has health care Coverage				
Yes	1.5	1.0 – 2.3	1.8	1.2 – 2.9
Has a personal doctor				
Yes	2.6	1.7 – 4.0	1.9	1.2 – 3.3
Age (years)				
40-59	.02	.01 - .03	.03	.01 - .06
Education level				
< than High school	.60	.33 – 1.1	1.0	.56 – 1.8
High school	.71	.41 – 1.2	1.0	.53 – 1.7
Employment status				
Employed	1.3	.95 – 1.8	1.3	.84 – 1.9
Income level*				
Above the Poverty level	2.0	.97 – 3.8	1.4	.78 – 2.6
Race				
White	1.2	.86 – 1.6		
African American	1.3	.62 – 2.7	.72	.47 – 1.1
Other	1.5	.63 – 3.8	.12	.01 – 1.5

^OR; odds ratio from univariate logistic regression analysis
*Poverty level is indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007

Table 9. Association Between Selected Independent Variables and Mammography Stratified by Residence in North Carolina, 2004

Variable	URBAN		RURAL	
n=9495	**OR**	**95%CI**	**OR**	**95%CI**
No. of women in the household				
1	.93	.70 – 1.2	.86	.58 – 1.3
2 or more	1.5	.74 – 3.3	.27	.10 - .83
Has health care Coverage				
Yes	1.2	.96 – 1.6	1.5	1.1 – 2.1
Has a personal doctor				
Yes	2.3	1.8 – 2.9	1.7	1.2 – 2.4
Age (years)				
40-59	.01	.01 - .02	.01	.01 - .02
Education level				
< than high school	.95	.67 – 1.3	.79	.52 – 1.2
High school	.77	.56 – 1.1	.72	.48 – 1.1
Employment status				
Employed	1.1	.95 – 1.4	.96	.73 – 1.3
Income level*				
Below the Poverty level	.99	.66 – 1.5	.76	.48 – 1.2
Race				
White	.80	.64 - .99	.78	.58 – 1.0
African American	1.1	.68 – 1.7	1.2	.78 – 1.9
Other	.28	.79 - .52	1.3	.69 – 2.5

OR; odds ratio from univariate logistic regression analysis
Poverty level is indicated as less than $13,670 for a two income household according to U.S. Census, 2007

Table 10. Association Between Selected Independent Variables Stratified by Residence in Georgia and North Carolina, 2002

Variable	n=321 GEORGIA				n=4112 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women the household	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
0	.87	.35 – 2.2	.75	.08 – 1.5	.75	.23 – 2.5	18.1	.95 – 343
1	1.1	.75 – 1.5	.27	.06 – 1.2	.84	.24 – 2.9	20.6	.98 – 431
Health care coverage								
Yes	1.1	.75 – 1.5	1.6	.98 – 2.7	1.1	.69 – 1.6	1.6	.79 – 3.2
Personal doctor								
Yes	1.8	1.3 – 2.5	1.4	.78 – 2.4	1.0	.67 – 1.6	.54	.21 – 1.4
Age (years)								
40-59	.04	.03 - .06	.09	.06 - .14	.04	.03 - .06	.07	.03 - .14
Education level								
< than high school	.91	.56 – 1.5	.55	.29 – 1.1	1.7	.90 – 3.1	1.4	.52 – 3.6
High school	.82	.62 – 1.1	.91	.60 – 1.4	.93	.65 – 1.3	.84	.44 – 1.6
Employment status								
Employed	1.0	.78 – 1.4	1.2	.78 – 1.9	1.1	.78 – 1.6	1.4	.72 – 2.6
Income level*								
Below the poverty level	1.3	.72 – 2.2	1.0	.48 – 2.1	.87	.39 – 2.0	1.3	.44 – 3.7
Race								
White	1.0	.51 – 2.0	.46	.12 – 1.8	1.1	.54 – 2.4	.81	.19 – 3.5
African American	1.3	.65 – 2.6	.61	.15 – 2.5	1.4	.62 – 3.0	1.7	.34 – 8.6
Other	.91	.38 – 2.2	1.3	.19 – 8.4	.97	.37 – 2.6	1.4	.29 – 7.0

OR; odds ration from multivariate logistic regression analysis

*Poverty level is indicated as less than $13,670 for a two income household according to U.S. Census, 2007

Table 11. Association Between and Selected Independent Variables and Mammography in Georgia and North Carolina Stratified by Residence, 2004

Variable	n=3140 GEORGIA				n=9495 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women in household	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**	**OR**	**95%CI**
0	.74	.28 – 2.0	.18	.03 - .99	1.5	.74 – 3.3	.27	.09 - .83
1	1.3	.39 – 3.2	.21	.04 – 1.2	1.7	.77 – 3.6	.31	.09 – 1.0
Health care coverage								
Yes	1.5	1.0 – 2.3	1.8	1.2 – 2.9	1.2	.96 – 1.6	1.5	1.1 – 2.1
Have a personal doctor								
Yes	2.6	1.7 – 3.9	2.0	1.2 – 3.3	2.3	1.8 – 2.9	1.7	1.2 – 2.4
Age (years)								
40-49	.07	.05 - .10	.11	.07 - .16	.05	.04 - .06	.05	.04 - .07
Education level								
< than High school	.70	.41 – 1.2	.96	.53 – 1.7	.77	.56 – 1.1	.72	.48 – 1.1
High school	1.2	.86 – 1.6	.96	.65 – 1.4	.81	.67 - .99	.91	.70 – 1.2
Employment status								
Employed	1.3	.95 – 1.8	1.3	.84 – 1.9	1.1	.95 – 1.4	.96	.73 – 1.3
Income level								
Below the poverty level	2.0	.97 – 3.8	1.4	.78 – 2.6	.99	.66 – 1.5	.76	.48 – 1.2
Race								
White	1.5	.63 – 3.8	.71	.19 – 2.6	.79	.52 – 1.2	1.3	.69 – 2.5
African American	1.3	.54 – 3.3	.99	.26 – 3.8	.99	.63 – 1.5	1.7	.87 – 3.3
Other	1.2	.97 – 3.8	5.9	.36 – 95.4	.74	.41 – 1.4	1.1	.51 – 2.3

OR; odds ration from multivariate logistic regression analysis
*Poverty level is indicated as less than $13,670 for a two income household per year according to U.S. Census, 2007.

Carolina with lower education levels (i.e., having only a high school diploma) were negatively associated with being screened. There were no significant relationships between race and mammography screening in either state for 2002 and 2004 in urban and rural counties.

Multivariate logistic regression was conducted analyzing the data by state, year, county of residence and age with each independent variable to find out if there was a significant association of mammography and specific age groups living in rural or urban counties when taking into account confounding factors. Additional multivariate regression was done to determine if there was a pattern of mammography use among women in a specific age group living in an urban or rural county in Georgia and North Carolina in 2002 and 2004. Tables 12 and 13 showed that women of screening age 40-59 living in an urban county in Georgia and North Carolina in both 2002 and 2004 were more likely to get a mammogram if they had a usual source of care. Women of 40-59 years of age in North Carolina living in rural areas in 2004 were more likely to get a mammogram if they had a primary doctor. Women 40-59 years of age living in a rural county in Georgia in 2004 who were employed were significantly associated with getting a mammogram. Contrasting with that result, in North Carolina in 2004 employed women 40-59 years of age living in an urban county were more likely to get a mammogram as shown by Table 13.

Table 12. Association between selected independent variables and mammography in women ages 40-59 Stratified by Residence in Georgia and North Carolina in 2002

Variable	n=3213 GEORGIA				n=4112 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women in household	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0	.60	.13 – 2.7	.17	.02 – 1.6	.16	.02 – 1.4	.47	.12 – 1.8
1	.67	.14 – 3.2	.16	.02 – 1.7	.21	.02 – 2.1	Missing	
Health care coverage								
Yes	.91	.60 – 1.4	1.5	.77 – 2.8	1.0	.61 – 1.6	1.1	.47 – 2.6
Personal doctor								
Yes	1.9	1.3 – 2.9	.98	.49 – 1.9	1.3	.77 – 2.1	.55	.17 – 1.8
Education level								
< High school	1.0	.56 – 1.8	.69	.28 – 1.7	2.3	1.1 – 4.5	1.6	.47 – 5.6
High school	.86	.62 – 1.2	1.2	.72 – 2.0	1.1	.70 – 1.6	.99	.46 – 2.2
Employment status								
Employed	1.1	.81 – 1.6	2.2	1.2 – 4.2	1.3	.81 – 1.9	1.4	.61 – 3.2
Income level*								
Below poverty level	1.1	.54 – 2.1	1.6	.56 – 4.6	3.0	.95 – 9.8	.52	.11 – 2.4
Race								
White	1.0	.48 – 2.2	.92	.14 – 6.1	.29	.04 – 2.4	.31	.05 – 2.0
African American	1.3	.59 – 2.8	.75	.11 – 5.1	.60	.06 – 5.8	.45	.06 – 3.7
Other	.98	.38 – 2.6	3.0	.23 – 39	Missing		.63	.09 – 4.5

OR; Odds Ratio from multivariate logistic regression analysis

*Poverty level is indicated as $13,670 annually for a two income household according to the U.S. Census, 2007

Table 13. Association Between Mammography and Selected Independent Variables in women ages 40-59 in Georgia and North Carolina Stratified by Residence, 2004

Variable	n=3140 GEORGIA				n=9495 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women in household	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0	1.4	.34 – 6.0	.15	.02 – 1.3	1.2	.45 – 3.0	.29	.08 – 1.0
1	3.3	.71 – 15	.39	.04 – 3.7	1.6	.61 – 4.4	.34	.09 – 1.3
Health care coverage								
Yes	1.3	.80 – 2.1	1.0	.58 – 1.9	1.2	.87 – 1.6	1.3	.89 – 1.9
Personal doctor								
Yes	2.3	1.4 – 3.8	1.3	.64 – 2.5	1.9	1.5 – 2.5	1.8	1.2 – 2.7
Education level								
< High school	1.2	.57 – 2.3	1.3	.60 – 2.9	1.1	.72 – 1.6	.72	.43 – 1.2
High school	1.4	.96 – 2.1	1.0	.68 – 1.8	1.0	.82 – 1.3	1.1	.78 – 1.4
Employment status								
Employed	1.3	.91 – 1.9	1.5	.87 – 2.5	1.3	1.1 – 1.6	1.1	.82 – 1.6
Income level*								
Below poverty level	2.0	.88 – 4.5	1.5	.69 – 3.4	1.4	.86 – 2.3	1.2	.65 – 2.1
Race								
White	1.4	.51 – 3.9	.64	.16 – 2.6	1.6	.68 – 3.9	1.5	.71 – 3.2
African American	1.1	.40 – 3.1	1.0	.23 – 4.2	1.9	.75 – 4.8	1.7	.76 – 3.6
Other	.75	.19 – 3.0	Missing		2.3	.75 – 7.0	1.3	.52 – 3.0

OR; Odds Ratio from multivariate logistic regression analysis

*Poverty level is indicated as $13,670 annually for a two income household according to the U.S. Census, 2007

Table 15 shows that having a personal doctor and health care coverage predicted that women 60 years of age and older in rural counties in Georgia in 2002 would get mammography screenings, whereas in 2004, women 60 years of age and older living in either urban and rural counties in Georgia and North Carolina who had a personal doctor and healthcare coverage had increased rates of mammography screening. It is possible that having a personal doctor and health insurance may be vital to getting screened. Having less than a high school education predicted decreased rates of mammography use among women 60 years of age and older living in urban counties in Georgia and North Carolina in 2004. In North Carolina in 2004, women above the screening age were less likely to be screened if they had a high school education in both urban and rural counties; this was true in Georgia in 2002 in rural and urban counties. Tables 14 and 15 demonstrate that being below the poverty level and living in a rural county in North Carolina in 2004 predicted that women 60 years of age and older would not get a mammogram.

Although a predominate pattern of mammography usage in the urban and rural counties of Georgia and North Carolina could not be established, Table 16 shows the finding that did remain constant was that women who had a usual source of care and health insurance were more likely to get screened than those who were less educated.

Table 14. Association Between Mammography and Selected Independent Variables in Women Ages 60+ in Georgia and North Carolina Stratified by Residence, 2002

Variable	n=3213 GEORGIA				n=4112 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women in household	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0	4.6	.91 – 23	1.4	.16 – 13	2.0	.16 – 23	20	.74 – 543
1	3.4	.57 – 20	1.3	.12 – 13	.72	.05 – 9.7	14	.36 – 544
Health care coverage								
Yes	2.1	.83 – 5.4	2.7	1.0 – 7.1	2.5	.92 – 6.9	3.2	.89 – 12
Personal doctor								
Yes	2.2	.86 – 5.7	4.1	1.4 – 12	Missing		.64	.05 – 8.1
Education level								
< High school	.29	.10 – .86	.39	.13 – 1.3	.49	.12 – 2.0	1.1	.19 – 6.5
High school	.35	.15 – .83	.39	.16 – .95	.27	.11 – .62	1.1	.28 – 4.3
Employment status								
Employed	.60	.26 – 1.4	.32	.12– .84	.50	.20 – 1.3	1.2	.32 – 4.3
Income level*								
Below poverty level	3.4	.40 – 28	.65	.19 – 2.2	.42	.11 – 1.6	1.8	.18 – 17
Race								
White	1.2	.13 - 12	Missing		.52	.03 – 11	4.2	.20 – 86
African American	1.6	.17 – 16	Missing		.44	.02 – 9.8	Missing	
Other	Missing		Missing		.14	.01 – 3.3	3.4	.09 - 124

OR; Odds Ratio from multivariate logistic regression analysis

*Poverty level is indicated as $13,670 annually for a two income household according to the U.S. Census, 2007

Table 15. Association Between Mammography and Selected Variables in Women Ages 60+ Living in Georgia and North Carolina Stratified by Residence, 2004

Variable	n=3140 GEORGIA				n=9495 NORTH CAROLINA			
	URBAN		RURAL		URBAN		RURAL	
Women in household	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0	Missing		Missing		3.4	1.0 – 11	20	Missing
1	Missing		Missing		1.6	.44 – 5.6	14	Missing
Health care coverage								
Yes	4.4	2.0 – 9.6	3.7	1.7 – 8.2	1.7	1.0 – 2.8	2.7	1.6 – 4.6
Personal doctor								
Yes	3.1	1.4 – 6.9	3.4	1.5 – 8.0	4.1	2.5 – 6.5	2.4	1.3 – 4.5
Education level								
< High school	.24	.10 – .57	.39	.14 – 1.1	.29	.16 – .51	.69	.40 – 1.2
High school	.78	.37 – 1.7	.47	.20 – 1.1	.31	.20 – .48	.36	.19 – .71
Employment status								
Employed	.84	.41 – 1.7	1.1	.51– 2.4	.80	.52 – 1.2	.69	.40 – 1.2
Income level*								
Below poverty level	1.7	.48 – 5.7	2.0	.71 – 5.8	.63	.32 – 1.3	.36	.19 – .71
Race								
White	7.7	1.6 – 38	4.7	.42 – 53	.99	.25 – 3.9	1.4	.27 – 7.5
African American	9.7	1.8 – 51	3.9	.33 – 47	1.8	.39 – 8.6	2.6	.45 – 15
Other	Missing		Missing		Missing		1.1	.19 – 6.6

OR: Odds Ratio from multivariate logistic regression analysis

*Poverty level is indicated as $13,670 annually for a two income household according to the U.S. Census, 2007

Table 16 Results of Statistical Tests Stratified by Urban or Rural Significance

State	Year	Variable	Urban	Rural
Univariate Regression				
GA	2002	Has a Personal Doctor	Y*	N*
		40-59 Years of Age	Y	Y
NC	2002	High School Diploma	N	Y
		Two or more women in household	Y	Y
GA	2004	Healthcare Coverage	Y	Y
		Personal Doctor	Y	N
		40-59 Years of Age	Y	N
NC	2004	Two or more women in household	N	Y
		Healthcare Coverage	N	Y
		Personal Doctor	Y	N
		40-59 Years of Age	Y	N
		White	Y	N
Multivariate Regression				
GA	2002	Personal Doctor	Y	N
		40-59 Years of Age	Y	Y
NC	2002	One woman in Household	N	Y
		40-59 Years of Age	Y	Y
GA	2004	Healthcare Coverage	N	Y
		Personal Doctor	Y	Y
		40-59 Years of Age	Y	Y
		Below Poverty Level	Y	N
NC	2004	Healthcare Coverage	N	Y
		Personal Doctor	Y	Y
		40-59 Years of Age	Y	Y
		High School Diploma	Y	N
GA (40-59)	2002	Personal Doctor	Y	N
		Employed	N	Y
NC (40-59)	2002	<High School Education	Y	N
GA (40-59)	2004	Personal Doctor	Y	N
NC (40-59)	2004	Personal Doctor	Y	Y
		Employed	Y	N
GA (60+)	2002	Healthcare Coverage	N	Y
		Personal Doctor	N	Y
		<High School Education	Y	N
		Employed	N	Y
NC (60+)	2002	High School Diploma	N	Y
GA (60+)	2004	Healthcare Coverage	Y	Y
		Personal Doctor	Y	Y
		<High School Education	Y	N
NC (60+)	2004	No other woman in Household	Y	N
		Healthcare Coverage	Y	Y
		Personal Doctor	Y	Y
		<High School Education	Y	N
		Below Poverty Level	N	Y

*Yes (Y) or No (N) designates whether this variable was found to be significant in the urban or rural county.

MAMMOGRAPHY FACILITIES IN GEORGIA AND NORTH CAROLINA

Georgia had 102 mammography facilities in 2005, 70 of which were located in urban counties and 28 in rural counties (as shown in Figure 5). Six of the 88 rural counties had more than one facility located in them; in the urban counties, 15 of the 71 contained one or more facilities. The reduced number of facilities in the rural counties could create accessibility issues for women living in those counties.

There were 96 facilities in North Carolina in 2005, of which 61 were located in urban counties and 32 were located in rural counties (as shown in Figure 6). Eleven of the 41 urban counties contained more than one facility; only seven of the 59 rural counties contained more than one facility.

Using data from ACS, there were 1,951,498 total women 18 years of age and older who lived in the urban counties of Georgia in 2005. According to the 2006 GAO report on mammography facilities, there should be one facility available for every 10,000 women of screening age (Government Accountability Office, 2006). As calculated by the GAO standard, there should be 195 facilities in the urban counties of Georgia, but there were only 70 in 2005, a shortage of 125 facilities (as shown in Figure 4). According to ACS, there are 258,556 women who lived in the rural counties of Georgia in 2005. To meet the GAO standard, there should have been 26 facilities in the rural counties of Georgia. In 2005 there were 28 facilities in Georgia's rural counties, resulting in a surplus of two facilities.

In North Carolina the numbers of mammography facilities in both the urban and rural counties were found to be inadequate when compared to the GAO standard. There were 2,015,349 women 18 years of age and older who lived in the urban counties of

North Carolina in 2005. To meet the GAO standard, there should have been 202 facilities in the urban counties, but there were only 61 facilities. Women who lived in urban counties had access to 141 fewer mammography facilities than the GAO standard. There were a total of 399,419 women living in the rural counties of North Carolina in 2005. The GAO standard called for 40 facilities; in actuality there were 32, resulting in a shortage of eight facilities.

The number of mammography facilities available in urban counties in Georgia was inadequate when compared to the mammography screening facilities which should be available per the GAO standard. In North Carolina, the number of mammography facilities in both the urban and rural counties was found to be inadequate when compared to the GAO standard.

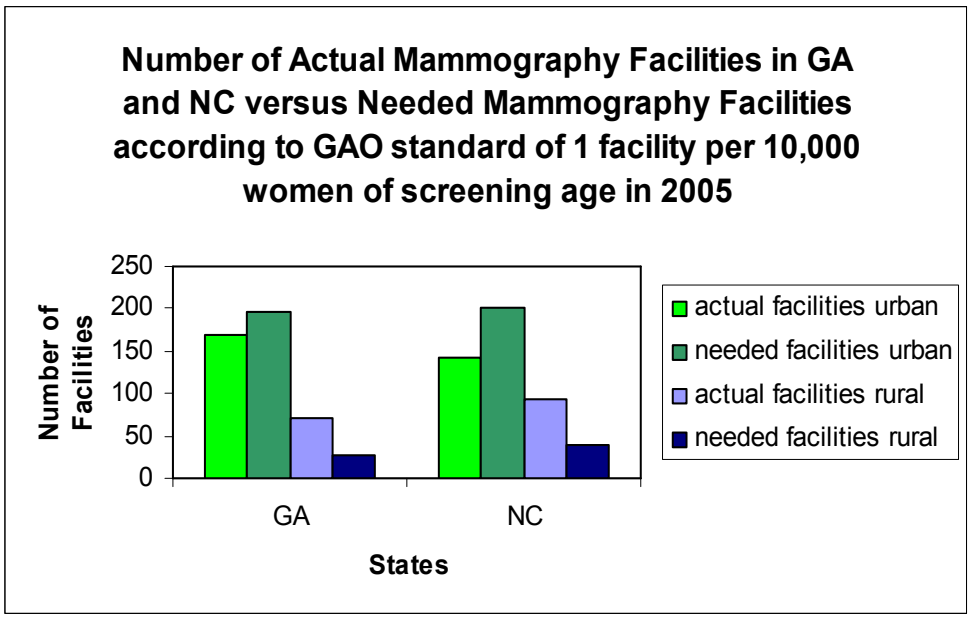

Figure 4. Calculated Number of Facilities Needed Per 10,000 Women According to Mammography GAO Standard Compared to Actual Number of Facilities in either Urban or Rural Counties in Georgia and North Carolina.

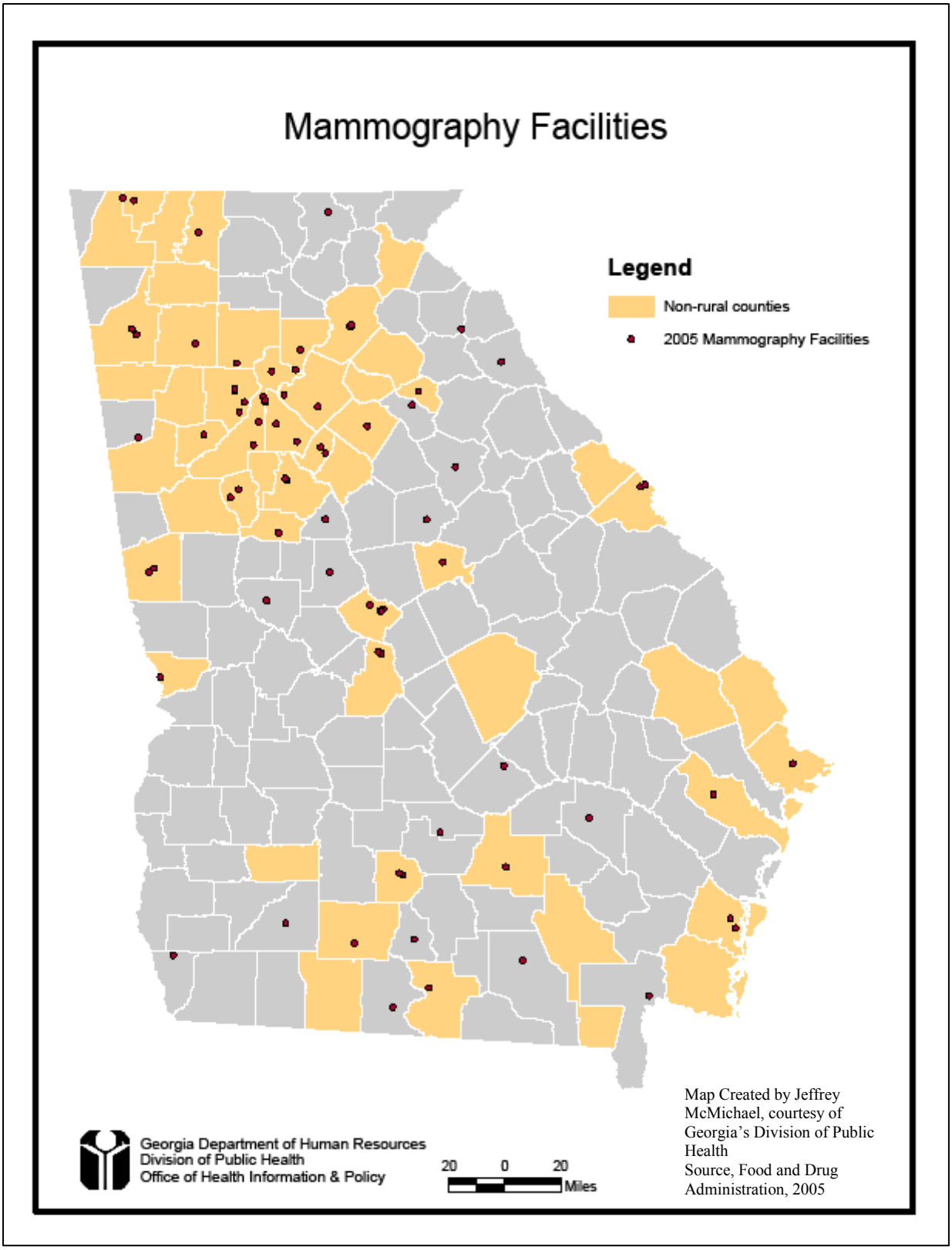

Figure 5. Georgia's mammography facilities superimposed on Georgia's urban counties (indicated in orange).

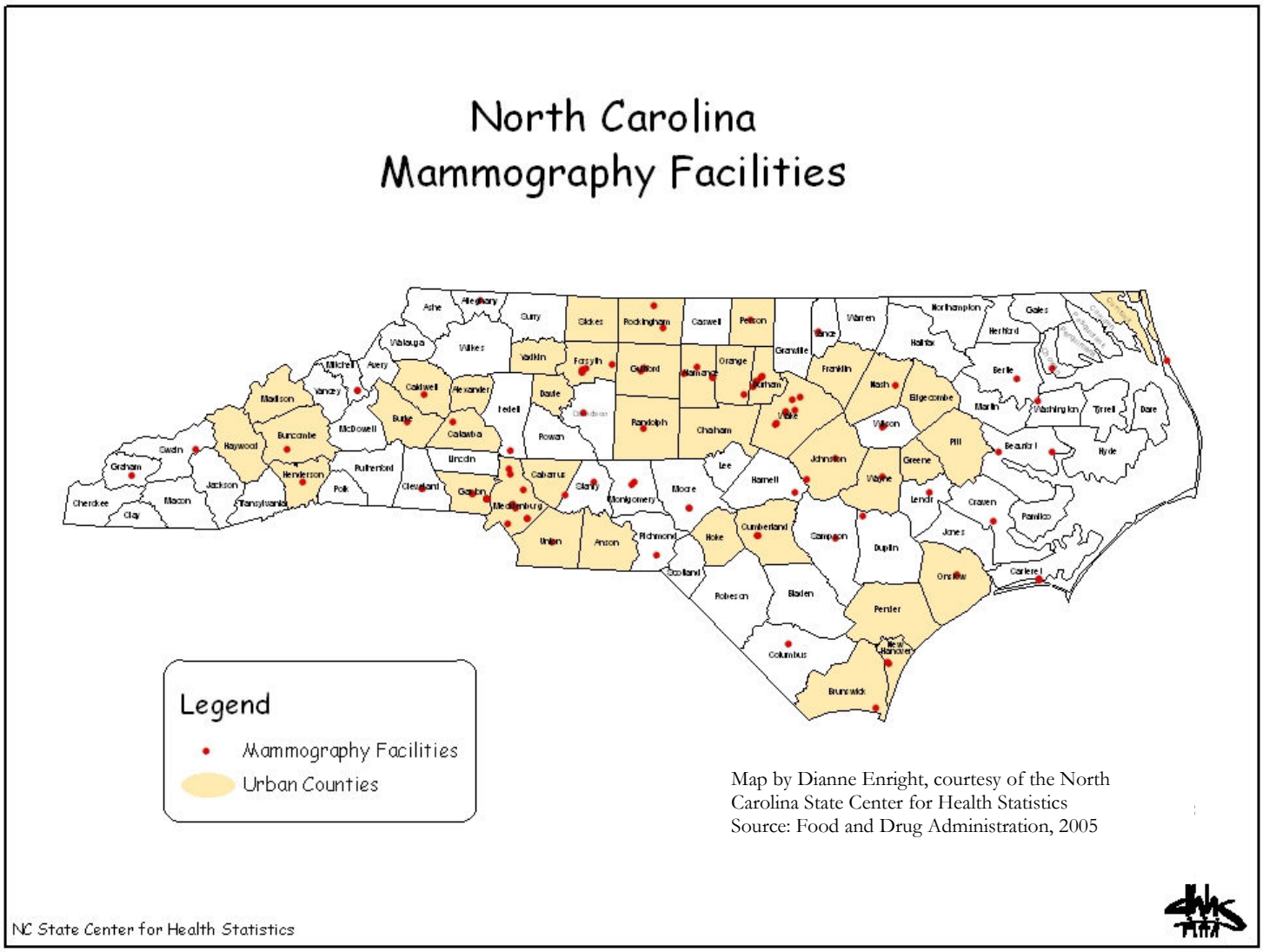

Figure 6. North Carolina's mammography facilities superimposed on the urban counties of the state (indicated in orange).

To assess whether there has been any change in the number of mammography facilities in the two states, the study author, with the aid of the public health departments of Georgia and North Carolina, examined and mapped the FDA 2007 facility data. The data revealed that both states had increased the number of mammography facilities, resulting in an increase in access. In 2007, Georgia had 240 facilities (compared to 102 in 2005); North Carolina gained 140 additional facilities since 2005 for a total of 236 facilities in 2007. The increased distribution of mammography facilities in both states is displayed in Figures 7 and 8.

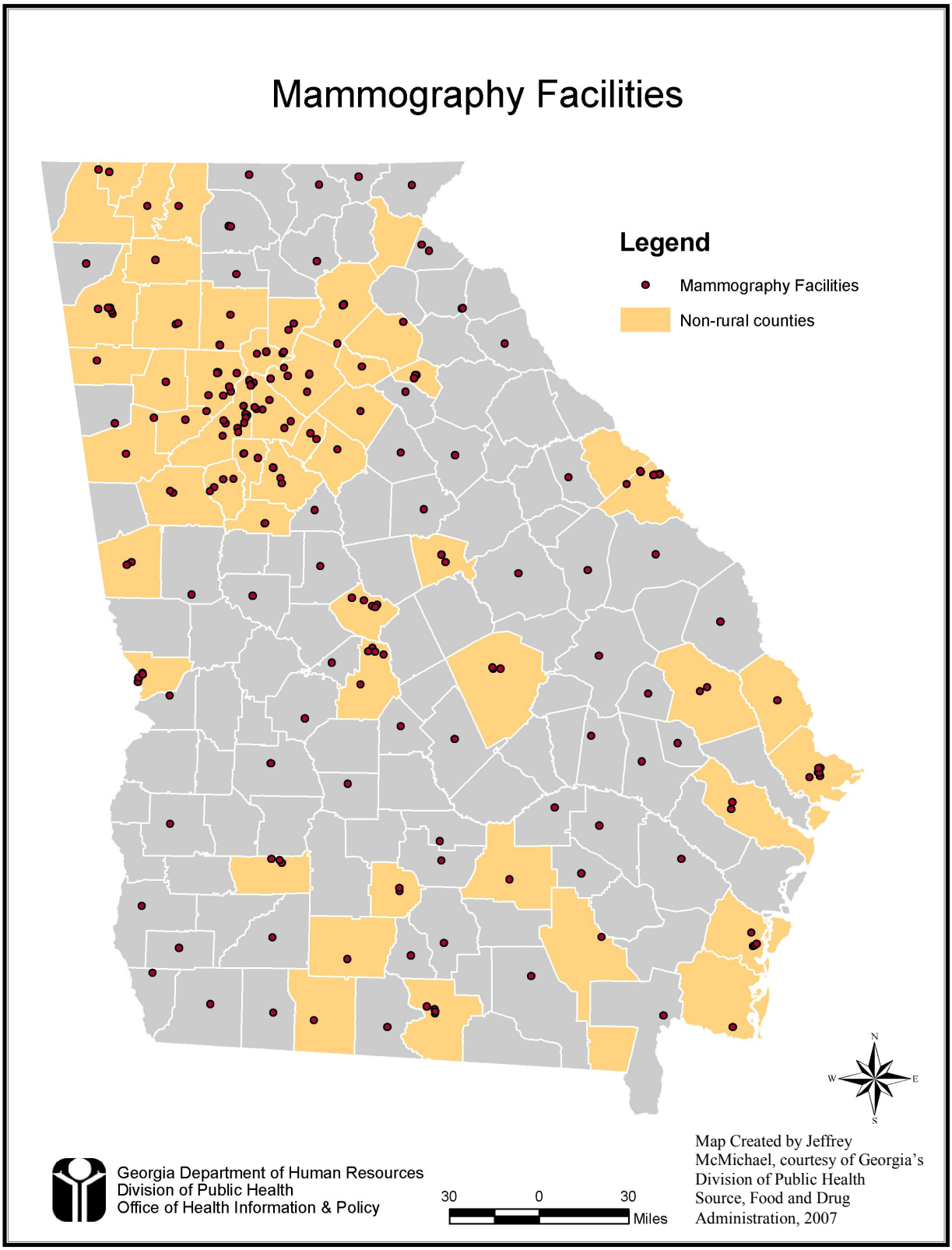

Figure 7. Georgia's mammography facilities superimposed on Georgia's urban counties (indicated in orange).

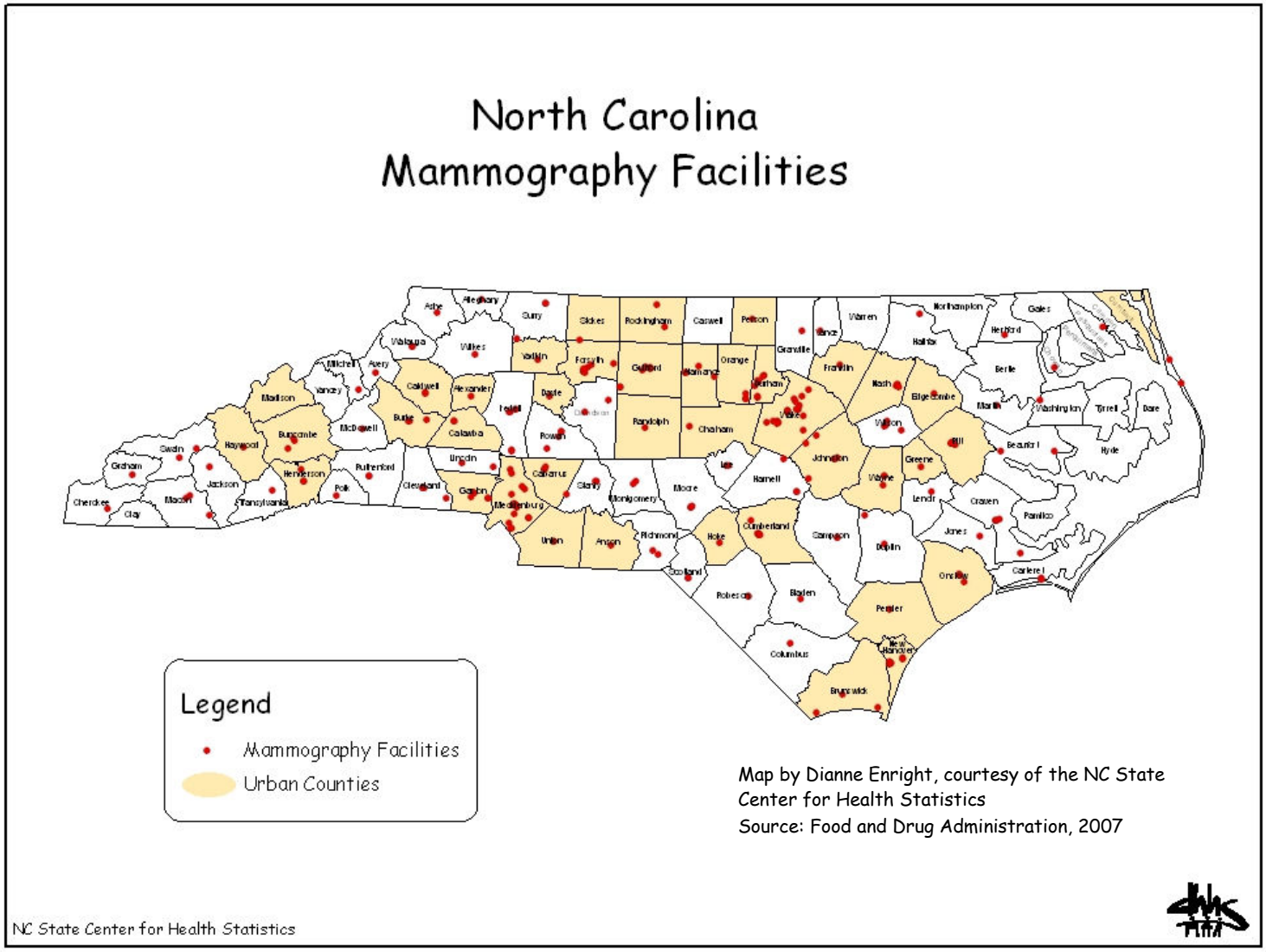

Figure 6. North Carolina's Mammography facilities superimposed on the urban counties of the state (indicated in orange).

INCLUSION OF RURAL RESIDENCE AS A RISK FACTOR FOR NOT GETTING SCREENED IN STATE CANCER PLANS

Even though a significant difference was not found between mammography screening rates of women who live in either urban or rural counties of Georgia and North Carolina, it is important to examine the Comprehensive Cancer Control State Plans (CCCSP) to see what they identify as risk factors for neglecting to get screened. Georgia and North Carolina's state plans may identify living in a rural county as a risk factor for not getting screened which may contribute to not finding a significant difference of women's mammography screening rates of those women who live in either a rural or urban county.

The CCCSPs of the eight states in HHS Region IV were examined to see if they defined the term "rural" in their state plans and if so, if they defined the term in the same way. Of the eight plans, only one plan (North Carolina) explicitly defined rural as a "non-metropolian area." The other seven plans lacked a glossary or neglected to provide an explicit definition of "rural." For all plans a term search was conducted for the word "rural " to determine its use and the frequency within each plan. Each state cancer plan was examined to determine whether these plans acknowledged a disparity of services amongst rural areas. The plans were searched for the following terms: urban, rural, metropolitan, non-metropolitan, county and residence. After noting the frequency of the terms mentioned within each plan, the plan was reviewed to determine how the terms were used in the plan with respect to goals or programs being developed in the state.

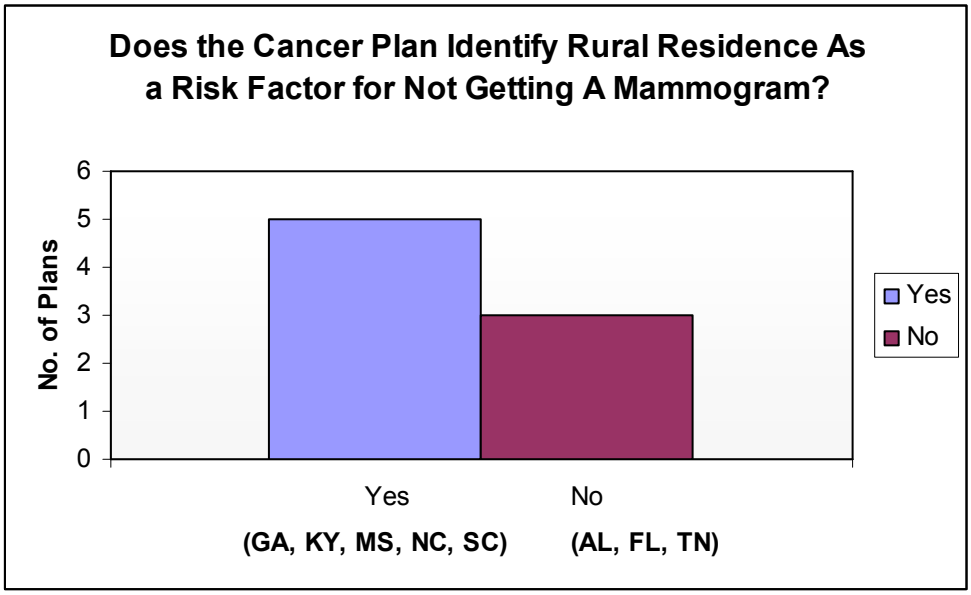

Figure 9. Chart of state cancer plans and whether they acknowledged living in a rural area as a risk factor for not getting a mammography screening.

As shown in Figure 9 above, five of the state cancer plans observed living in a rural area as a risk factor for not getting a mammogram; three states did not. This finding partially confirms a study by Leger et al. (2002) who found that of the Southeastern states, no intervention research targeting blacks on mammography use had occurred in Tennessee, Mississippi, Louisiana, Alabama, South Carolina, or Florida (Legler et al., 2002). They concluded that states without studies were largely rural and had relatively little research infrastructure. However, the difference in the findings of Legler et al. and the study's findings reported herein may be due to the fact that their study was conducted in 2002. Since that time, more attention has been paid to closing the gap in racial disparities pertaining to mammography screening and more research has since been conducted in Southeastern states.

All of the plans (with the exception of Tennessee) recognized the barrier of transportation which prevents women from getting mammograms (Appendix C, p. 104)

Furthermore, three state cancer plans identified possible ways to fix this problem. Tennessee, in its plan did identify the location of the mammography facility as a barrier to receiving a mammography screening, but it did not specifically address transportation as the issue. All the other state plans outlined methods to provide transportation services or mammograms to individuals without transportation. For example, Kentucky's plan encouraged worksite and community cancer screenings (Appendix C, p. 96).

Four plans identified two other barriers for women to receive mammography screenings: a shortage of specialists or a lack of state-of-the-art equipment used in diagnosis. Florida, Kentucky, North Carolina and South Carolina all identified the issue of a lack of health care specialists in rural areas. Both Kentucky and North Carolina stressed the importance of establishing networks and linkages between urban health centers and rural health practitioners to help narrow this problem (Appendix C, p. 96, 100). Both proposed that this could be done through telemedicine or continuing medical education workshops. Two state plans, Mississippi and Tennessee, recognized the language barriers to receiving mammography, but provided no solutions, such as offering translation services at mammography facilities or having bilingual health brochures (Appendix C, p.98, 104). Georgia and South Carolina recognized the importance of healthcare coverage and ways to help finance mammography screening, but offered no clear solutions for ways to go about fixing the problem. Georgia is the only state which identified in its plan the importance of providing support to family members when the patient's cancer is terminal (Appendix C, p. 93).

CHAPTER V
DISCUSSION AND CONCLUSION

As discussed in Chapters I and II, appropriate and timely utilization of mammography screening and breast cancer symptoms lead to early detection of breast cancer. However, universal adherence to routine screening still is a distant goal. This study attempted to determine whether rural residents of two Southeastern states had lower mammography screening rates than their urban counterparts.

This study found no significant difference between mammography screening rates of women in the rural counties of Georgia and North Carolina and those living in urban counties of these states. This study had the following findings: there is not a significant difference in mammography screening rates among women who live in rural counties in Georgia and North Carolina for years 2002 and 2004 when compared to women living in urban counties for those years; utilizing FDA 2005 data to assess the compliance with GAO's recommended standard on availability of mammography, it was found that the number of facilities in the rural counties of Georgia was adequate, but was not in the urban counties of either state; and five of the eight HHS Region IV states note rural residence as a risk factor for neglecting to get screened. Though both states increased access for women of screening age by 2007 deficiencies still exist.

Although no significant pattern was established for mammography screening and living in either an urban or rural county, some important findings from this study did

emerge. The most important finding from the univariate logistic regression is that women of screening age (40-59 years) had reduced odds of getting screened in both Georgia and North Carolina for both 2002 and 2004 whether they lived in urban and rural counties. This suggests that current programs targeting women of screening age may be ineffective.

After conducting the multivariate logistic regression analysis which adjusted for confounding factors, it was determined that having a personal doctor was significantly associated with women of 40-59 years of age getting screened. This result applied to women who lived in urban counties in both Georgia and North Carolina in 2004. This result confirms the Legler et al. findings in which urban residents used preventative services more often than rural residents because there is a greater availability of medical services in urban areas. Women who live in rural areas have limited access to health care practitioners and preventative health care services (Legler et al., 2002).

Women who were employed and had access to preventative medical services in rural counties of Georgia in 2002 and urban counties of North Carolina in 2004 were positively predicted to have a mammogram.

Among women 60 years of age and older who lived in either urban or in rural counties of Georgia or North Carolina in 2004, the best indicators for getting screened were having health coverage and a personal doctor. The critical role of a physician's recommendation for mammography screening has been validated repeatedly (O'Malley et al., 2001; Taplin, Anderman, Grothaus, Curry, & Montano, 1994) along with the priority of developing and testing strategies to improve physician recommendation of mammography (Chamot & Perneger, 2003; Nutting et al., 2001).

The important role that education plays in getting screened was prominent among women 60 years of age and older living in either urban or rural counties of Georgia in 2002 and in North Carolina among women 60 years of age or older who lived in either urban or rural counties in 2004. Women having only a high school education were negatively predicted to get a mammogram.

Though no significant findings between race and mammography screening rates were found, it should be noted that the largest ethnic group to take the Behavior Risk Factor Surveillance System survey (BRFSS) for the years 2002 and 2004 in both Georgia and North Carolina were white women. This demographic is similar to Tangka et. al's (2006) study in which white women in Georgia with health care coverage and a personal doctor were most likely to get screened. This implies that the screening rates reported herein may not be accurate for African American and other ethnic populations.

The finding that the number of mammography facilities in both Georgia and North Carolina has increased from 2005 to 2007 may not be sufficient to assess the accessibility of the facilities. Mere counts of facilities in urban and rural counties is at best a gross measure of accessibility since having access to mammography may depend on factors that are independent of facility location and which were impossible to measure in this study. As discussed in the literature review, common barriers to screening include access to transportation, hours of operation of the facility, availability of translation services, and whether a facility accepts individuals unable to pay. A limitation of the FDA data on mammography facilities is that they do not identify mobile facilities, which may serve a multi-county area.

It also should be noted that despite the increase in numbers of mammography facilities there is still a large number of counties in both Georgia and North Carolina without a facility. According to the FDA 2007 data, 58 of the 159 Georgia counties have no facility and 16 of the 100 North Carolina counties lack a facility. Another unexpected finding of this study was that the number of mammography facilities per 10,000 women in urban counties in both Georgia and North Carolina for 2005 and 2007 were insufficient according to the GAO standard. This may be cause for examining adequacy of facility accessibility in the comprehensive cancer control state plans of Georgia and North Carolina.

As noted previously, five of the eight HHS Region IV states addressed living in a rural area as a risk factor for not getting screened. This suggests that these states may be taking affirmative action to ensure that women of screening age in rural counties utilize mammography on a timely basis. More examination of the actions of these states may provide explanation for their success in ensuring that no urban/rural disparity in screening rates exist in their respective states.

Limitations

Due to the cross-sectional structure of the Behavioral Risk Factor Surveillance Survey, an association between an urban or rural county residence and mammography screening rates cannot be established. Because the survey was administered via telephone (excluding individuals who do not own a telephone or use cell phones only) and is based on a small sample size, not all of the eligible individuals in the counties of Georgia and North Carolina were represented. These survey participation problems may

be an explanation for failing to find a significant difference between screening rates among urban and rural women.

Not all survey respondents listed a Federal Information Processing Standards (FIPS) code. On the 2002 Georgia BRFSS, 93 respondents did not report their county of residence, in 2004 there were 86 respondents with no reported county of residence. This problem also was found in North Carolina BRFSS data; in 2002, 85 respondents did not report their county of residence, and in 2004, 144 respondents neglected to indicate the county in which they lived. As a result, these individuals were excluded from the analysis. The impact of these exclusions is not known.

The significance of the barriers to getting mammography screening among women who live in either urban or rural counties could not be tested because the question concerning the barriers to health care was worded differently on the BRFSS surveys for 2002 compared to 2004. In 2002, the section addressing Health Care Access included a question coded as MEDREAS which asked, "What was the main reason you did not get medical care?". The responses were placed into the following categories: cost, distance, office was not open when I could get there; too long a wait for an appointment, no child care, no transportation, no access for people with disabilities, and medical provider did not speak my language. In 2004, the section addressing Health Care Access no longer asked about the medical reason for not getting care and only asked about the barrier of cost. The question's wording was changed to the following, "Was there a time in the past twelve months when you needed to see a doctor but could not because of cost?". The responses received fell into the following categories: yes, no, do not know/not sure. Because only the barrier of cost was examined on the 2004 survey, the study author was

unable to use significance tests to measure the strength of association of the barrier of cost as well as the other barriers which prevent a woman from getting a mammogram.

Knowing the reason(s) a woman did not get a mammogram would have made it possible to determine which barriers have the greatest impact. If the 2004 BRFSS had contained the original question on why a woman did not get a mammogram, barriers such as wait times, language, and transportation issues could have been tracked over time to see if programs aimed at removing barriers were successful. Since BRFSS chose to focus only on cost in 2004 no other barrier that can be studied in a longitudinal manner.

Another change in the Health Care Access Section between 2002 and 2004 surveys was on the 2004 BRFSS survey, which had no question asking where the individual normally received their medical care. The answers to the question in 2002 fell in the following categories: a doctor's office, public health clinic or community center, a hospital outpatient department, a hospital emergency room, urgent care center, some other kind of place, do not know/not sure, no usual place. On the 2004 BRFSS survey this information was not collected, which prevented the study author from identifying where a woman received her medical care and if issues of access were prominently associated with a specific type of health provider.

Because the 2002 BRFSS questions on Health Care Access were changed or eliminated, data from those questions could not be used. If these questions had not been removed or altered, it would have been possible to identify which barrier had the greatest influence on getting a mammogram and possibly explain why women in rural counties were or were not getting a mammogram. Women who live in rural counties must struggle with issues of geographical access and overcome the barriers associated with

transportation, distance, lack of special health care providers, and specialized equipment to obtain a mammogram. For future program development these barriers should be targeted.

The variable of income is another limitation to this study because of the small sample size and the large strata of income categories. For the purpose of this study, individuals were classified as having incomes below the poverty level or above the poverty level. Income level may have had an impact on the ability of a woman to access preventative services and health care coverage, but this could not be tested because the sample size was too small to analyze the effect of different levels of income on mammography screening rates in detail.

The calculation of mammography facilities per 10,000 women used for this study was based on population data used from the American Community Survey for women 18 to 65 years of age. Because this study focused on women of screening age, women 65 years of age and older were excluded from the population used to calculate mammography facility availability rates.

The state cancer plans for HHS Region IV did not use a consistent definition of the terms rural, urban, metropolitan, and non-metropolitan. In fact, only one of the eight plans (North Carolina) explicitly defined a rural area as a "non metropolitan" area. All of the other plans lacked a definition for rural and did not clarify how the term was used in their plan. Another obvious limitation of the plan review was that the plans may not accurately represent the actions of a state in respect to cancer prevention programs.

Recommendations for Future Research

The findings of this study suggest multiple opportunities for future research on mammography screening. It is unknown if having a mammogram is contingent upon whether an individual lives in an urban or rural county because of the cross-sectional design of the BRFSS and other limitations of data used. Examining such factors as income level, employment, education, health insurance coverage, ethnicity, access to transportation, and age in a longitudinal manner may strengthen the known association between increased mammography screening rates and an individual's residence and provide insight for more effective screening program interventions.

In order to increase the number of women age 40-59 years who get mammogram screenings, it is important to study and subsequently help remove barriers to access. It is the author's recommendation that the BRFSS reinstate the removed questions about where individuals typically go for medical care (FACILIT3), and what is preventing them from seeking care (MEDREAS) so that successful interventions and programs can be developed in order to effectively remove those barriers and target those women who are not getting screened.

To better assess the accessibility of mammography facilities, a survey should be developed by the American Cancer Society, the FDA or state licensure entities to determine the times a mammography facility stays open, if they provide translation services, if they have telemedicine capability, how many mobile units they have, and how many individuals they serve from neighboring counties without a mammography facility, and whether the facility places a limitation on providing service to individuals who do no have health insurance coverage.

All state cancer plans should have sections which define the terms used in the plan to insure a consistent definition of rural and urban and which have a section that addresses geographical access. so that plans better able to be compared. A state that has a plan addressing rural residence as a risk factor for not getting screened and one that does not should be compared to find out if there are significant differences among women getting screened who live in urban or rural counties.

Conclusions

This study found no significant differences in mammography screening rates between the screening age women who live in rural counties in Georgia or North Carolina versus the screening age women who live in the urban counties of these states. The univariate logistic regression analysis found that women of screening age 40-59 years were at reduced odds for getting screened irrespective of residence.

The state cancer plans of both Georgia and North Carolina identified rural residence as a risk factor for not getting screened. These states may have taken actions to target those populations who live in rural counties. Further examination of the actions of the states may provide insight on why no significant difference was found.

Consistent with the findings of previous studies, it was found that women of screening age with a personal physician had higher rates of mammography use, so programs encouraging physicians to recommend mammograms to their patients should continue to be encouraged and funded. Providing access to a personal physician is critical for improving screening rates. Among women 60 years of age and older, it was found that having a personal doctor and health care coverage was integral to getting screened regardless of urban or rural residence in both states. Having health care

coverage gives individuals access to preventative health care services such as mammograms, which can be life saving. Public policy makers need to develop a program which provides access to personal doctors and preventative services to all individuals at risk.

Mammography screening rates among all states should be examined using not only the BRFSS data, but also the National Health Interview Survey to determine whether significant differences exist among women who live in either urban or rural counties. With a larger body of data, studies can be refined, findings can be confirmed and the larger issue (if it is a shortage of mammography facilities among women in urban areas) can be identified and more easily resolved. More importantly, data needs to be made publicly accessible so the issue of mammography screening rates among women living in either urban or rural counties can be more closely examined and compared.

State cancer plans should be standardized and include a glossary of terms used. For the sake of consistency, the CDC should require use of a standardized definition of key terms so that all terms studied within the plans can then be compared with certainty. The implementation of the cancer plans also should be examined by the CDC and if states are not implementing their state plans, the amount of funding a state receives for their comprehensive cancer control plans should be re-evaluated.

Mammography screening is an extremely important procedure for early detection of breast cancer. This study was unable to establish residence in either urban or rural areas as a significant factor, but the study highlighted the inadequacy of key data to accurately measure pivotal factors which may lead to appropriate utilization of

mammography and underscores the need for further research into methods of extending health care coverage and access.

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APPENDIX A
FIPS CODES FOR GEORGIA

FIPS[1]	County name	RUC code[2]	Population 1990	Population 2000	Population 2006	Change 1990-2000	Change 2000-06
13001	Appling County	7	15,744	17,415	17,860	10.6%	2.6%
13003	Atkinson County	9	6,213	7,609	8,047	22.5%	5.8%
13005	Bacon County	7	9,566	10,103	10,482	5.6%	3.8%
13007	Baker County	3	3,615	4,074	4,098	12.7%	0.6%
13009	Baldwin County	4	39,530	44,700	45,275	13.1%	1.3%
13011	Banks County	8	10,308	14,422	16,445	39.9%	14.0%
13013	Barrow County	1	29,721	46,144	63,702	55.3%	38.1%
13015	Bartow County	1	55,915	76,019	91,266	36.0%	20.1%
13017	Ben Hill County	7	16,245	17,484	17,635	7.6%	0.9%
13019	Berrien County	6	14,153	16,235	16,756	14.7%	3.2%
13021	Bibb County	3	150,137	153,887	154,903	2.5%	0.7%
13023	Bleckley County	6	10,430	11,666	12,353	11.9%	5.9%
13025	Brantley County	3	11,077	14,629	15,735	32.1%	7.6%
13027	Brooks County	3	15,398	16,450	16,464	6.8%	0.1%
13029	Bryan County	2	15,438	23,417	29,648	51.7%	26.6%
13031	Bulloch County	4	43,125	55,983	63,207	29.8%	12.9%
13033	Burke County	2	20,579	22,243	22,986	8.1%	3.3%
13035	Butts County	1	15,326	19,523	23,561	27.2%	20.5%
13037	Calhoun County	8	5,013	6,320	6,094	26.1%	-3.6%
13039	Camden County	4	30,167	43,664	45,118	44.7%	3.3%
13043	Candler County	7	7,744	9,577	10,674	23.7%	11.5%
13045	Carroll County	1	71,422	87,268	107,325	22.2%	23.0%
13047	Catoosa County	2	42,464	53,252	62,016	25.4%	16.5%
13049	Charlton County	6	8,496	10,282	10,882	21.0%	5.8%
13051	Chatham County	2	216,774	232,347	241,411	7.2%	3.9%
13053	Chattahoochee County	2	16,934	14,882	14,041	-12.1%	-5.7%
13055	Chattooga County	6	22,236	25,470	26,442	14.5%	3.8%
13057	Cherokee County	1	90,204	141,907	195,327	57.3%	37.6%
13059	Clarke County	3	87,594	101,489	112,787	15.9%	11.1%
13061	Clay County	9	3,364	3,357	3,180	-0.2%	-5.3%
13063	Clayton County	1	181,436	236,517	271,240	30.4%	14.7%
13065	Clinch County	6	6,160	6,878	6,897	11.7%	0.3%
13067	Cobb County	1	447,745	607,751	679,325	35.7%	11.8%
13069	Coffee County	7	29,592	37,412	40,242	26.4%	7.6%
13071	Colquitt County	6	36,645	42,038	44,821	14.8%	6.6%
13073	Columbia County	2	66,031	89,288	106,887	35.2%	19.7%
13075	Cook County	6	13,456	15,771	16,333	17.2%	3.6%
13077	Coweta County	1	53,853	89,215	115,291	65.7%	29.2%
13079	Crawford County	3	8,991	12,495	12,823	39.0%	2.6%
13081	Crisp County	6	20,011	21,996	22,051	9.9%	0.3%
13083	Dade County	2	13,183	15,154	16,233	15.0%	7.1%
13085	Dawson County	1	9,429	15,999	20,643	69.7%	29.0%
13087	Decatur County	6	25,517	28,240	28,665	10.7%	1.5%
13089	DeKalb County	1	546,174	666,072	723,602	22.0%	8.6%

13091	Dodge County	7	17,607	19,171	19,700	8.9%	2.8%
13093	Dooly County	6	9,901	11,525	11,748	16.4%	1.9%
13095	Dougherty County	3	96,321	96,065	94,773	-0.3%	-1.3%
13097	Douglas County	1	71,120	92,284	119,557	29.7%	29.6%
13099	Early County	6	11,854	12,354	12,065	4.2%	-2.3%
13101	Echols County	3	2,334	3,750	4,274	60.8%	14.0%
13103	Effingham County	2	25,687	37,535	48,954	46.1%	30.4%
13105	Elbert County	6	18,949	20,511	20,768	8.2%	1.3%
13107	Emanuel County	7	20,546	21,837	22,600	6.3%	3.5%
13109	Evans County	6	8,724	10,495	11,425	20.3%	8.9%
13111	Fannin County	8	15,992	19,798	22,319	23.8%	12.7%
13113	Fayette County	1	62,415	91,263	106,671	46.2%	16.9%
13115	Floyd County	3	81,251	90,565	95,322	11.5%	5.3%
13117	Forsyth County	1	44,083	98,407	150,968	123.2%	53.4%
13119	Franklin County	8	16,650	20,287	21,691	21.8%	6.9%
13121	Fulton County	1	648,776	815,806	960,009	25.7%	17.7%
13123	Gilmer County	6	13,368	23,456	28,175	75.5%	20.1%
13125	Glascock County	9	2,357	2,556	2,720	8.4%	6.4%
13127	Glynn County	3	62,496	67,568	73,630	8.1%	9.0%
13129	Gordon County	6	35,067	44,104	51,419	25.8%	16.6%
13131	Grady County	6	20,279	23,659	25,082	16.7%	6.0%
13133	Greene County	6	11,793	14,406	15,534	22.2%	7.8%
13135	Gwinnett County	1	352,910	588,448	757,104	66.7%	28.7%
13137	Habersham County	6	27,622	35,898	41,112	30.0%	14.5%
13139	Hall County	3	95,434	139,315	173,256	46.0%	24.4%
13141	Hancock County	7	8,908	10,076	9,677	13.1%	-3.9%
13143	Haralson County	1	21,966	25,690	28,616	17.0%	11.4%
13145	Harris County	2	17,788	23,695	28,785	33.2%	21.5%
13147	Hart County	6	19,712	22,998	24,276	16.7%	5.6%
13149	Heard County	1	8,628	11,012	11,472	27.6%	4.2%
13151	Henry County	1	58,741	119,370	178,033	103.3%	49.2%
13153	Houston County	3	89,208	110,765	127,530	24.2%	15.1%
13155	Irwin County	7	8,649	9,931	10,403	14.8%	4.8%
13157	Jackson County	6	30,005	41,589	55,778	38.6%	34.1%
13159	Jasper County	1	8,453	11,426	13,624	35.2%	19.2%
13161	Jeff Davis County	7	12,032	12,685	13,278	5.4%	4.7%
13163	Jefferson County	6	17,408	17,263	16,768	-0.8%	-2.9%
13165	Jenkins County	6	8,247	8,575	8,725	4.0%	1.7%
13167	Johnson County	9	8,329	8,560	9,626	2.8%	12.5%
13169	Jones County	3	20,739	23,639	26,973	14.0%	14.1%
13171	Lamar County	1	13,038	15,912	16,679	22.0%	4.8%
13173	Lanier County	3	5,531	7,241	7,723	30.9%	6.7%
13175	Laurens County	6	39,988	44,874	47,316	12.2%	5.4%
13177	Lee County	3	16,250	24,757	32,495	52.4%	31.3%
13179	Liberty County	3	52,745	61,610	62,571	16.8%	1.6%
13181	Lincoln County	8	7,442	8,348	8,257	12.2%	-1.1%
13183	Long County	3	6,202	10,304	11,452	66.1%	11.1%
13185	Lowndes County	3	75,981	92,125	97,844	21.2%	6.2%

13187	Lumpkin County	6	14,573	20,986	25,462	44.0%	21.3%
13189	McDuffie County	2	20,119	21,231	21,917	5.5%	3.2%
13191	McIntosh County	3	8,634	10,847	11,248	25.6%	3.7%
13193	Macon County	6	13,114	14,074	13,817	7.3%	-1.9%
13195	Madison County	3	21,050	25,730	27,837	22.2%	8.2%
13197	Marion County	2	5,590	7,144	7,276	27.8%	1.8%
13199	Meriwether County	1	22,411	22,534	22,881	0.5%	1.6%
13201	Miller County	8	6,280	6,383	6,239	1.6%	-2.3%
13205	Mitchell County	6	20,275	23,934	23,852	18.0%	-0.3%
13207	Monroe County	3	17,113	21,774	24,443	27.2%	12.3%
13209	Montgomery County	9	7,379	8,270	9,067	12.1%	9.6%
13211	Morgan County	6	12,883	15,457	17,908	20.0%	15.9%
13213	Murray County	3	26,147	36,503	41,398	39.6%	13.4%
13215	Muscogee County	2	179,280	186,291	188,660	3.9%	1.3%
13217	Newton County	1	41,808	62,001	91,451	48.3%	47.5%
13219	Oconee County	3	17,618	26,225	30,858	48.9%	17.7%
13221	Oglethorpe County	3	9,763	12,635	13,997	29.4%	10.8%
13223	Paulding County	1	41,611	81,568	121,530	96.2%	48.9%
13225	Peach County	6	21,189	23,668	24,785	11.7%	4.7%
13227	Pickens County	1	14,432	22,979	29,640	59.3%	29.0%
13229	Pierce County	6	13,328	15,620	17,452	17.2%	11.7%
13231	Pike County	1	10,224	13,688	16,801	33.9%	22.7%
13233	Polk County	6	33,815	38,127	41,091	12.8%	7.8%
13235	Pulaski County	6	8,108	9,588	9,887	18.3%	3.1%
13237	Putnam County	6	14,137	18,812	19,930	33.1%	5.9%
13239	Quitman County	9	2,210	2,598	2,486	17.6%	-4.3%
13241	Rabun County	9	11,648	15,050	16,354	29.2%	8.7%
13243	Randolph County	6	8,023	7,791	7,357	-2.9%	-5.6%
13245	Richmond County	2	189,719	199,775	194,398	5.3%	-2.7%
13247	Rockdale County	1	54,091	70,111	80,332	29.6%	14.6%
13249	Schley County	8	3,590	3,766	4,198	4.9%	11.5%
13251	Screven County	6	13,842	15,374	15,190	11.1%	-1.2%
13253	Seminole County	6	9,010	9,369	9,168	4.0%	-2.1%
13255	Spalding County	1	54,457	58,417	62,185	7.3%	6.5%
13257	Stephens County	7	23,436	25,435	25,143	8.5%	-1.1%
13259	Stewart County	8	5,654	5,259	4,754	-7.1%	-9.6%
13261	Sumter County	6	30,232	33,200	32,490	9.8%	-2.1%
13263	Talbot County	8	6,524	6,498	6,605	-0.4%	1.6%
13265	Taliaferro County	8	1,915	2,077	1,877	8.5%	-9.6%
13267	Tattnall County	6	17,722	22,305	23,492	25.9%	5.3%
13269	Taylor County	8	7,642	8,815	8,792	15.3%	-0.3%
13271	Telfair County	7	11,000	11,794	13,268	7.2%	12.5%
13273	Terrell County	3	10,653	10,970	10,657	3.0%	-2.9%
13275	Thomas County	4	38,943	42,734	45,135	9.7%	5.6%
13277	Tift County	4	34,998	38,390	41,685	9.7%	8.6%
13279	Toombs County	7	24,072	26,067	27,623	8.3%	6.0%
13281	Towns County	9	6,754	9,319	10,525	38.0%	12.9%
13283	Treutlen County	7	5,994	6,854	6,852	14.3%	-0.0%

13285	Troup County	4	55,532	58,779	63,245	5.8%	7.6%
13287	Turner County	6	8,703	9,504	9,322	9.2%	-1.9%
13289	Twiggs County	3	9,806	10,590	10,184	8.0%	-3.8%
13291	Union County	9	11,993	17,289	20,652	44.2%	19.5%
13293	Upson County	6	26,300	27,597	27,676	4.9%	0.3%
13295	Walker County	2	58,310	61,053	64,606	4.7%	5.8%
13297	Walton County	1	38,586	60,687	79,388	57.3%	30.8%
13299	Ware County	4	35,471	35,499	35,748	0.1%	0.7%
13301	Warren County	8	6,078	6,336	5,949	4.2%	-6.1%
13303	Washington County	7	19,112	21,176	20,723	10.8%	-2.1%
13305	Wayne County	6	22,356	26,569	28,895	18.8%	8.8%
13307	Webster County	8	2,263	2,383	2,252	5.6%	-5.5%
13309	Wheeler County	9	4,903	6,179	6,908	26.0%	11.8%
13311	White County	8	13,006	19,944	24,738	53.3%	24.0%
13313	Whitfield County	3	72,462	83,558	92,999	15.3%	11.3%
13315	Wilcox County	9	7,008	8,577	8,712	22.4%	1.6%
13317	Wilkes County	6	10,597	10,687	10,468	0.8%	-2.0%
13319	Wilkinson County	8	10,228	10,220	9,995	-0.1%	-2.2%
13321	Worth County	3	19,744	22,000	21,938	11.3%	-0.3%

Source: U.S. Census Bureau, 1990 and 2000 Censuses of Population (corrected), and 2006 county estimate files.

1) The FIPS codes uniquely identify each county and are part of the Federal Information Processing Standards (FIPS) developed by the National Institute of Standards and Technology (NIST), U.S. Department of Commerce. For more information, see the NIST FIPS publication page.

2) The 2003 rural-urban continuum codes classify metropolitan counties (codes 1 through 3) by size of the Metropolitan Statistical Area (MSA), and nonmetropolitan counties (codes 4 through 9) by degree of urbanization and proximity to metro areas.

APPENDIX B
FIPS CODES FOR NORTH CAROLINA

FIPS[1]	County name	RUC code[2]	Population 1990	Population 2000	Population 2006	Change 1990-2000	Change 2000-06
37001	Alamance County	3	108,213	130,794	142,661	20.9%	9.1%
37003	Alexander County	2	27,544	33,612	36,177	22.0%	7.6%
37005	Alleghany County	9	9,590	10,680	10,912	11.4%	2.2%
37007	Anson County	1	23,474	25,275	25,472	7.7%	0.8%
37009	Ashe County	9	22,209	24,384	25,499	9.8%	4.6%
37011	Avery County	8	14,867	17,167	17,674	15.5%	3.0%
37013	Beaufort County	6	42,283	44,958	46,355	6.3%	3.1%
37015	Bertie County	9	20,388	19,757	19,094	-3.1%	-3.4%
37017	Bladen County	6	28,663	32,278	32,921	12.6%	2.0%
37019	Brunswick County	2	50,985	73,141	94,945	43.5%	29.8%
37021	Buncombe County	2	174,357	206,289	222,174	18.3%	7.7%
37023	Burke County	2	75,740	89,145	90,054	17.7%	1.0%
37025	Cabarrus County	1	98,935	131,063	156,395	32.5%	19.4%
37027	Caldwell County	2	70,709	77,386	79,841	9.4%	3.2%
37029	Camden County	8	5,904	6,885	9,271	16.6%	34.7%
37031	Carteret County	4	52,407	59,383	63,584	13.3%	7.1%
37033	Caswell County	8	20,662	23,501	23,546	13.7%	0.2%
37035	Catawba County	2	118,412	141,677	153,784	19.7%	8.5%
37037	Chatham County	2	38,979	49,329	60,052	26.6%	21.7%
37039	Cherokee County	9	20,170	24,298	26,309	20.5%	8.3%
37041	Chowan County	7	13,506	14,150	14,695	4.8%	3.9%
37043	Clay County	9	7,155	8,775	10,008	22.6%	14.1%
37045	Cleveland County	4	84,958	96,278	98,373	13.3%	2.2%
37047	Columbus County	6	49,587	54,749	54,637	10.4%	-0.2%
37049	Craven County	5	81,812	91,523	94,875	11.9%	3.7%
37051	Cumberland County	2	274,713	302,967	299,060	10.3%	-1.3%
37053	Currituck County	1	13,736	18,190	23,770	32.4%	30.7%
37055	Dare County	5	22,746	29,967	33,935	31.7%	13.2%
37057	Davidson County	4	126,688	147,250	156,236	16.2%	6.1%
37059	Davie County	2	27,859	34,835	40,035	25.0%	14.9%
37061	Duplin County	6	39,995	49,063	52,790	22.7%	7.6%
37063	Durham County	2	181,844	223,314	246,896	22.8%	10.6%
37065	Edgecombe County	3	56,692	55,606	53,964	-1.9%	-3.0%
37067	Forsyth County	2	265,855	306,063	332,355	15.1%	8.6%
37069	Franklin County	2	36,414	47,260	55,886	29.8%	18.3%
37071	Gaston County	1	174,769	190,316	199,397	8.9%	4.8%
37073	Gates County	8	9,305	10,516	11,527	13.0%	9.6%
37075	Graham County	9	7,196	7,993	7,995	11.1%	0.0%
37077	Granville County	6	38,341	48,498	54,473	26.5%	12.3%
37079	Greene County	3	15,384	18,974	20,157	23.3%	6.2%
37081	Guilford County	2	347,431	421,048	451,905	21.2%	7.3%
37083	Halifax County	4	55,516	57,370	55,521	3.3%	-3.2%
37085	Harnett County	4	67,833	91,025	106,283	34.2%	16.7%
37087	Haywood County	2	46,948	54,034	56,447	15.1%	4.5%

37089	Henderson County	2	69,747	89,214	99,033	27.9%	11.0%
37091	Hertford County	7	22,317	22,977	23,581	3.0%	2.6%
37093	Hoke County	2	22,856	33,646	42,303	47.2%	25.7%
37095	Hyde County	9	5,411	5,826	5,341	7.7%	-8.3%
37097	Iredell County	4	93,205	122,660	146,206	31.6%	19.2%
37099	Jackson County	6	26,835	33,120	35,562	23.4%	7.4%
37101	Johnston County	2	81,306	121,900	152,143	49.9%	24.8%
37103	Jones County	8	9,361	10,419	10,204	11.3%	-1.9%
37105	Lee County	4	41,370	49,208	56,908	18.9%	15.7%
37107	Lenoir County	4	57,274	59,598	57,662	4.1%	-3.3%
37109	Lincoln County	4	50,319	63,780	71,894	26.8%	12.7%
37111	McDowell County	6	35,681	42,151	43,414	18.1%	3.0%
37113	Macon County	7	23,504	29,811	32,395	26.8%	8.7%
37115	Madison County	2	16,953	19,635	20,355	15.8%	3.7%
37117	Martin County	6	25,078	25,546	24,342	1.9%	-4.7%
37119	Mecklenburg County	1	511,211	695,370	827,445	36.0%	19.0%
37121	Mitchell County	9	14,433	15,687	15,681	8.7%	-0.0%
37123	Montgomery County	6	23,359	26,822	27,638	14.8%	3.0%
37125	Moore County	4	59,000	74,762	83,162	26.7%	11.2%
37127	Nash County	3	76,677	87,385	92,312	14.0%	5.6%
37129	New Hanover County	2	120,284	160,327	182,591	33.3%	13.9%
37131	Northampton County	9	21,004	22,086	21,247	5.2%	-3.8%
37133	Onslow County	3	149,838	150,355	150,673	0.3%	0.2%
37135	Orange County	2	93,662	115,537	120,100	23.4%	3.9%
37137	Pamlico County	9	11,368	12,934	12,785	13.8%	-1.2%
37139	Pasquotank County	7	31,298	34,897	39,591	11.5%	13.5%
37141	Pender County	2	28,855	41,082	48,630	42.4%	18.4%
37143	Perquimans County	9	10,447	11,368	12,337	8.8%	8.5%
37145	Person County	2	30,180	35,623	37,341	18.0%	4.8%
37147	Pitt County	3	108,480	133,719	145,619	23.3%	8.9%
37149	Polk County	8	14,458	18,324	19,226	26.7%	4.9%
37151	Randolph County	2	106,546	130,471	140,410	22.5%	7.6%
37153	Richmond County	4	44,511	46,564	46,555	4.6%	0.0%
37155	Robeson County	4	105,170	123,241	129,021	17.2%	4.7%
37157	Rockingham County	2	86,064	91,928	93,063	6.8%	1.2%
37159	Rowan County	4	110,605	130,340	136,254	17.8%	4.5%
37161	Rutherford County	4	56,956	62,901	63,867	10.4%	1.5%
37163	Sampson County	6	47,297	60,161	63,561	27.2%	5.7%
37165	Scotland County	6	33,763	35,998	37,094	6.6%	3.0%
37167	Stanly County	6	51,765	58,100	59,358	12.2%	2.2%
37169	Stokes County	2	37,224	44,711	46,168	20.1%	3.3%
37171	Surry County	4	61,704	71,216	72,687	15.4%	2.0%
37173	Swain County	8	11,268	12,968	13,445	15.1%	3.6%
37175	Transylvania County	6	25,520	29,334	29,780	14.9%	1.5%
37177	Tyrrell County	9	3,856	4,149	4,187	7.6%	0.9%
37179	Union County	1	84,210	123,772	175,272	47.0%	41.6%
37181	Vance County	4	38,892	42,954	43,810	10.4%	2.0%
37183	Wake County	2	426,311	627,866	786,522	47.3%	25.3%

37185	Warren County	8	17,265	19,972	19,605	15.7%	-1.8%
37187	Washington County	7	13,997	13,723	13,227	-2.0%	-3.6%
37189	Watauga County	6	36,952	42,693	42,700	15.5%	0.0%
37191	Wayne County	3	104,666	113,329	113,847	8.3%	0.5%
37193	Wilkes County	6	59,393	65,632	67,310	10.5%	2.6%
37195	Wilson County	4	66,061	73,811	76,624	11.7%	3.8%
37197	Yadkin County	2	30,488	36,348	38,056	19.2%	4.7%
37199	Yancey County	8	15,419	17,774	18,421	15.3%	3.6%

Source: U.S. Census Bureau, 1990 and 2000 Censuses of Population (corrected), and 2006 county estimate files.

1) The FIPS codes uniquely identify each county and are part of the Federal Information Processing Standards (FIPS) developed by the National Institute of Standards and Technology (NIST), U.S. Department of Commerce. For more information, see the NIST FIPS publication page.

2) The 2003 rural-urban continuum codes classify metropolitan counties (codes 1 through 3) by size of the Metropolitan Statistical Area (MSA), and nonmetropolitan counties (codes 4 through 9) by degree of urbanization and proximity to metro areas.

APPENDIX C:
HEALTH AND HUMAN SERVICES REGION IV STATE PLANS; EXAMINATION OF CANCER PLANS FOR INCLUSION OF RURAL RESIDENCE AS A RISK FACTOR FOR NOT GETTING SCREENED

Cancer control planners, program staff and researchers developed state cancer plans to reduce cancer risk, the number of new cancer cases, and the number of deaths from cancer, as well as enhance quality of life for cancer survivors. In order to develop a cancer plan there are generally five phases: 1. Assessing program priorities 2. Identifying potential partners 3. Researching reviews of different intervention approaches 4. Finding research-tested intervention programs and products 5. Planning and evaluating the state's program (American Cancer Society, Commission on Cancer, & Department of Health and Human Services, 2007). To assess the program priorities, a state will analyze the cancer burden at the local, state or national level and review risk factors to identify high-risk populations and cancer control priorities. Partners for comprehensive cancer control can be found by identifying practice partners working with community based programs through the American Cancer Society's (ACS) Regional Cancer Control Partners, Center for Disease Control and Prevention's (CDC) Comprehensive Cancer Control Network, Commission on Cancer's state liaisons, National Cancer Institute's (NCI) Cancer Information Service and local researchers funded by ACS, the Agency for Healthcare Research and Quality, CDC and NCI. The CCC's are expected to review different intervention approaches that have been shown to be effective or ineffective and then adapt or adopt interventions to address the specific state's objectives or cancer burdens. Lastly, once the interventional programs are in place, to evaluate the programs and review changes as needed. The state cancer plans lay the foundation to help propel the

implementation and evaluation of programs to address a state's specific cancer problems. Because each state is unique in its size, geographic, and demographic make-up, no two plans are the same or have the same structure. Generally they do have a section on each of the following cancers; breast, cervical, colorectal, prostate, skin, and testicular. These plans identify risk factors and living and working conditions which may increase an individual's chances of developing a particular cancer.

ALABAMA

Term Searched	Number of Times Mentioned	Addressed How?
Urban	0	N/A
Rural	4	Rural Health Care providers-providing medical services to underserved populations, participation in clinical trials, rural primary health care clinics community-based educational programs, resource used to expand Community Health Advisors (CHA) across state
Metropolitan	0	N/A
Non-metropolitan	0	N/A
County	7	Delivery of medical services, County Health department as a resource for prevention and cancer treatment, clinical trials
Residence	0	N/A

Although Alabama's cancer plan had as an projected outcome under its Breast and Cervical section "to increase from 70% to 80% by 2005 mammography utilization in medically underserved women under age 65 but older than 50 years of age," rural or

residence is not mentioned as a risk factor in the negligence of women in Alabama in getting a mammogram. The Alabama plan also had as a strategy "to increase knowledge of all women with regard to the importance of breast and cervical screening." To reach the goal of increasing the knowledge of the importance of screening, the plan had as an objective to increase the number of counties, from 16 to 26, where Community Health Advisors (CHAs) educate and inform their peers. The "Early Detection" section also stated that one of its objectives is "to reduce barriers which prevent women from obtaining appropriate breast and cervical cancer education and screening (breast self exams, clinical breast exams, mammography, and Pap smears)" which includes the common barrier of lack of transportation. In order to reach this objective, transportation services would be provided to women who would otherwise be unable to participate in cancer screening activities. The plan also addressed other barriers which have prevented women from getting screened such as provider mistrust as well as navigating the healthcare system (Alabama Department of Public Health Cancer Prevention Branch, 2001).

FLORIDA

Term Search	Number of Times Mentioned	Addressed How?
Urban	0	N/A
Rural	0	N/A
Metropolitan	1	Metropolitan Planning Organization to improve transportation to healthcare for those most in need
Non-metropolitan	0	N/A
County	10	County health departments exploring feasibility of making screening available

		through them, share data about cancer gaps, needs, disparities
Residence	0	N/A

Florida's Comprehensive Cancer Control Plan neglected to mention rural residence as a possible risk factor for neglecting to get mammography screening. One of Florida's first goals stated in their plan is to "make state-of-the-art clinical services for cancer screening, diagnosis, and treatment more accessible and affordable throughout Florida." Although the plan's goal of accessible and affordable treatment is admirable, it was nonspecific in addressing the needs of individual women. Furthermore, there was no mention of difference in screening rates based on where an individual lives. The only time the term "metropolitan" was mentioned was at the end of the plan in the "Suggested New Activities" section in which the Metropolitan Planning Organization plans to implement and evaluate an advocacy initiative to improve transportation to healthcare facilities for those in need (Florida Department of Health, 2003) .

GEORGIA

Term Searched	Number of Times Mentioned	Addressed How?
Urban	8	Cancer care coverage for urban and rural residents, referral network for urban and rural populations who are high risk for not getting screened, urban populations identified as at risk group for not getting screened
Rural	8	Rural Populations with insufficient mammography services, rural populations cancer care coverage, referral network targeting urban and rural populations

		who are at high risk for not getting screened, outreach screening and education targeting rural populations, goal to reduce rate of preventable cancers for those individuals in rural areas, reducing cancer morbidity and mortality in rural populations, intervention and treatment programs for rural populations, rural support systems for cancer patients and their families when cancer is terminal
Metropolitan	2	Eight mobile mammography facilities are located in 4 metropolitan areas
Non-Metropolitan	0	N/A
County	9	The county level of data analysis using Behavior Risk Factor Surveillance System (BRFSS) to find out more about Georgian's knowledge, attitude, and behavior regarding prevention and screening, referral network
Residence	0	N/A

Georgia's strategic cancer plan did acknowledge rural areas as being at risk and the difficulty of obtaining mammography services there. The plan expressed this by noting that in rural parts of Georgia most individuals cannot access a mammography facility within 25 minutes or 25 miles of their home. In addition to the lack of permanent facilities, "55 of Georgia's 159 counties have no facilities and only 8 mobile units are located in four metropolitan areas." This statement highlighted the discrepancy of health care available in rural areas.

The plan also acknowledged the importance of health care coverage which will pay for mammography screenings. One of the goals highlighted in the plan is the need to provide both urban and rural health coverage. The plan also recognized the importance of tailoring screening programs to a specific ethnic group (African Americans in this case) by providing information about outreach screening and education as offered by Mercer and Morehouse Universities. An indicator of the plan's success is the screening rate increases and second if the rate of preventable cancers as well as cancer morbidity and mortality, are reduced among populations living in rural areas (Georgia Cancer Coalition, 2005).

KENTUCKY

Term Search	Number of Times Mentioned	Addressed How?
Urban	3	Bridging the gap of health care access between urban and rural populations
Rural	18	Kentucky Office of Rural Health on the Breast Cancer Advisory Committee, Cooperative Extensive Service (CES) that exists in rural areas, percentage of the pop. that lives in rural areas, use of tobacco products among rural populations, reduce the inequity of cancer burden among rural residents, geographical access among rural populations, telemedicine, partnerships with urban health providers among rural populations, lack of needed resources in rural health care facilities,

		expanding the Telecare Program among rural health facilities, rural physicians speaking English as their second language
Metropolitan	0	N/A
Non-metropolitan	0	N/A
County	8	Tobacco control programs at the county level, cardiovascular disease at the county level, under special initiatives county breast and cervical coalitions, county extension agents who took a survey on the cancer plan development, a strategy to increase the amount of nonprofits at the county level to serve the target population, encouraging county level health departments in fostering opportunities for work site and community cancer screenings
Residence	0	N/A

Kentucky's cancer plan addressed rural and urban populations primarily through tailored programs or nonprofits, one of which was called Bridging the Gap, sponsored by the Information Action Council of the National Action Plan on Cancer, whose purpose was to link urban and rural residents to cancer information through internet technologies. Another way of bridging the lack of knowledge of preventative cancer strategies among specific individuals was by developing partnerships between local physicians and urban health providers. That way, the rural residents who may be underserved, as well as special needs patients, could gain access to specialists. The plan also mentioned the Cooperative Extension Service (CES), which was a public education provider located in

Kentucky's 120 counties helping to reach rural, underserved families on health-related issues. Geographical access was of particular concern to the Kentucky Cancer plan, to such a degree that there is a section in the plan devoted to addressing it. According to 1990 Census Bureau estimates, 48% of Kentucky's residents live in rural areas and specifically a priority of the plan stated, "reduce the inequity in cancer burden among rural populations" and more specifically to "increase access to cancer screening and treatment in geographically underserved areas." Rural residents were of greatest concern for "in seeking cancer care, they face a lack of specialized local care, cost and travel requirements." Adding to the difficulties that rural residents face was the fact that rural physicians and nurses have limited resources in providing or coordinating the quality of care that may be needed. Furthermore, no one individual or entity is responsible for overseeing overall cancer care. To help ease the difficulty of providing extensive health resources and facilities to rural residents, Kentucky's plan advocated for the use of telemedicine which is "the application of modern telecommunications to the practice of medicine.". Some services and opportunities that telemedicine provides are: administrative video conferences between a central headquarters and remote branches, networking continuing medical education (CME) offerings which include instruction in sophisticated medical procedures, video consultations permitting examination, diagnosis and treatment of a patient remotely, teleradiology, telepathology, patient medical records access and medical data banks.

Kentucky had a telemedicine program called Kentucky Telecare which was started in 1993 by the University of Kentucky Chandler Medical Center and used two-way interactive video to bring rural health care providers and patients together with

medical specialists at secondary and tertiary care centers. An alternative to telemedicine was to arrange for treatment specialists to establish office hours in remote rural areas. Another option would be to increase free or low-cost transportation and housing options for persons in remote areas who need to travel elsewhere for screening and treatment services. Getting the county health departments involved by offering opportunities for work site and community cancer screenings was another option (Kentucky Department for Public Health & Kentucky Cancer Program, 2001).

MISSISSIPPI

Term Searched	Number of Times Mentioned	Addressed How?
Urban	3	Barriers to cancer prevention exist among rural and urban communities, the lack of access to transportation and as well as linguistic barriers in urban areas
Rural	12	Barriers to cancer prevention exist among rural and urban communities, including poverty rates, uninsured residents, lack of public transportation, Southeast Mississippi Rural Health Initiative (SEMRHI), HIV Rural Network Program, in which rural health providers aim to get more rural population inclusion in future surveys,
Metropolitan	0	N/A
Non-metropolitan	0	N/A
County	7	County population estimates, county maps
Residence	0	N/A

Rural communities are identified at the beginning of Mississippi's cancer plan as a major component to cancer disparities due to the barriers to that they face. The barriers that were discussed in relation to rural communities included poverty, the uninsured and elderly, a lack of transportation, and a lack of access to primary and specialty health care. Urban community members struggled with the barriers of transportation, high Medicaid rates, and cultural and linguistic barriers.

Although the plan recognized the difficulty in cancer prevention in rural communities due to the barriers identified, the plan lacked any strategies, initiatives, or ways to address the problem of neglecting to get mammography and other preventative health services to rural residents (Mississippi Partnership for Comprehensive Cancer Control Coalition, 2005) .

NORTH CAROLINA

Term Search	Number of Times Mentioned	Addressed How?
Urban	29	Problems related to tobacco use among urban populations, mammography use among urban populations, barriers to access medical care among urban populations, geographic availability and access, continuing medical education (CME) for urban and rural physicians, earlier cancer diagnosis for urban populations than rural residents, distance to health care providers among urban populations, differences in health care among rural and urban residents, differences in rural-urban rates of breast

		cancer fatality
Rural	60	Problems related to tobacco use among rural populations, mammography use among rural populations, lack of specialized practitioners in rural areas, use of preventative health services in rural areas, barriers to access for medical care in rural areas, racial disparities that exist in rural areas, availability of health care practitioners in rural areas, transportation services and distribution of cancer information in rural areas, healthcare disparities among rural populations, differences in health care among rural and urban residents, differences in rural-urban rates of breast cancer fatality, racial disparities,
Metropolitan	0	N/A
Non-metropolitan	1	Women who neglect to get Pap tests reside in non-metropolitan areas
County	26	Statewide distribution of radiation therapy facilities, care facilities broken down by county, county unit of measure, maps of counties
Residence	3	Inadequate follow-up on mammography screening, strategy to determine influence of geographic area of residence and economic status on choice of treatment

North Carolina had an extensive cancer plan which thoroughly covered rural residence and how it can be a risk factor for neglecting to get mammography screening. One study found that among those patients that neglected to get preventative medical care, "factors associated with inadequate follow-up include rural residence and low income." Another study found that, "women who seem to be most likely to underutilize services are low income, older, from rural or non-metropolitan areas." Rural residency is also pointed out in the plan as having played a role in late stage cancer diagnosis. This was partly due to the lack of state-of-the-art equipment for diagnosis, which again was rarely found in rural areas and was more prevalent in urban areas.

The plan also highlighted a major barrier to receiving mammograms, which is that the specialized health care providers who were trained to perform diagnostic procedures were generally located in urban areas. The common barrier of transportation was a factor when a specialist was not available in a rural area so North Carolina's plan aimed to establish networks or linkages between rural providers and urban cancer centers so that optimal care was more accessible to rural cancer patients. In fact, an Eastern Regional Cancer Coalition had been formed to build networks or linkages among rural providers and urban cancer centers. The plan also recommended that health care practitioners in rural and underserved areas needed to be kept informed of current cancer therapies and resources, including the information on where and how to obtain these resources for their patients.

Continuing medical education (CME) was also discussed in the cancer plan and how there was a difference in CME interest and demand in practice location, physicians preferring urban to rural counties. Interestingly, family physicians were found to have a

statistically higher interest in screening, treatment, and follow-up care than other specialists. The preferred method for receiving a CME lecture was by in person lecture (63%) rather than a video conference format (6%).

One recommendation to help make rural residents aware of their preventative health services was the distribution of cancer information to patients, providers, and the public with the emphasis on rural residents. The information included the availability of transportation services. Improving continuing education on cancer-related topics was another objective for targeting practitioners in underserved and rural areas. One other goal which directly addressed rural residence was continuing to support efforts to establish linkages among rural providers and urban health centers (Advisory Committee on Cancer Coordination and Control, 2001).

SOUTH CAROLINA

Term Searched	Number of Times Mentioned	Addressed How?
Urban	1	Where the state physicians practice
Rural	14	Preventative health care services that exist in rural areas, tobacco control programs among rural populations, lack of transportation and access, number of rural health clinics, barriers to screening among rural residents, Southern Appalachia Leadership Initiative on Cancer in rural areas
Metropolitan	0	N/A
Non-metropolitan	0	N/A
County	8	Delivery of preventative services-Best Chance Network at the county level, County Health department a

		resource for prevention and cancer clinical trials, objective to work with county recreation districts, cancer registry records
Residence	1	Cancer registry records

To further emphasize the divide between health care availability in rural areas, South Carolina's plan pointed out that "more than 74% of the state's physicians practice in urban areas located in 15 of the states 46 counties." According to South Carolina's research, the women who were least likely to get a breast cancer screening are over 40 years of age poor, rural, less educated and/or African American. This was largely due to a transportation barrier. Women who lived in rural areas usually did not own a car and lived on fixed incomes. Another barrier common to these women because of where they lived was that the number or providers able to deliver care was limited. Due to the fact that a large portion of the state's population lived in rural areas, educational projects were focusing on reaching out to rural health care providers and, since the state is relatively small, the opportunity to disseminate cancer information and network among cancer professionals had great potential.

One initiative which encouraged the development of cancer information and treatment networking was the Southern Appalachia Leadership Initiative on Cancer (SALIC). This initiative was a partnership between the North Carolina Extension Service at North Carolina State University with other extension programs at the University of Georgia and Clemson, the Department of Health and Environmental Control (DHEC), the American Cancer Society, the Greenville Hospital System and the USC School of Public Health (South Carolina Department of Health and Environmental Control, 1999). The

Southern Appalachia Leadership Initiative on Cancer worked to reduce barriers to cancer prevention and control such as lack of available or primary health care, transportation, ability to pay for services and lack of understanding and knowledge of cancer.

Another program to help provide preventative health services to the underserved was the Best Chance Network, a partnership between the American Cancer Society and DHEC Cancer Program. This program provided over 55,000 screenings to underserved women in South Carolina (South Carolina Department of Health and Environmental Control, 1999).

TENNESSEE

Term Searched	Number of Times Mentioned	Addressed How?
Urban	0	N/A
Rural	6	Lack of health providers in rural areas, needs of rural survivors of cancer
Metropolitan	0	N/A
Non-metropolitan	0	N/A
County	7	Smoking policies, ultraviolet radiation policies,
Residence	0	N/A

The Tennessee comprehensive cancer plan did identify the fact that there was a lack of health providers in rural areas, but did not mention rural residence as a risk factor for failing to get a mammography screening. The barriers for mammography were; a lack of a recommendation from the primary physician, limited access to screenings due to culture, language and geography issues, limited access due to location, hours of operation and cost, limited or inaccurate information about the need for screening and the screening procedure, misinformation, and fear. The strategies outlined in the plan to increase

mammography screening rates included a long-term commitment to educating the public about the importance of screenings and financial assistance for screening and treatment.