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Cathy J. Bradley
David Neumark
Lisa M. Shickle
Nicholas Farrell

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Differences in Breast Cancer Diagnosis and Treatment:Experiences of Insured and Uninsured Patients in a Safety Net Setting

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ABSTRACT

To explore how well the safety net performs at eliminating differences in diagnosis and treatment of insured and uninsured women with breast cancer, we compared insured and uninsured women treated in a safety net setting. Controlling for socioeconomic characteristics, uninsured women are more likely to be diagnosed with advanced disease, requiring more extensive treatment relative to insured women, and also experience delays in initiating and completing treatment. The findings suggest that, despite the safety net system, uninsured women with breast cancer are likely to require more costly treatment and to have worse outcomes, relative to insured women with breast cancer.

Cathy J. Bradley
Department of Health Administration
Virginia Commonwealth University
1008 E. Clay St.
Richmond, VA 23298
cjbradley@vcu.edu

Lisa M. Shickle
Department of Health Administration
Virginia Commonwealth University
1008 E. Clay St.
Richmond, VA 23298
lmshickle@vcu.edu

David Neumark
Department of Economics
3151 Social Science Plaza
University of California, Irvine
Irvine, CA 92697-5100
and NBER
dneumark@uci.edu

Nicholas Farrell
Department of Health Administration
Virginia Commonwealth University
1008 E. Clay Street
Richmond, VA 23298
nfarrell@mcvh-vcu.edu

The Institute of Medicine's report, *Insuring America's Health: Principles and Recommendations*, highlighted the sub-par health care of uninsured persons (approximately 43 million people) and called for universal health insurance (Institute of Medicine 2004). Instead of universal coverage, the United States (U.S.) relies on a safety net system to treat uninsured patients, including patients with chronic, life threatening, and costly diseases such as breast cancer. Breast cancer is the second leading cause of cancer death for women and the third leading cause of death in women overall (American Cancer Society 2006).

In this study, we compare diagnosis and treatment between insured and uninsured women with breast cancer treated in a safety net setting, to explore how well the safety net system performs in eliminating differences in diagnosis and health care between insured and uninsured women. Treatment patterns observed at a large safety net provider may offer the best evidence to study differences between insured and uninsured patients. Because the population of interest is the uninsured, there is not a single repository of claims data (e.g., Medicaid, Medicare, Anthem) that documents treatment history. Although our study is specific to a single health care facility, we are able to provide a detailed characterization, using administrative billing data, of the treatment of the uninsured. While larger scale studies (for example, Ayanian et al., 1993) have confirmed that uninsured patients have worse survival than insured patients, because of the absence of detailed information on treatment the reasons for this disparity are unknown.

Safety net providers are often associated with urban academic institutions that diagnose and treat a significant proportion of a community's indigent population by offering diagnostic and treatment services at no or low cost, based on the patient's assets and income. In addition to safety net providers, there are also other options for

subsidized health care for low-income uninsured women. For example, the Centers for Disease Control National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides access to breast and cervical cancer screening services for underserved women in the U.S. (Centers for Disease Control 2006).[1]

Nonetheless, on average uninsured women with breast cancer are diagnosed at a later stage, and have poorer survival than insured women (Ayanian 1993). Our research explores how effective the safety net system is at eliminating differences between insured and uninsured patients in the diagnosis and treatment of breast cancer. Breast cancer represents a "best case scenario" for studying whether the safety net system can eliminate differences in diagnosis and treatment between insured and uninsured patients, given multiple options for free or low cost diagnosis and care, and given that patients are likely to be motivated to follow and complete recommended therapy.

Conceptual Framework

Differences in diagnosis, treatment, and survival between insured and uninsured women could be explained by a failure of safety net or other institutions to close the gap between these two groups, or by a lack of access to these institutions on the part of some women. Alternatively, these differences could be attributable to variation in behavior related to health and health care — perhaps associated with factors such as socioeconomic status — which are correlated with but not caused by health insurance status. Because these differences may have as much or more influence on health and health care behavior than does health insurance, failure to account for such differences likely results in overestimation of the deleterious effects of being uninsured (Currie and Thomas 1995; Doyle 2005).

We therefore structure our conceptual model to include individual and contextual differences that influence health care utilization. A considerable body of research has demonstrated a relationship between breast cancer screening and/or stage at diagnosis and individual characteristics such as age, race, income, marital status, and education (Bradley et al. 2002; Anderson et al. 2007; Schootman et al. 2007; Taplin et al. 2004). These factors are also correlated with having health insurance. A sparser but growing body of literature suggests that contextual factors (i.e., characteristics of the geographic location in which an individual resides) also are associated with and may influence health care utilization (Coughlin et al. 2007). These factors include racial/ethnic composition (Benjamins et al. 2004) and education and income level (Engelman et al 2002) of the surrounding population as well as supply of health care providers within a geographic location (Davidson et al. 2005).

We incorporate contextual factors in our model by using patients' address information to identify their census tract of residence. Census tracts are small subdivisions of counties established by the U.S. Census Bureau, usually with 2,500 to 8,000 residents, and are designed to be homogeneous with respect to population characteristics, economic status, and living conditions (U.S. Census Bureau 2007). The *Public Health Disparities Geocoding Project* demonstrated that poverty at the level of the census tract captured socioeconomic differences in health across a wide range of health outcomes, including outcomes related to cancer (Krieger et al. 2002). We include in our models census tract characteristics that emerge from the literature as predictors of health care utilization, along with additional characteristics (e.g., proportion of families headed by single females, housing units without a motor vehicle) that may be correlated with socioeconomic vulnerability and poor access to health care. In addition, we estimate

models with fixed effects for each census tract, which capture all of these measurable factors defined at the census tract level, as well as any other unmeasured factors common to residents of the same tract.

Study Data and Methods

Context

We evaluate the effect of health insurance on breast cancer diagnosis and treatment at a large urban safety net hospital system — Virginia Commonwealth University Health Care System's (VCUHS) Massey Cancer Center (MCC). MCC is an integral component of a healthcare system serving the cancer care needs of patients in the Greater Richmond Virginia Metropolitan Area and surrounding counties (a population of approximately 1.7 million people). As a safety net provider, many uninsured patients are drawn to MCC. When uninsured (or underinsured) patients make an appointment at VCUHS, their level of financial need is assessed. Based on their income, VCUHS will offer care at low or no cost. MCC is also a National Cancer Institute designated clinical cancer center, which attracts and treats patients regardless of health insurance status. VCUHS inpatient facilities are located in downtown Richmond, but it has two outpatient facilities that offer mammography services for screening and diagnosis and deliver chemotherapy; one is located downtown, and the other, in a suburban setting, caters to an insured population. Uninsured patients are screened and treated in the downtown facility and are seen in the oncology fellows' clinic for chemotherapy administration.

Among women treated at VCUHS, we compare tumor size and stage of breast cancers at diagnosis — which are strong predictors of breast cancer survival (Smigal et al. 2006; Carter et al. 1989; Rosenberg et al. 2005; Elkin et al. 2005) — for women with and without insurance. We also compare the time from diagnosis to surgery and from

surgery to the start of adjuvant chemotherapy, the likelihood of starting and completing chemotherapy, and the time to complete chemotherapy regimens.

Data and Study Sample

Data were obtained from the hospital cancer registry, the VCUHS administrative billing system, and medical records. The registry contains information on incident cancer cases, including: the American Joint Committee on Cancer (AJCC) Tumor Node Metastases (TNM) staging; date of diagnosis; and information about treatment including surgery, chemotherapy, and radiation. The billing system contains information on: patient age, race, and marital status; address; inpatient, outpatient, and physician services; drugs administered (type, dose); dates of service; insurance source (at the time of first treatment for cancer at VCUHS); charges; International Classification of Diseases version 9 codes; and Current Procedural Terminology codes.

Records for all breast cancer patients identified through the cancer registry diagnosed between January 1, 1999 and March 31, 2006 were merged with the VCUHS administrative billing system. Medical record numbers and dates of diagnosis were used to extract all billing claims from 3 months prior to 12 months following the diagnosis date. For patients with more than one primary breast cancer, only the first cancer diagnosis was included. A medical oncologist randomly selected and manually audited the medical records from 15% of the patients that received chemotherapy. Insights from this audit guided our coding and interpretation of the billing records and ensured that all services and their dates were accurately recorded.

VCUHS treats approximately 300 new breast cancer cases annually. Patients treated at VCUHS are comparable, in terms of cancer stage at diagnosis, to patients treated at other Virginia teaching hospitals, Virginia community comprehensive cancer

centers, and all Virginia hospitals combined.[2] However, VCUHS is the main safety provider in the region and, as such, it likely treats a disproportionate share of uninsured patients relative to other providers. Although uninsured women are more likely to be diagnosed with advanced stage disease, their proportion of the total VCUHS cancer patient population is still somewhat small and alters only slightly the distribution of cancer stages diagnosed at VCUHS relative to other providers (for example, 59% of VCUHS breast cancer cases are diagnosed with in situ or local disease whereas other Virginia providers report that 60% of their cases are in situ or local stage). All cancer patients seen at VCUHS are entered on its cancer registry. Patients may receive a portion of their care elsewhere. For example, VCUHS provides 53% and 75% of surgery and chemotherapy, respectively, to insured patients; the corresponding numbers for uninsured patients are 87% and 90%, respectively. The registry includes all treatment information, regardless of location, up to and including the initiation of chemotherapy.[3]

We identified all women aged 21 to 64 diagnosed with a first primary breast tumor with an AJCC stage of 0, I, II, or III. Patients with distant metastases, who were likely receiving palliative care without intent to cure, were excluded. We chose 64 as the upper age limit because almost all women qualify for Medicare coverage at age 65. Because we were interested in the timing of surgery and outpatient chemotherapy, we excluded patients that died within 1 year of diagnosis (n=17), had no evidence of surgery (n=31), or had a bone marrow transplant (n=12).[4] We also excluded 60 women insured by Medicaid because we could not determine whether they were enrolled in Medicaid at the time of diagnosis or were uninsured at diagnosis with Medicaid enrollment made retroactive to the time of diagnosis. Lastly, we excluded 50 women because we could not

match their address to a census tract. The remaining sample size was 1,334 women — 1,121 with private or military insurance and 213 uninsured.

Analytical Approach

We first compared the stage of disease and tumor size (≥2 cm) in insured and uninsured patients using logistic regression. AJCC disease stage was dichotomized into in situ (0) and local (I) versus regional (II, III). Chemotherapy is recommended less often for women with in situ or local stage cancer whereas chemotherapy is routinely recommended to women with regional stage breast cancer. In addition, because regional stage cancers are more advanced, the probability of cancer recurrence is higher for women with regional stage disease. Tumors ≥2 cm indicate higher stage and — because women with a tumor this large likely presented with a palpable mass — the absence of mammography screening. Cases missing tumor size (n=302) were excluded from this analysis.

Second, we compared the number of days between diagnosis and surgery and between surgery and chemotherapy initiation and the likelihood of a delay of more than 90 days from diagnosis to surgery between insured and uninsured patients. These outcomes reflect the timeliness of care, which can influence its quality. A meta-analysis of a variety of studies of this question finds that a delay of 12 or more weeks from symptom detection to treatment initiation is associated with a 15 percentage point lower survival rate at 20 years following diagnosis relative to women that had treatment within 12 weeks of experiencing breast cancer symptoms (Richards et al. 1999). The time from a suspicious mammogram to surgery would better reflect the time period between diagnosis and surgery, but these data are not available. Therefore, our estimates are conservative relative to the actual time between diagnosis and surgery.

From these analyses, we excluded patients with neoadjuvant chemotherapy (n=73), which introduces delays between diagnosis and surgery. We conducted the analysis with and without patients that had identical surgery and diagnosis dates (n=351), because they likely received their initial biopsy and lumpectomy at the same time. The distribution of the time between diagnosis and surgery was right skewed. Therefore, we repeated the analysis using the natural log transformation of the dependent variable; the findings were qualitatively similar (results not shown).[5]

Third, we compared the likelihood of initiating and completing a chemotherapy regimen of doxorubicin plus cyclophosphamide (AC) or doxorubicin plus cyclophosphamide followed by paclitaxel (ACT), the two most common adjuvant regimens used to treat breast cancer patients (Levine and Whelan 2006). For the patients that completed AC or ACT, we also compared the number of days from the start of chemotherapy to the completion of chemotherapy (AC, n=247; ACT, n=133). A complete course of therapy was defined as 4 courses of AC or 8 courses of ACT. In our analysis of chemotherapy completion, we limited the sample to patients that received all of their chemotherapy at VCUHS (n=526) to ensure that we had complete data.[6] Other protocols were prescribed during the study period, but their dosing schedules were irregular or they were administered as part of a clinical trial. In a population-based study, Harlan et al. found that uninsured women were equally likely to receive guideline care as insured women (Harlan et al. 2005). We would expect to find the same result for the safety net setting.

For each outcome, we report estimates of three models. Model 1 includes health insurance status, along with patient characteristics (e.g., race, age, marital status) to provide a baseline estimate of the differences between insured and uninsured women.

Race is a prime socioeconomic variable that is associated with health insurance status (Monheit and Vistnes 2000) and also with differences in diagnosis and treatment of breast cancer (Lantz et al. 2006). In the models for days between diagnosis and surgery, surgery and chemotherapy initiation, and chemotherapy initiation and completion, Model 1 also includes variables for cancer stage and tumor size and shortest distance to the VCUHS facility where chemotherapy could be administered. Distance was included to reflect the possibility that uninsured patients may have to travel farther than insured patients to the safety net facility that will treat them. In contrast, insured patients have the option of going to the closest facility. For uninsured patients, the shortest distance was the number of miles between their residence and the downtown facility (Dalton clinic) where they have to be treated. The shortest distance for insured patients was lesser of the distance between their residence and the Dalton clinic and between their residence and the suburban facility. In the models for days between surgery and chemotherapy initiation and chemotherapy completion, a dichotomous variable for mastectomy is also added as a control, to account for longer recovery times associated with mastectomy.

Model 2 estimates the insurance-related differential controlling for census tract characteristics including census tract median income, percent of women with some college and percent of women with a college degree or higher (relative to the percent of women with a high school or less education), median value of owner occupied housing, percent of families headed by unmarried women, percent of owner occupied housing, percent of blacks residing in the census tract, and percent of housing without a motor vehicle.

Finally, Model 3 adds dichotomous variables for each census tract in which patients resided. This approach controls for all tract-related differences in the environment and social context (e.g., transportation, housing) in which patients live, including differences in physical access to VCUHS. Because the census tract controls should account for many socioeconomic differences between the insured and the uninsured, the differences that remain are much more likely due to differences in how well the safety net system reaches the uninsured and how it treats the uninsured once they have been diagnosed. In Model 3, the effects of insurance status are identified from differences between insured and uninsured women within the same census tract. Hence we drop observations in census tracts with only one patient, and, for the logistic models, additional observations for which census tracts perfectly predicted the outcome of interest.

The differences we observe in chemotherapy-related outcomes may be attributable to differences in the two facilities at which patients receive care. To address this potential source of bias, we repeat all chemotherapy related analyses on a sample restricted to those treated at the downtown facility. As noted earlier, the insured patients can choose their facility, whereas all uninsured patients are treated at the downtown facility. Thus, the only comparison we can do that controls for the facility at which treatment is received is the comparison for this subsample.

Results

Descriptive statistics by insurance status are reported in Table 1. The insured and uninsured were of similar ages. Uninsured women were more likely to be black and unmarried, and more likely to be diagnosed with advanced cancer stage and larger tumors. As would be expected given cancer stage and tumor size, uninsured women were

more likely to have a mastectomy and more likely to initiate chemotherapy. Uninsured women had considerably longer times from diagnosis to surgery (24 or 19 days depending on whether we exclude or include patients diagnosed on the same day as surgery) and from surgery to chemotherapy initiation (21 days longer). A higher percentage of uninsured women experienced a delay of 90 or more days from diagnosis to surgery (23 versus 3 percent). Once chemotherapy was initiated, insured women were more likely to complete chemotherapy.

Among women that completed chemotherapy, uninsured women took longer to complete chemotherapy (approximately 4 and 32 days longer for AC and ACT, respectively). AC is expected to be complete within 64 days and ACT should be completed within 148 days (Hershman et al. 2004). Sixty-eight percent of insured women completed AC within 64 days and 69% of them completed ACT within 148 days. In contrast, less than half of uninsured women completed AC within 64 days and only 35% completed ACT within 148 days.

The lower panel of Table 1 reports census tract characteristics. Along every dimension, census tracts where insured women resided were different from census tracts where uninsured women resided. Insured women resided in census tracts with higher median income, high gross value of housing, and with greater shares of owner occupied housing and women with a college degree, but with fewer families headed by unmarried women, fewer homes without a motor vehicle, and shares of blacks relative to census tracts where uninsured women reside. However, despite these differences, insured and uninsured women faced quite similar distances to the closest clinic where chemotherapy could be delivered. The mean distance was 22 miles for insured women and 25 for

uninsured women; the medians were 11 for insured women and 10 miles for uninsured women.

Table 2 reports results from logistic regressions for regional AJCC stage and tumor size ≥2 cm. In the Model 1 estimates, insured women were less likely to be diagnosed with regional stage disease (OR=0.72, p=0.06). Adding the census tract characteristics in Model 2 does not alter the estimated differential, whereas the addition of individual census tract controls in Model 3 makes the estimated differential somewhat larger, with insured women two-thirds as likely to be diagnosed with late stage disease (OR=0.65, p=.05). In column 2, the estimates for Models 1-3 all indicate that insured women were only about half as likely to be diagnosed with a tumor ≥2 cm than were uninsured women; the estimates are similar across all models (e.g., OR=0.53, p=0.02 in Model 3). Consistent with the literature, the estimates indicate that African American women are more likely to be diagnosed with advanced stage and larger tumors relative to white women (Henson et al. 2003). However, Table 2 shows that a large insurance-related differential exists conditional on race, as well as other controls.

Table 3 reports OLS estimates of models for days from diagnosis to surgery for all women and women that received their diagnosis on the same day as surgery. The estimates in column 1 indicate that uninsured women receive their surgery 16 days later than insured women ($p<0.01$), regardless of model specification. When we exclude women who were diagnosed and had surgery on the same day, in column 2, the estimated differences between insured and uninsured women widen slightly. Finally, in estimations for the likelihood of having a delay of 90 days or more between diagnosis and surgery, insured women are much less likely to experience such a delay relative to uninsured women (OR=0.34, 95% CI= 0.17 to 0.69). This estimate was robust across the 3 models,

including Model 3 where the sample size dramatically decreased from 1261 to 360 due to the inclusion of census tract dummy variables.[7]

Table 4 reports results from logistic regressions for initiating chemotherapy, completing a regimen of AC or ACT, and experiencing a delay in the completion of either AC or ACT. The estimates in column 1 indicate no significant differences between insured and uninsured women in the likelihood of initiating chemotherapy. Likewise, the estimates in column 2 suggest no differences in the likelihood of chemotherapy completion. However, in column 3, the estimates clearly indicate the insured women are less likely to have a delay in chemotherapy completion (OR=0.36, $p<0.01$, for Models 1 and 2). The estimated difference in the likelihood of delay is even larger when individual census tract controls are added in Model 3 (OR=0.14, $p=0.01$).

Table 5 addresses the timeliness with which treatments are delivered and completed. The Model 1 estimates indicate that insured women start chemotherapy approximately 18 days sooner than uninsured women ($p<0.01$). Insured women also complete AC and ACT regimens 4 ($p=0.01$) and 24 ($p<0.01$) days faster, respectively, than uninsured women. When individual census tracts are added, in Model 3, the coefficients for chemotherapy completion became statistically insignificant (and very small for ACT). In general, though, the samples available for estimating the models for chemotherapy completion – especially for ACT – are very small, especially for uninsured women.

Table 6 addresses the possibility of bias introduced by treatment at different facilities (the downtown Dalton clinic versus the suburban clinic). For each outcome and model, however, the estimates are very similar to their full sample counterparts in Tables 4 and 5, which suggests that differences we find between insured and uninsured women

are not due to differences between the treatment sites at which the two groups of women tend to get treated.

Possible Explanations for Differences

To summarize, the combined results in Tables 2 through 6 establish that, in the safety net setting we study, insured women with breast cancer are diagnosed with smaller tumors and at earlier disease stages, and they receive surgery and initiate chemotherapy considerably faster than otherwise similar uninsured women; the evidence regarding whether insured women complete chemotherapy faster is more mixed, with some specifications pointing to significant differences. On the other hand, race differences in treatment-related outcomes are quite small and generally insignificant, although African American women are more commonly diagnosed at a later stage and with larger tumors. Moreover, neither race differences nor other socioeconomic characteristics associated with census tract of residence account for the diagnosis and treatment time differences between insured and uninsured women. A number of other factors may help to explain some of these differences, in some cases highlighting possible shortcomings of the safety net system.

Stage and tumor size were much more advanced in uninsured women relative to insured women. Larger tumors at diagnosis in uninsured patients may reflect poor access to care and cancer screening. The number of tumors ≥2 cm has been steadily declining since 1980 — a decade that marked the beginning of the use of mammograms for breast cancer screening — but uninsured women are less likely to use mammography services relative to insured women (Coughlin et al. 2004). It is possible that there are too few mammography providers available to uninsured women, making access to screening difficult or burdensome. Alternatively, uninsured women may be unaware that low cost

options for cancer screening exist and seek care only when they become aware of a palpable mass. At least one study found that less than half of the uninsured who live near safety net providers are aware of their presence (Cunningham et al. 2007).

It is unclear why the differences in timeliness of treatment persist in a safety net setting where treatment was provided without regard to insurance status. Scheduling and keeping clinical appointments may be difficult for uninsured patients. An analysis of the frequency of cancellations in the oncology fellows' clinic, where uninsured patients are treated, found that uninsured patients were twice as likely to miss their appointments for treatment as were insured patients. The reasons cited by patients for missing appointments included being unaware of the appointment, patient or family illnesses, or other emergencies and transportation problems (Youssef et al. 2006). However, the interpretation of the results from this study is unclear because the analysis did not include other controls for patient characteristics that may be correlated with missed appointments; we conjecture that such behavior is likely to be related to factors such as socioeconomic status, access to transportation, etc., for which have been able to control in our analysis.

The oncology clinic may also be overburdened with patients, making it difficult for physicians to see patients in a timely manner. A report from the Kaiser Commission on Medicaid and the Uninsured (2005) argued that safety net spending has not kept pace with growth in the number of uninsured and the cost of treating them, and as a result predicted an increasing strain on the ability of safety net providers to meet the health care demands placed on them.

Perhaps supportive care medications such as those that reduce nausea, which may improve tolerance to therapy, are too expensive for uninsured patients to purchase out-of-

pocket, and these patients therefore experience the toxic effects of chemotherapy at greater rates or severity than insured patients. Uninsured women may also have more non-cancer related medical conditions that interfere with recovery from surgery and chemotherapy initiation and completion. As suggestive evidence consistent with this hypothesis, we found that 22% of uninsured women were admitted to the hospital compared with 16% of insured women ($p=0.09$), and 26% had at least one emergency department (ED) visit compared with 10% of insured women ($p<.01$); these differences were largely associated medical conditions unrelated to cancer. (However, we only detect admissions and ED visits at VCUHS, and insured women may be more likely to go elsewhere.) A greater prevalence of other medical conditions among the uninsured interfering with cancer treatment would still point to shortcomings of the safety net system, although it would suggest that the differences based on insurance status are not solely attributable to differences in treatment after women are diagnosed with breast cancer.

Implications of Inequality in Access and Care

Safety net providers are supposed to act as substitutes for universal coverage in the United States. In spite of proximity to a safety net provider that is a National Cancer Institute designated clinical cancer center, we find that uninsured women had more advanced cancer and larger tumors than otherwise similar women with health insurance. From a health outcomes perspective, the method of breast cancer detection (mammography versus clinical breast exam) alone has been shown to be an important prognostic factor, and larger tumor size at diagnosis has grave implications for patients' long-term survival (Shen et al. 2005; Duffy et al. 2003; Michaelson et al. 2003; Berry et al. 2005; Cronin et al. 2006; Berry et al. 2006). From the safety net system perspective,

because uninsured women present with more advanced disease, they require more extensive and costly treatment. In our sample, a higher proportion of uninsured women required mastectomy (37% versus 26%) and chemotherapy (62% versus 52%) relative to insured women. They were also more likely to require the longer, more extensive regimen of ACT instead of AC (50% versus 41%, p=0.09). Once they initiated therapy, there is evidence suggesting that these women had a more difficult time completing it in a timely fashion, although this evidence is not always statistically significant. Together, these findings suggest considerable morbidity for the affected women at increased cost to the health care system.

Uninsured women also experienced lengthy delays from diagnosis to surgery and from surgery to chemotherapy initiation and, once chemotherapy was initiated, delays in treatment completion relative to otherwise similar insured women. However, in this safety net setting, insured and uninsured women were equally likely to initiate and complete chemotherapy. Although short delays in treatment completion have not been shown to adversely affect survival or cancer recurrence, a delay of 3 or more months from symptom detection to treatment initiation is associated with compromised survival (Richards et al. 1999). In our sample, uninsured women were more likely to experience a 90-day delay between diagnosis and surgery relative to insured women. This estimate is conservative because it excludes time from symptom recognition or an abnormal mammogram to surgery. Our findings may partially explain why other studies have found survival disparities between insured and uninsured women, despite the safety net system.

Our approach has some limitations. First, it is confined to a single institution. This reduces generalizability, but also avoids heterogeneity across institutions. Second, we do not have information on patient income, education, family, health behaviors, prior

contact with the health care system, and work situations. However, we did control for census tract of residence, which captures the social and geographic context in which patients live and is strongly related to income, employment, etc. Third, patients that relied upon VCUHS for all of their treatment may differ (in comorbidity, severity, or recommended protocol) from patients that chose to get their chemotherapy elsewhere, especially for insured women who are likely to have more options.

Implications for Policy

An expansion of the safety net has been sought as a way to provide access to health care for uninsured persons (Hadley and Cunningham 2004; Office of Management and Budget 2002); in 2004, total federal safety net spending was $22.8 billion, which reflected a 15% increase over 2001 spending (Kaiser Commission on Medicaid and the Uninsured 2005). Our study indicates that within a safety net provider — one that was equally likely to provide surgery and chemotherapy without regard to health insurance — uninsured breast cancer patients are more likely to be diagnosed with severe disease and to experience treatment delays that could ultimately affect their chances for survival and increase costs to the healthcare system.

In other settings, uninsured patients have been shown to receive about half as much medical care as insured patients (Institute of Medicine 2004). Safety net providers, in all likelihood, reduce differences between the diagnosis and treatment of the insured and the uninsured. Nonetheless, in our study of one safety net provider, important differences remain. These differences are large and are robust to controlling for census tract of residence, race, and other demographic characteristics. As a result, the diagnosis and treatment differences associated with health insurance status, within this safety net system, seem unlikely to be attributable to unmeasured socioeconomic differences

between women with and without insurance. Our evidence suggests, therefore, that safety net institutions — at least as they currently operate — are only a partial substitute for health insurance, and that a more comprehensive alternative for uninsured patients is needed.

NOTES

1. The NBCCEDP is targeted to low-income women under age 65 that are uninsured or under-insured. This program is administered by state health departments. If cancer is detected under the auspices of this program, patients in 48 states are enrolled in Medicaid to cover their care.
2. Based on authors' analysis of the Virginia data in the National Cancer Data Base. (http://www.facs.org/ncdbbenchmarks8.cfm, accessed February 2007).
3. The cancer registry records information on all incident cancer cases evaluated at VCUHS.
4. Patients that received a bone marrow transplant are generally hospitalized for extended periods of time. Therefore, they would not be expected to start and complete chemotherapy in the same time period as patients receiving outpatient chemotherapy.
5. For the analysis including women with simultaneous diagnosis and surgery, for those whose diagnosis and surgery were on the same day we first reset day until surgery from 0 to 1 before taking logs.
6. The VCUHS cancer registry does not indicate the type of chemotherapy administered to patients or if patients completed a prescribed regimen. The only source of this information is administrative billing data.
7. Since the frequency of delays of 90 days or more is so low for insured women (2.8%, as reported in Table 1), in the logistic model with census tract dummy variables, the number of tracts with perfect predictions for the dependent variable is very high.

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Table 1. Patient, tumor, and treatment characteristics of women by insurance type

Patient and clinical characteristics	Private/military insurance N=1121	Uninsured N=213	*p*-value[a]
	N(%)	N(%)	
Race			<0.001
Non-black	866 (77.25)	81 (38.03)	
Black	255 (22.75)	132 (61.97)	
Marital status			<0.001
Married	814 (69.01)	66 (30.99)	
Unmarried	307 (27.39)	147 (69.01)	
Stage			0.03
0	246 (21.94)	36 (16.90)	
I	425 (37.91)	68 (31.92)	
II	352 (31.40)	85 (39.91)	
III	98 (8.74)	24 (11.27)	
Tumor size			<0.001
<2 cm	550 (49.06)	73 (34.27)	
2-5 cm	268 (23.91)	74 (34.74)	
>5 cm	47 (4.19)	20 (9.39)	
Size missing	256 (22.84)	46 (21.60)	
Mastectomy	296 (26.40)	79 (37.09)	0.001
90 day delay between diagnosis and surgery[b]	31 (2.88)	50 (23.47)	
Any chemotherapy	581 (51.83)	131 (61.50)	0.001
Completed chemotherapy, AC or ACT (n=526)	369 (88.92)	90 (81.08)	0.03
Completed AC within 64 days[b] (n=247)	133 (68.03)	17 (43.59)	0.02
Completed ACT within 148 days[b] (n=133)	84 (68.85)	9 (34.62)	0.001
	Mean (SD)	Mean (SD)	
Age	50.35 (7.62)	49.58 (9.05)	0.16
Days from diagnosis to surgery (N=1261), all patients[b]	24.42 (27.46)	43.13 (48.98)	<0.001
Days from diagnosis to surgery, excluding women with surgery and diagnosis on same day (N=910)[b]	33.99 (26.91)	58.35 (48.56)	<0.001
Days from surgery to chemotherapy initiation (N=474)[c]	48.85 (25.51)	69.48 (47.32)	<0.001
Days from 1st chemotherapy to last chemotherapy[d]			
AC (n=247)	65.50 (6.15)	69.41 (8.14)	<0.001
ACT (n=133)	127.62 (27.40)	159.62 (36.39)	<0.001
Shortest distance to facility	21.59 (27.55)	24.64 (29.85)	0.15
Census tract characteristics			
Median income	$53,259 ($21,546)	$37,856 ($14,296)	<0.001
Median gross value of owner occupied homes	$130,566 ($59,450)	$92,578 ($34,561)	<0.001
Share families headed by unmarried females	9.49 (7.49)	17.07 (12.21)	<0.001
Share black race	24.53 (23.73)	48.03 (30.52)	<0.001
Share total owner occupied housing	77.35 (17.38)	64.39 (21.63)	<0.001
Share of housing without a vehicle	6.50 (7.10)	14.03 (14.40)	<0.001
Share females with high school or less education	43.81 (17.29)	55.81 (14.09)	<0.001
Share females with some college	28.36 (5.67)	27.09 (6.75)	<0.001
Share females with college degree or higher	27.83 (16.15)	17.10 (11.07)	<0.001

Notes: SD=standard deviation, AC=doxorubicin plus cyclophosphamide, ACT=doxorubicin plus cyclophosphamide followed by paclitaxel.

[a]Significance level is based on tests of equality of means for continuous variables, and is determined by the *t*-test; for the categorical variables it is based on the test for statistical independence, and is determined by the Likelihood Ratio Chi-square test.

[b]Women who did not have neoadjuvant chemotherapy.

[c]Women who initiated AC or ACT chemotherapy, but did not have neoadjuvant therapy.

[d]Women who completed ACT or ACT, did not have neoadjuvant therapy, and did not have surgery after chemotherapy began.

Table 2. Likelihood of late stage cancer and tumors ≥2 cm, women with breast cancer age 21 to 64 years, 1999-2006 (OR and 95% CI[a])

Independent variables	AJCC regional stage	*p*-value	Tumor size ≥2 cm	*p*-value
	Insured, N=1121 Uninsured, N=213		Insured, N=865 Uninsured, N=167	
	(1)		(2)	
Model 1: Controlling for patient characteristics				
Insured	0.72 (0.52 to 1.01)	0.06	0.51 (0.36 to 0.74)	<0.001
Uninsured	1.0 (referent)		1.0 (referent)	
Black	1.39 (1.08 to 1.81)	0.01	1.52 (1.13 to 2.04)	0.01
Non-Black	1.0 (referent)		1.0 (referent)	
Married	1.07 (0.83 to 1.38)	0.61	1.04 (0.78 to 1.39)	0.79
Unmarried	1.0 (referent)		1.0 (referent)	
Age at diagnosis	0.97 (0.95 to 0.98)	<0.001	0.97 (0.95 to 0.98)	<0.001
	Pseudo R^2 = 0.02		Pseudo R^2 = 0.04	
Model 2: Controlling for census tract characteristics added to Model 1[b]				
Insured	0.71 (0.51 to 0.99)	0.04	0.53 (0.37 to 0.77)	0.001
Uninsured	1.0 (referent)		1.0 (referent)	
Black	1.42 (1.05 to 1.93)	0.02	1.44 (1.00 to 2.06)	0.05
Non-Black	1.0 (referent)		1.0 (referent)	
Married	1.07 (0.82 to 1.38)	0.62	1.04 (0.78 to 1.40)	0.77
Unmarried	1.0 (referent)		1.0 (referent)	
Age at diagnosis	0.97 (0.95 to 0.98)	<0.001	0.97 (0.95 to 0.98)	<0.001
Median income	0.89 (0.76 to 1.05)	0.17	0.95 (0.78 to 1.16)	0.63
Share families headed by unmarried females	1.01 (0.99 to 1.04)	0.21	1.02 (0.99 to 1.05)	0.21
Share black race	1.00 (0.99 to 1.01)	0.50	0.99 (0.98 to 1.00)	0.18
Share total owner occupied housing	1.01 (1.00 to 1.02)	0.17	1.01 (0.99 to 1.02)	0.24
Share females with some college	1.00 (0.98 to 1.03)	0.72	0.99 (0.96 to 1.02)	0.46
Share females with college degree or higher	1.01 (1.00 to 1.02)	0.36	1.00 (0.98 to 1.02)	0.90
Median gross value of owner occupied housing	0.99 (0.94 to 1.04)	0.76	0.96 (0.90 to 1.03)	0.27
Share of housing without a vehicle	0.99 (0.96 to 1.03)	0.21	0.99 (0.97 to 1.02))	0.59
	Pseudo R^2 = 0.03		Pseudo R^2 = 0.05	
Model 3: Census tract dichotomous variables added to Model 1[c]				
	Insured, N=951 Uninsured, N=168		Insured, N=677 Uninsured, N=118	
Insured	0.65 (0.42 to 1.00)	0.05	0.53 (0.31 to 0.89)	0.02
Uninsured	1.0 (referent)		1.0 (referent)	
	Pseudo R^2 = 0.10		Pseudo R^2 = 0.11	

Notes: OR=odds ratio, CI=confidence interval, AJCC=American Joint Committee on Cancer.
[a]CI's are based on robust standard errors.
[b]Median values (income and gross value of owner housing) were divided by $10,000. Shares range from 0 to 100.
[c]Control variables in not listed for Model 3 are the same as in Model 1. Coefficients for individual census tracts are not reported.

Table 3. Days until surgery and likelihood of a 90 day delay from diagnosis to surgery (OR and 95% CI), women with breast cancer age 21 to 64 years, 1999-2006

Independent variables	Days from diagnosis to surgery (all patients)	*p*-value	Days from diagnosis to surgery (excludes simultaneous diagnosis and surgery date)	*p*-value	Delay of 90 or more days from diagnosis to surgery	*p*-value
	Insured, N=1077 Uninsured, N=184		Insured, N=774 Uninsured, N=136		Insured, N=1077 Uninsured, N=184	
	(1)		(2)		(3)	
	Model 1: Controlling for patient characteristics					
Insured	-15.83 (4.11)	<0.001	-21.09 (4.83)	<0.001	0.34 (0.17 to 0.69)	0.003
Uninsured	(referent)		(referent)		1.0 (referent)	
Black	3.69 (2.27)	0.10	7.37 (2.66)	0.01	2.04 (1.06 to 3.94)	0.03
Non-Black	(referent)		(referent)		1.0 (referent)	
Married	-3.13 (2.03)	0.12	-2.01 (2.33)	0.39	0.73 (0.40 to 1.36)	0.33
Unmarried	(referent)		(referent)		1.0 (referent)	
Age at diagnosis	0.17 (0.11)	0.14	0.15 (0.13)	0.25	1.02 (0.98 to 1.06)	0.32
Stage 0	(referent)		(referent)		1.0 (referent)	
Stage I	5.42 (3.19)	0.09	1.86 (3.77)	0.62	2.03 (0.69 to 5.95)	0.20
Stage II	4.87 (3.55)	0.17	1.50 (4.21)	0.72	1.65 (0.57 to 4.81)	0.36
Stage III	9.62 (6.41)	0.13	16.83 (8.19)	0.04	4.89 (1.51 to 15.79)	0.01
Tumor size <2 cm	(referent)		(referent)		1.0 (referent)	
Tumor size 2-5 cm	1.72 (2.90)	0.55	-0.61 (3.43)	0.86	1.02 (0.40 to 2.56)	0.98
Tumor size >5 cm	0.21 (7.21)	0.98	-0.96 (9.28)	0.92	1.89 (0.45 to 7.91)	0.38
Tumor size missing	9.00 (3.51)	0.01	9.95 (4.82)	0.02	2.07 (0.83 to 5.14)	0.12
	R^2=0.06		R^2=0.11		Pseudo R^2 = 0.10	
	Model 2: Controlling for census tract characteristics added to Model 1[a]					
Insured	-15.96 (4.19)	<0.001	-20.87 (4.89)	<0.001	0.37 (0.18 to 0.75)	0.01
Uninsured	(referent)		(referent)		1.0 (referent)	
	R^2=0.07		R^2=0.12		Pseudo R^2 = 0.12	
	Model 3: Census tract dichotomous variables added to Model 1[a,b]					
					Insured, N=285 Uninsured, N=75	
Insured	-15.53 (5.20)	0.003	-18.62 (6.71)	0.01	0.39 (0.15 to 1.00)	0.05
Uninsured	(referent)		(referent)		1.0 (referent)	
	R^2=0.34		R^2=0.40		Pseudo R^2 = 0.27	

Notes: Robust standard errors are shown in parentheses in columns 1 and 2. OR=odds ratio, CI=confidence interval. CI's in column 3 are based on robust standard errors.

[a]Models 2 and 3 control for race (black or non-black), age at diagnosis (continuous), marital status (married or unmarried), AJCC cancer stage (0, I, II, or III), and tumor size (<2 cm, 2 to 5 cm, or ≥5 cm). Census tract characteristics included in Model 2 are the same as those reported for Model 2 in Table 2. Odds ratios for these variables are not reported.

[b]Coefficients for individual census tracts are not reported.

Table 4. Likelihood of initiating and completing chemotherapy, women with breast cancer age 21 to 64 years, 1999-2006 (OR and 95% CI)

Independent variables	Initiated chemotherapy	*p*-value	Completed chemotherapy (AC or ACT)	*p*-value	Any delay in chemotherapy (AC or ACT)	*p*-value
	Insured, N=1121 Uninsured, N=213		Insured, N=415 Uninsured, N=111		Insured, N=335 Uninsured, N=67	
	(1)		(2)		(3)	
	Model 1: Controlling for patient characteristics					
Insured	0.73 (0.45 to 1.78)	0.20	1.84 (0.92 to 3.70)	0.09	0.36 (0.20 to 0.68)	0.001
Uninsured	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Black	0.83 (0.57 to 1.19)	0.31	1.30 (0.70 to 2.41)	0.41	0.84 (0.50 to 1.42)	0.52
Non-Black	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Married	1.03 (0.73 to 1.45)	0.88	1.13 (0.62 to 2.07)	0.69	0.85 (0.53 to 1.36)	0.49
Unmarried	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Age at diagnosis	0.95 (0.93 to 0.97)	<0.001	0.98 (0.95 to 1.02)	0.34	0.98 (0.96 to 1.01)	0.23
Mastectomy	1.34 (0.93 to 1.91)	0.17	1.10 (0.64 to 1.89)	0.73	0.88 (0.56 to 1.38)	0.57
Late stage	20.78 (13.56 to 31.84)	<0.001	0.38 (0.18 to 0.83)	0.02	0.49 (0.29 to 0.85)	0.01
Tumor size <2 cm	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Tumor size 2-5 cm	0.79 (0.47 to 1.34)	0.38	2.00 (1.00 to 3.99)	0.05	1.30 (0.75 to 2.27)	0.35
Tumor size >5 cm	2.80 (0.72 to 10.90)	0.14	0.33 (0.14 to 0.76)	0.01	4.05 (1.36 to 12.06)	0.01
Tumor size missing	0.13 (0.09 to 0.20)	<0.001	0.97 (0.37 to 2.55)	0.94	0.71 (0.28 to 1.82)	0.48
Shortest distance to facility	0.995 (0.988 to 1.00)	0.06	1.00 (0.99 to 1.01)	0.77	1.00 (0.28 to 1.82)	0.49
	Pseudo R^2 = 0.39		Pseudo R^2 = 0.18		Pseudo R^2 = 0.06	
	Model 2: Census tract characteristics added to Model 1[a]					
Insured	0.70 (0.42 to 1.13)	0.14	1.77 (0.86 to 3.65)	0.12	0.36 (0.18 to 0.70)	0.002
Uninsured	1.0 (referent)		1.0 (referent)			
Shortest distance to facility	1.00 (0.99 to 1.00)	0.20	1.00 (0.99 to 1.01)	0.59	1.00 (1.00 to 1.01)	0.35
	Pseudo R^2 = 0.39		Pseudo R^2 = 0.10		Pseudo R^2 = 0.08	
	Model 3: Census tract dichotomous variables added to Model 1[a,b]					
	Insured, N=933 Uninsured, N=169		Insured, N=131 Uninsured, N=47		Insured, N=183 Uninsured, N=34	
Insured	0.54 (0.26 to 1.14)	0.11	2.51 (0.74 to 8.52)	0.14	0.14 (0.04 to 0.55)	0.01
Uninsured	1.0 (referent)		1.0 (referent)		1.0 (referent)	
Shortest distance to facility	0.99 (0.98 to 1.00)	0.07	1.04 (0.97 to 1.11)	0.30	1.05 (1.00 to 1.09)	0.03
	Pseudo R^2 = 0.50		Pseudo R^2 = 0.29		Pseudo R^2 = 0.21	

Notes: OR=odds ratio, CI=confidence interval. CI's are based on robust standard errors. AC= doxorubicin plus cyclophosphamide, ACT= doxorubicin plus cyclophosphamide followed by paclitaxel.

[a]Models 2 and 3 control for race (black or non-black), age at diagnosis (continuous), marital status (married or unmarried), late stage, and tumor size (<2 cm, 2 to 5 cm, or ≥5 cm). Census tract characteristics included in Model 2 are the same as those reported for Model 2 in Table 2. Odds ratios for these variables are not reported.

[b]Coefficients for individual census tracts are not reported.

Table 5. Days until chemotherapy and days until chemotherapy completion, women with breast cancer age 21 to 64 years, 1999-2006

Independent variables	Days from surgery to chemotherapy initiation	*p*-value	Days from chemotherapy initiation to completion, AC	*p*-value	Days from chemotherapy initiation to completion, ACT	*p*-value
	Insured, N=387 Uninsured, N=87		Insured, N=210 Uninsured, N=37		Insured, N=107 Uninsured, N=26	
	(1)		(2)		(3)	
	Model 1: Controlling for patient characteristics					
Insured	-17.90 (5.79)	0.002	-4.29 (1.68)	0.01	-23.57 (7.29)	0.002
Uninsured	(referent)		(referent)		(referent)	
Black	10.41 (3.78)	0.01	-0.99 (0.96)	0.31	2.80 (6.14)	0.65
Non-Black	(referent)		(referent)		(referent)	
Married	0.17 (3.51)	0.96	0.55 (0.97)	0.57	-9.41 (6.51)	0.15
Unmarried	(referent)		(referent)		(referent)	
Age at diagnosis	0.21 (0.18)	0.25	-0.01 (0.05)	0.98	-0.08 (0.31)	0.80
Mastectomy	3.31 (3.03)	0.28	-0.93 (0.77)	0.23	-3.13 (5.13)	0.54
Late stage	-3.94 (3.38)	0.25	-2.89 (0.84)	0.001	-23.00 (13.86)	0.10
Tumor size <2 cm	(referent)		(referent)		(referent)	
Tumor size 2-5 cm	-1.62 (3.20)	0.61	1.19 (0.84)	0.16	-1.94 (5.75)	0.74
Tumor size >5 cm	-0.26 (9.13)	0.98	7.48 (11.50)	0.52	15.93 (13.85)	0.25
Tumor size missing	5.26 (5.76)	0.36	-0.18 (1.62)	0.91	17.58 (13.75)	0.20
Shortest distance to facility	0.02 (0.04)	0.74	0.01 (0.02)	0.71	0.02 (0.05)	0.74
	$R^2 = 0.10$		$R^2 = 0.10$		$R^2 = 0.23$	
	Model 2: Census tract characteristics added to Model 1[a]					
Insured	-17.52 (5.73)	0.002	-4.11 (1.78)	0.02	-16.17 (7.31)	0.03
Uninsured	(referent)		(referent)			
Shortest distance to facility	0.01 (0.5)	0.79	0.01 (0.02)	0.76	0.01 (0.06)	0.90
	$R^2 = 0.11$		$R^2 = 0.15$		$R^2 = 0.33$	
	Model 3: Census tract dichotomous variables added to Model 1[a,b]					
Insured	-23.09 (10.31)	0.03	-4.85 (3.56)	0.18	0.47 (24.09)	0.98
Uninsured	(referent)		(referent)		(referent)	
Shortest distance to facility	-0.05 (0.11)	0.61	0.16 (0.15)	0.30	-0.08 (0.14)	0.61
	$R^2 = 0.53$		$R^2 = 0.81$		$R^2 = 0.84$	

Notes: AC= doxorubicin plus cyclophosphamide, ACT= doxorubicin plus cyclophosphamide followed by paclitaxel. Robust standard errors shown in parentheses.

[a]Models 2 and 3 control for race (black or non-black), age at diagnosis (continuous), marital status (married or unmarried), late stage, and tumor size (<2 cm, 2 to 5 cm, or ≥5 cm). Census tract characteristics included in Model 2 are the same as those reported for Model 2 in Table 2. Odds ratios for these variables are not reported.

[b]Coefficients for individual census tracts are not reported.

Table 6. Likelihood of completing chemotherapy (OR and 95% CI), days until chemotherapy initiation, and days until chemotherapy completion, women with breast cancer age 21 to 64 years, 1999-2006, Downtown Facility Only[a]

Independent variables	Completed chemotherapy (AC or ACT)	*p*-value	Any delay in chemotherapy (AC or ACT)	*p*-value	Days from surgery to chemotherapy initiation	*p*-value	Days from chemotherapy initiation to chemotherapy completion, AC	*p*-value	Days from chemotherapy initiation to chemotherapy completion, ACT	*p*-value
	Insured, N=202 Uninsured, N=107		Insured, N=159 Uninsured, N=65		Insured, N=187 Uninsured, N=85		Insured, N=101 Uninsured, N=35		Insured, N=46 Uninsured, N=26	
	(1)		(2)		(3)		(4)		(5)	
	Model 1: Controlling for patient characteristics									
Insured	1.96 (0.78 to 3.42)	0.20	0.35 (0.18 to 0.69)	0.002	-19.25 (6.17)	0.002	-5.18 (1.90)	0.01	-14.65 (7.21)	0.05
Uninsured	1.0 (referent)		1.0 (referent)		(referent)		(referent)		(referent)	
Black	1.55 (0.79 to 306)	0.21	0.89 (0.46 to 1.72)	0.73	12.55 (4.93)	0.01	-0.93 (1.44)	0.52	-1.05 (7.19)	0.88
Non-Black	1.0 (referent)		1.0 (referent)		(referent)		(referent)		(referent)	
Married	0.93 (0.44 to 1.96)	0.69	0.86 (0.45 to 1.64)	0.64	6.21 (5.47)	0.26	0.12 (1.68)	0.94	-10.23 (8.04)	0.21
Unmarried	1.0 (referent)		1.0 (referent)		(referent)		(referent)		(referent)	
Age at diagnosis	0.98 (0.94 to 1.02)	0.25	1.00 (0.96 to 1.04)	0.87	0.31 (0.25)	0.21	-0.01 (0.06)	0.94	0.24 (0.37)	0.52
Mastectomy	0.83 (0.43 to 1.60)	0.59	0.96 (0.52 to 1.78)	0.89	4.73 (4.81)	0.33	-1.18 (1.22)	0.34	-6.73 (6.61)	0.31
Late stage	0.33 (0.12 to 0.88)	0.02	0.39 (0.18 to 0.84)	0.02	-2.58 (5.12)	0.62	-4.34 (1.11)	<0.001	-32.74 (14.46)	0.03
Tumor size <2 cm	1.0 (referent)		1.0 (referent)		(referent)		(referent)		(referent)	
Tumor size 2-5 cm	2.14 (0.89 to 5.12)	0.09	2.37 (1.08 to 5.18)	0.03	-5.36 (5.13)	0.30	1.97 (1.22)	0.11	-6.12 (8.32)	0.47
Tumor size >5 cm	0.37 (0.13 to 1.07)	0.07	8.11 (1.92 to 34.31)	0.004	-12.51 (12.34)	0.31	-3.92 (6.37)	0.54	25.83 (17.76)	0.15
Tumor size missing	1.18 (0.34 to 4.10)	0.79	1.11 (0.34 to 3.58)	0.86	4.07 (8.46)	0.63	1.49 (3.02)	0.62	3.96 (10.93)	0.72
Miles to Dalton	1.00 (0.99 to 1.01)	0.43	1.00 (0.99 to 1.01)	0.57	-0.02 (0.07)	0.75	0.01 (0.02)	0.41	-0.06 (0.06)	0.31
	Pseudo $R^2 = 0.10$		Pseudo $R^2 = 0.09$		$R^2 = 0.13$		$R^2 = 0.15$		$R^2 = 0.28$	
	Model 2: Census tract characteristics added to Model 1[b]									
Insured	1.68 (0.76 to 3.71)	0.20	0.35 (0.17 to 0.73)	0.01	-17.52 (5.73)	0.002	-5.47 (1.97)	0.01	-8.65 (7.47)	0.25
Uninsured	1.0 (referent)				(referent)		(referent)			
	Pseudo $R^2 = 0.14$		Pseudo $R^2 = 0.11$		$R^2 = 0.11$		$R^2 = 0.19$		$R^2 = 0.45$	

Notes: OR=odds ratio, CI=confidence interval. CI's in columns 1 and 2 are based on robust standard errors. Robust standard errors are shown in parentheses in columns 3-5. AC= doxorubicin plus cyclophosphamide, ACT= doxorubicin plus cyclophosphamide followed by paclitaxel.

[a]The specification with census tract dummy variables (Model 3 in Tables 2-5) is not estimated for the subsample treated at the downtown facility only due to limitations on the sample sizes.

[b]Model 2 also controls for race (black or non-black), age at diagnosis (continuous), marital status (married or unmarried), AJCC cancer stage (0, I, II, or III), tumor size (<2 cm, 2 to 5 cm, or ≥5 cm), and miles to Dalton, as well as the census tract characteristics reported for Model 2 in Table 2. Coefficients for these variables are not reported.