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

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.

The Institute of Medicine's 2004 report, *Insuring America's Health: Principles and Recommendations*, highlighted the sub-par health care of uninsured people (then approximately 43 million people) and called for universal health insurance (Institute of Medicine 2004). Instead of universal coverage, the United States 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 in 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 patients. There is not a single repository of claims data (e.g., Medicaid, Medicare, or private insurer) that documents treatment history of the uninsured population. Thus, treatment patterns observed at a large safety-net provider may offer the best evidence to study differences between insured and uninsured patients.

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 rates than insured patients, the reasons for

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this disparity are unknown because of the absence of detailed information on treatment (e.g., treatments prescribed and completed).

Safety-net providers often are 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 United States (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 et al. 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 the 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, Given, and Roberts 2002; Anderson et al. 2007; Schootman et al. 2007; Taplin et al. 2004). These factors also are 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, Kirby, and Bond Huie 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 census tract level 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 health care 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 under-insured) 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 that 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—both of which are strong predictors of breast cancer survival (Smigal et al. 2006; Carter, Allen, and Henson 1989; Rosenberg, Chia, and Plevritis 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* (ICD-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 three months prior to diagnosis and 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 who 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 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 newly diagnosed cancer cases 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, including the initiation of chemotherapy.

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 nearly all women qualify for Medicare coverage at age 65. Because we were interested in the timing of surgery and outpatient chemotherapy, we excluded patients who died within one year of diagnosis ($n=17$), had no evidence of surgery ($n=31$), or had a bone marrow transplant ($n=12$).[3] 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 addresses 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 who 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 who 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).[4]

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 who complet-

ed 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 four courses of AC or eight courses of ACT. In our analysis of chemotherapy completion, we limited the sample to patients who received all of their chemotherapy at VCUHS ($n=526$) to ensure that we had complete data.[5] 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 as 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, compared to insured patients, uninsured patients may have to travel farther to a 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 were to be treated. The shortest distance for insured patients was the 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 also was 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, the percentage of women with some college and the percentage of women with a college degree or higher (relative to the percentage of women with a high school or less education), median value of owner-occupied housing, the percentage of families headed by unmarried women, the percentage of owner-occupied housing, the percentage of blacks residing in the census tract, and the percentage of households without a motor vehicle.

Finally, Model 3 instead 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 dropped 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 received care. To address this potential source of bias, we repeated 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 must be 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 at an advanced cancer stage and with 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. Compared to insured women, uninsured women had considerably longer times from diagnosis to surgery (24 or 19 days longer 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 days or more from diagnosis to surgery (23% versus 3%). Once chemotherapy was initiated, insured women were more likely to complete chemotherapy.

Among women who completed chemotherapy, uninsured women took longer to complete chemotherapy (approximately four and 32 days longer for AC and ACT, respectively). AC is expected to be completed 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, higher gross value of housing, and greater shares of owner-occupied housing and women with a college degree; these tracts had fewer families headed by unmarried women, fewer homes without a motor vehicle, and lower proportions of blacks relative to census tracts where uninsured women resided. However, despite differences in census tract of residence, insured and uninsured women faced similar distances to the closest clinic for chemotherapy treatment. The mean distance was 22 miles for insured women and 25 miles for uninsured women; the medians were 11 miles for insured women and 10 miles for uninsured women.

Table 2 reports results from logistic regressions for regional AJCC stage and tumor size $\geq$2 cm. In the Model 1 estimates, insured women were less likely to be diagnosed with regional stage disease (odds ratio [OR]=.72, p=.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=.65, p=.05). In column 2, the estimates for Models 1 to 3 all indicate that insured women were only about half as likely to be diagnosed with a tumor $\geq$2 cm than were uninsured women; the estimates are similar across all models (e.g., OR=.53, p=.02 in Model 3). Consistent with the literature, the estimates indicate that African-American women were 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 ordinary least squares (OLS) estimates of models for days from diagnosis to surgery for all women and women who received their diagnosis on the same day as surgery. The estimates in column 1 indicate that uninsured women received their surgery 16 days later than insured women (p<.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 were much less likely to experience such a delay relative to uninsured women (OR=.34, 95% confidence interval [CI]= .17 to .69). This estimate was robust across the three models, including Model 3 where the sample size dramatically decreased from 1,261 to 360 due to the inclusion of census tract dummy variables.[6]

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

	Private/military insurance (*N*=1,121)		Uninsured (*N*=213)		
	Number	%	Number	%	*p*-value[a]
Patient and clinical characteristics					
Race					<.001
Non-black	866	77.25	81	38.03	
Black	255	22.75	132	61.97	
Marital status					<.001
Married	814	69.01	66	30.99	
Unmarried	307	27.39	147	69.01	
Stage					.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					<.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	.001
90-day delay between diagnosis and surgery[b]	31	2.88	50	23.47	
Any chemotherapy	581	51.83	131	61.50	.001
Completed chemotherapy, AC or ACT (*N*=526)	369	88.92	90	81.08	.03
Completed AC within 64 days[b] (*N*=247)	133	68.03	17	43.59	.02
Completed ACT within 148 days[b] (*N*=133)	84	68.85	9	34.62	.001
	Mean		Mean		
Age	50.35 (7.62)		49.58 (9.05)		.16
Days from diagnosis to surgery (*N*=1,261), all patients[b]	24.42 (27.46)		43.13 (48.98)		<.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)		<.001
Days from surgery to chemotherapy initiation (*N*=474)[c]	48.85 (25.51)		69.48 (47.32)		<.001
Days from first chemotherapy to last chemotherapy[d]					
AC (*N*=247)	65.50 (6.15)		69.41 (8.14)		<.001
ACT (*N*=133)	127.62 (27.40)		159.62 (36.39)		<.001
Shortest distance to facility	21.59 (27.55)		24.64 (29.85)		.15
Census tract characteristics					
Median income	$53,259 ($21,546)		$37,856 ($14,296)		<.001
Median gross value of owner-occupied homes	$130,566 ($59,450)		$92,578 ($34,561)		<.001
Share of families headed by unmarried females	9.49 (7.49)		17.07 (12.21)		<.001
Share black	24.53 (23.73)		48.03 (30.52)		<.001
Share of housing owner-occupied	77.35 (17.38)		64.39 (21.63)		<.001
Share of households without a vehicle	6.50 (7.10)		14.03 (14.40)		<.001
Share of females with high school or less education	43.81 (17.29)		55.81 (14.09)		<.001
Share of females with some college	28.36 (5.67)		27.09 (6.75)		<.001
Share of females with college degree or higher	27.83 (16.15)		17.10 (11.07)		<.001

Notes: Standard deviations are in parentheses. 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 ages 21 to 64, 1999–2006

	(1) AJCC regional stage			(2) Tumor size ≥2 cm		
Independent variables	OR	95% CI[a]	***p*-value**	OR	95% CI	***p*-value**
Model 1: Controlling for patient characteristics						
Insured	.72	.52 to 1.01	.06	.51	.36 to .74	<.001
Uninsured	1.0	Referent		1.0	Referent	
Black	1.39	1.08 to 1.81	.01	1.52	1.13 to 2.04	.01
Non-black	1.0	Referent		1.0	Referent	
Married	1.07	.83 to 1.81	.61	1.04	.78 to 1.39	.79
Unmarried	1.0	Referent		1.0	Referent	
Age at diagnosis	.97	.95 to .98	<.001	.97	.95 to .98	<.001
	Pseudo R^2 = .02			Pseudo R^2 = .04		
Model 2: Controlling for census tract characteristics added to Model 1[b]						
Insured	.71	.51 to .99	.04	.53	.37 to .77	.001
Uninsured	1.0	Referent		1.0	Referent	
Black	1.42	1.05 to 1.93	.02	1.44	1.00 to 2.06	.05
Non-black	1.0	Referent		1.0	Referent	
Married	1.07	.82 to 1.38	.62	1.04	.78 to 1.40	.77
Unmarried	1.0	Referent		1.0	Referent	
Age at diagnosis	.97	.95 to .98	<.001	.97	.95 to .98	<.001
Median income	.89	.76 to 1.05	.17	.95	.78 to 1.16	.63
Share families headed by unmarried females	1.01	.99 to 1.04	.21	1.02	.99 to 1.05	.21
Share black	1.00	.99 to 1.01	.50	.99	.98 to 1.00	.18
Share of housing owner-occupied	1.01	1.00 to 1.02	.17	1.01	.99 to 1.02	.24
Share of females with some college	1.00	.98 to 1.03	.72	.99	.96 to 1.02	.46
Share of females with college degree or higher	1.01	1.00 to 1.02	.36	1.00	.98 to 1.02	.90
Median gross value of owner-occupied housing	.99	.94 to 1.04	.76	.96	.90 to 1.03	.27
Share of households without a vehicle	.99	.96 to 1.03	.21	.99	.97 to 1.02	.59
	Pseudo R^2 = .03			Pseudo R^2 =.05		
Model 3: Census tract dichotomous variables added to Model 1[c]						
Insured	.65	.42 to 1.00	.05	.53	.31 to .89	.02
Uninsured	1.0	Referent		1.0	Referent	
	Pseudo R^2 = .10			Pseudo R^2 =.11		

Notes: OR=odds ratio, CI=confidence interval, AJCC=American Joint Committee on Cancer. For AJCC regional stage, N=1,121 insured, and N=213 uninsured for Models 1 and 2; N=951 insured, and N=168 uninsured for Model 3. For tumor size ≥ 2 cm, N=865 insured, and N=167 uninsured for Models 1 and 2; N=677 insured, and N=118 uninsured for Model 3.
[a] CIs 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 not listed for Model 3 are the same as in Model 1. Coefficients for individual census tracts are not reported.

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 that the insured women were less likely to have a delay in chemotherapy completion (OR=.36, p<.01, for Models 1 and 2). The estimated difference in the likelihood of delay was even larger when individual census tract controls were added in Model 3 (OR=.14, p=.01).

Table 5 addresses the timeliness with which treatments were delivered and completed. The

Table 3. Days until surgery and likelihood of a 90-day delay from diagnosis to surgery, women with breast cancer ages 21 to 64, 1999–2006

Independent variables	(1) Days from diagnosis to surgery (all patients)	*p*-value	(2) Days from diagnosis to surgery (excludes simultaneous diagnosis and surgery date)	*p*-value	(3) Delay of 90 or more days from diagnosis to surgery		*p*-value
					OR	95% CI	
Model 1: Controlling for patient characteristics							
Insured	−15.83 (4.11)	<.001	−21.09 (4.83)	<.001	.34	.17 to .69	.003
Uninsured	Referent		Referent		1.0	Referent	
Black	3.69 (2.27)	.10	7.37 (2.66)	.01	2.04	1.06 to 3.94	.03
Non-black	Referent		Referent		1.0	Referent	
Married	−3.13 (2.03)	.12	−2.01 (2.33)	.39	.73	.40 to 1.36	.33
Unmarried	Referent		Referent		1.0	Referent	
Age at diagnosis	.17 (.11)	.14	.15 (.13)	.25	1.02	.98 to 1.06	.32
Stage 0	Referent		Referent		1.0	Referent	
Stage I	5.42 (3.19)	.09	1.86 (3.77)	.62	2.03	.69 to 5.95	.20
Stage II	4.87 (3.55)	.17	1.50 (4.21)	.72	1.65	.57 to 4.81	.36
Stage III	9.62 (6.41)	.13	16.83 (8.19)	.04	4.89	1.51 to 15.79	.01
Tumor size <2 cm	Referent		Referent		1.0	Referent	
Tumor size 2–5 cm	1.72 (2.90)	.55	−.61 (3.43)	.86	1.02	.40 to 2.56	.98
Tumor size ≥5 cm	.21 (7.21)	.98	−.96 (9.28)	.92	1.89	.45 to 7.91	.38
Tumor size missing	9.00 (3.51)	.01	9.95 (4.82)	.02	2.07	.83 to 5.14	.12
	R^2=.06		R^2=.11		Pseudo R^2 = .10		
Model 2: Controlling for census tract characteristics added to Model 1[a]							
Insured	−15.96 (4.19)	<.001	−20.87 (4.89)	<.001	.37	.18 to .75	.01
Uninsured	Referent		Referent		1.0	Referent	
	R^2=.07		R^2=.12		Pseudo R^2 = .12		
Model 3: Census tract dichotomous variables added to Model 1[a,b]							
Insured	−15.53 (5.20)	.003	−18.62 (6.71)	.01	.39	.15 to 1.00	.05
Uninsured	Referent		Referent		1.0	Referent	
	R^2=.34		R^2=.40		Pseudo R^2 = .27		

Notes: Robust standard errors are shown in parentheses in columns 1 and 2. OR=odds ratio, CI=confidence interval. CIs in column 3 are based on robust standard errors. In column 1, N=1,077 insured, N=183 uninsured for all models; in column 2, N=774 insured, N=136 for all models; in column 3, N=1,077 insured, N=184 uninsured for Models 1 and 2, and N=285 insured, N=75 for Model 3.

[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. Estimates 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 ages 21 to 64, 1999–2006

Independent variables	(1) Initiated chemotherapy OR	95% CI	*p*-value	(2) Completed chemotherapy (AC or ACT) OR	95% CI	*p*-value	(3) Any delay in chemotherapy (AC or ACT) OR	95% CI	*p*-value
Model 1: Controlling for patient characteristics									
Insured	.73	.45 to 1.78	.20	1.84	.92 to 3.70	.09	.36	.20 to .68	.001
Uninsured	1.0	Referent		1.0	Referent		1.0	Referent	
Black	.83	.57 to 1.19	.31	1.30	.70 to 2.41	.41	.84	.50 to 1.42	.52
Non-black	1.0	Referent		1.0	Referent		1.0	Referent	
Married	1.03	.73 to 1.45	.88	1.13	.62 to 2.07	.69	.85	.53 to 1.36	.49
Unmarried	1.0	Referent		1.0	Referent		1.0	Referent	
Age at diagnosis	.95	.93 to .97	<.001	.98	.95 to 1.02	.34	.98	.96 to 1.01	.23
Mastectomy	1.34	.93 to 1.91	.17	1.10	.64 to 1.89	.73	.88	.56 to 1.38	.57
Late stage	20.78	13.56 to 31.84	<.001	.38	.18 to .83	.02	.49	.29 to .85	.01
Tumor size <2 cm	1.0	Referent		1.0	Referent		1.0	Referent	
Tumor size 2–5 cm	.79	.47 to 1.34	.38	2.00	1.00 to 3.99	.05	1.30	.75 to 2.27	.35
Tumor size ≥5 cm	2.80	.72 to 10.90	.14	.33	.14 to .76	.01	4.05	1.36 to 12.06	.01
Tumor size missing	.13	.09 to .20	<.001	.97	.37 to 2.55	.94	.71	.28 to 1.82	.48
Shortest distance to facility	.995	.988 to 1.00	.06	1.00	.99 to 1.01	.77	1.00	.28 to 1.82	.49
	Pseudo R^2 = .39			Pseudo R^2 = .18			Pseudo R^2 = .06		
Model 2: Census tract characteristics added to Model 1[a]									
Insured	.70	.42 to 1.13	.14	1.77	.86 to 3.65	.12	.36	.18 to .70	.002
Uninsured	1.0	Referent		1.0	Referent				
Shortest distance to facility	1.00	.99 to 1.00	.20	1.00	.99 to 1.01	.59	1.00	1.00 to 1.01	.35
	Pseudo R^2 = .39			Pseudo R^2 = .10			Pseudo R^2 = .08		
Model 3: Census tract dichotomous variables added to Model 1[a,b]									
Insured	.54	.26 to 1.14	.11	2.51	.74 to 8.52	.14	.14	.04 to .55	.01
Uninsured	1.0	Referent		1.0	Referent		1.0	Referent	
Shortest distance to facility	.99	.98 to 1.00	.07	1.04	.97 to 1.11	.30	1.05	1.00 to 1.09	.03
	Pseudo R^2 = .50			Pseudo R^2 = .29			Pseudo R^2 = .21		

Notes: OR=odds ratio, CI=confidence interval. CIs are based on robust standard errors. AC= doxorubicin plus cyclophosphamide, ACT= doxorubicin plus cyclophosphamide followed by paclitaxel. In column 1, N=1,121 insured, N=213 uninsured for Models 1 and 2, and N=933 insured, N=169 uninsured for Model 3; in column 2, N=415 insured, N=111 uninsured for Models 1 and 2, and N=131 insured, N=47 uninsured for Model 3; in column 3, N=335 insured, N=64 uninsured for Models 1 and 2, and N=183 insured, N=34 for Model 3.

[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. Estimates for these variables are not reported.

Table 5. Days until chemotherapy and days until chemotherapy completion, women with breast cancer ages 21 to 64, 1999–2006

Independent variables	(1) Days from surgery to chemotherapy initiation	*p*-value	(2) Days from chemotherapy initiation to completion, AC	*p*-value	(3) Days from chemotherapy initiation to completion, ACT	*p*-value
Model 1: Controlling for patient characteristics						
Insured	−17.90 (5.79)	.002	−4.29 (1.68)	.01	−23.57 (7.29)	.002
Uninsured	Referent		Referent		Referent	
Black	10.41 (3.78)	.01	−.99 (.96)	.31	2.80 (6.14)	.65
Non-black	Referent		Referent		Referent	
Married	.17 (3.51)	.96	.55 (.97)	.57	−9.41 (6.51)	.15
Unmarried	Referent		Referent		Referent	
Age at diagnosis	.21 (.18)	.25	−.01 (.05)	.98	−.08 (.31)	.80
Mastectomy	3.31 (3.03)	.28	−.93 (.77)	.23	−3.13 (5.13)	.54
Late stage	−3.94 (3.38)	.25	−2.89 (.84)	.001	−23.00 (13.86)	.10
Tumor size <2 cm	Referent		Referent		Referent	
Tumor size 2–5 cm	−1.62 (3.20)	.61	1.19 (.84)	.16	−1.94 (5.75)	.74
Tumor size ≥5 cm	−.26 (9.13)	.98	7.48 (11.50)	.52	15.93 (13.85)	.25
Tumor size missing	5.26 (5.76)	.36	−.18 (1.62)	.91	17.58 (13.75)	.20
Shortest distance to facility	.02 (.04)	.74	.01 (.02)	.71	.02 (.05)	.74
	R^2 = .10		R^2 = .10		R^2 = .23	
Model 2: Census tract characteristics added to Model 1[a]						
Insured	−17.52 (5.73)	.002	−4.11 (1.78)	.02	−16.17 (7.31)	.03
Uninsured	Referent		Referent			
Shortest distance to facility	.01 (.5)	.79	.01 (.02)	.76	.01 (.06)	.90
	R^2 = .11		R^2 = .15		R^2 = .33	
Model 3: Census tract dichotomous variables added to Model 1[a,b]						
Insured	−23.09 (10.31)	.03	−4.85 (3.56)	.18	.47 (24.09)	.98
Uninsured	Referent		Referent		Referent	
Shortest distance to facility	−.05 (.11)	.61	.16 (.15)	.30	−.08 (.14)	.61
	R^2 = .53		R^2 = .81		R^2 = .84	

Notes: AC= doxorubicin plus cyclophosphamide, ACT= doxorubicin plus cyclophosphamide followed by paclitaxel. Robust standard errors are shown in parentheses. In column 1, N=387 insured, N=87 uninsured for all models; in column 2, N=210 insured, N=37 uninsured for all models; in column 3, N=107 insured, N=26 uninsured for all models.

[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. Estimates for these variables are not reported.

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

Model 1 estimates indicate that insured women started chemotherapy approximately 18 days sooner than uninsured women ($p<.01$). Insured women also completed AC and ACT regimens four ($p=.01$) and 24 ($p<.01$) days faster, respectively, than uninsured women. When individual census tracts were 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—were 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 were very similar to their full sample counterparts in Tables 4 and 5, which suggests that differences we found between insured and uninsured women were 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 studied, insured women with breast cancer were diagnosed with smaller tumors and at earlier disease stages, and received surgery and initiated chemotherapy considerably faster than otherwise similar uninsured women; the evidence regarding whether insured women completed chemotherapy faster was more mixed, with some specifications pointing to significant differences. On the other hand, race differences in treatment-related outcomes were quite small and generally insignificant, although African-American women were 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 accounted for the diagnosis and treatment time differences between insured and uninsured women. A number of other factors could 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 could reflect poor access to care and cancer screening. The number of tumors $\geq$2 cm has been steadily declining since the 1980s—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 than are 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 differences in the timeliness of treatment persisted 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, interpretation of the results from Youssef et al.'s 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 and access to transportation, for which we have been able to control in our analysis.

The oncology clinic at the Massey Cancer Center also may be overburdened with patients, making it difficult for physicians to see patients in a timely manner. A report from the Kaiser Commission on Medicaid

Table 6. Likelihood of completing chemotherapy, days until chemotherapy initiation, and days until chemotherapy completion, women with breast cancer ages 21 to 64, 1999–2006, downtown facility only

Independent variables	(1) Completed chemotherapy (AC or ACT) OR	95% CI	*p*-value	(2) Any delay in chemotherapy (AC or ACT) OR	95% CI	*p*-value	(3) Days from surgery to chemotherapy initiation	*p*-value	(4) Days from chemotherapy initiation to chemotherapy completion, AC	*p*-value	(5) Days from chemotherapy initiation to chemotherapy completion, ACT	*p*-value
Model 1: Controlling for patient characteristics												
Insured	1.96	.78 to 3.42	.20	.35	.18 to .69	.002	−19.25 (6.17)	.002	−5.18 (1.90)	.01	−14.65 (7.21)	.05
Uninsured	1.0	Referent		1.0	Referent		Referent		Referent		Referent	
Black	1.55	.79 to 306	.21	.89	.46 to 1.72	.73	12.55 (4.93)	.01	−.93 (1.44)	.52	−1.05 (7.19)	.88
Non-black	1.0	Referent		1.0	Referent		Referent		Referent		Referent	
Married	.93	.44 to 1.96	.69	.86	.45 to 1.64	.64	6.21 (5.47)	.26	.12 (1.68)	.94	−10.23 (8.04)	.21
Unmarried	1.0	Referent		1.0	Referent		Referent		Referent		Referent	
Age at diagnosis	.98	.94 to 1.02	.25	1.00	.96 to 1.04	.87	.31 (.25)	.21	−.01 (.06)	.94	.24 (.37)	.52
Mastectomy	.83	.43 to 1.60	.59	.96	.52 to 1.78	.89	4.73 (4.81)	.33	−1.18 (1.22)	.34	−6.73 (6.61)	.31
Late stage	.33	.12 to .88	.02	.39	.18 to .84	.02	−2.58 (5.12)	.62	−4.34 (1.11)	<.001	−32.74 (14.46)	.03
Tumor size <2 cm	1.0	Referent		1.0	Referent		Referent		Referent		Referent	
Tumor size 2–5 cm	2.14	.89 to 5.12	.09	2.37	1.08 to 5.18	.03	−5.36 (5.13)	.30	1.97 (1.22)	.11	−6.12 (8.32)	.47
Tumor size ≥5 cm	.37	.13 to 1.07	.07	8.11	1.92 to 34.31	.004	−12.51 (12.34)	.31	−3.92 (6.37)	.54	25.83 (17.76)	.15
Tumor size missing	1.18	.34 to 4.10	.79	1.11	.34 to 3.58	.86	4.07 (8.46)	.63	1.49 (3.02)	.62	3.96 (10.93)	.72
Miles to Dalton	1.00	.99 to 1.01	.43	1.00	.99 to 1.01	.57	−.02 (.07)	.75	.01 (.02)	.41	−.06 (.06)	.31
	Pseudo R^2 = .10			Pseudo R^2 = .09			R^2 = .13		R^2 = .15		R^2 = .28	
Model 2: Census tract characteristics added to Model 1[a]												
Insured	1.68	.76 to 3.71	.20	.35	.17 to .73	.01	−17.52 (5.73)	.002	−5.47 (1.97)	.01	−8.65 (7.47)	.25
Uninsured	1.0	Referent		1.0	Referent		Referent		Referent		Referent	
	Pseudo R^2 = .14			Pseudo R^2 = .11			R^2 = .11		R^2 = .19		R^2 = .45	

Notes: OR=odds ratio, CI=confidence interval. CIs 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. 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.

In column 1, N=202 insured, N=107 uninsured for all models; in column 2, N=159 insured, N=65 uninsured for all models; in column 3, N=187 insured, N=85 uninsured for all models; in column 4, N=101 insured, N=35 uninsured for all models; in column 5, N=46 insured, N=26 uninsured for all models.

[a] 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.

and the Uninsured (2005) argued that safety-net spending has not kept pace with growth in the number of uninsured people and the cost of treating them, and as a result predicted an increasing strain on the ability of safety-net providers to meet health care demands placed on them.

Perhaps supportive care medications, such as those that reduce nausea and may improve tolerance to therapy, are too expensive for uninsured patients to purchase out of pocket; thus these patients may experience the toxic effects of chemotherapy at greater rates or severity than insured patients. Uninsured women also may have more noncancer-related medical conditions that interfere with recovery from surgery and chemotherapy initiation and completion. As evidence consistent with this hypothesis, we found that 22% of uninsured women were admitted to the hospital, compared with 16% of insured women ($p=.09$), and 26% had at least one emergency department (ED) visit, compared with 10% of insured women ($p<.01$); these differences were largely associated with medical conditions unrelated to cancer. (However, we only detected admissions and ED visits at VCUHS, and insured women may have been more likely to go elsewhere.) A greater prevalence among the uninsured of other medical conditions interfering with cancer treatment still would point to shortcomings of the safety-net system, although it would suggest that the differences based on insurance status were not solely attributable to differences in treatment after women were 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 designated as a National Cancer Institute 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%, $p=.09$). Evidence suggests that once uninsured women initiated therapy, they had a more difficult time completing it in a timely fashion, although this evidence was 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 three 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 was confined to a single institution. This reduces generalizability, but also avoids heterogeneity across institutions. Second, we

did 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 and employment. Third, patients who relied upon VCUHS for all of their treatment might differ (in comorbidity, severity, or recommended protocol) from patients who chose to get their chemotherapy elsewhere, especially insured women, who likely have more options.

Implications for Policy

Researchers and policymakers have proposed expanding the safety net as a way to provide access to health care for uninsured people (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 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 ultimately could affect their chances for survival and increase costs to the health care 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 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

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1 The NBCCEDP is targeted to low-income women under age 65 who are un-insured 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 This is based on authors' analysis of the Virginia data in the National Cancer Data Base http://www.facs.org/ncdbbenchmarks8.cfm. Accessed February 2007.
3 Patients who received a bone marrow transplant generally were 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.
4 For the analysis including women with simultaneous diagnosis and surgery—for those whose diagnosis and surgery were on the same day—we reset days until surgery from 0 to 1 before taking logs.
5 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.
6 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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