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Is Distance to Provider a Barrier to Care for Medicaid Patients With Breast, Colorectal, or Lung Cancer?

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Abstract

Purpose—Distance to provider might be an important barrier to timely diagnosis and treatment for cancer patients who qualify for Medicaid coverage. Whether driving time or driving distance is a better indicator of travel burden is also of interest.

Methods—Driving distances and times from patient residence to primary care provider were calculated for 3,917 breast, colorectal (CRC) and lung cancer Medicaid patients in Washington State from 1997 to 2003 using MapQuest.com. We fitted regression models of stage at diagnosis and time-to-treatment (number of days between diagnosis and surgery) to test the hypothesis that travel burden is associated with timely diagnosis and treatment of cancer.

Findings—Later stage at diagnosis for breast cancer Medicaid patients is associated with travel burden (OR = 1.488 per 100 driving miles, $P = .037$ and OR = 1.270 per driving hour, $P = .016$). Time-to-treatment after diagnosis of CRC is also associated with travel burden (14.57 days per 100 driving miles, $P = .002$ and 5.86 days per driving hour, $P = .018$).

Conclusions—Although travel burden is associated with timely diagnosis and treatment for some types of cancer, we did not find evidence that driving time was, in general, better at predicting timeliness of cancer diagnosis and treatment than driving distance. More intensive efforts at early detection of breast cancer and early treatment of CRC for Medicaid patients who live in remote areas may be needed.

Keywords

access to care; cancer; distance; health services research; insurance

Low-income populations bear a relatively high burden of travel to primary care providers (PCP) because they often reside in remote, rural areas and have limited means of transportation.[1,2] In addition, American Indians/Alaska Natives (AI/ANs), many of whom live on remote reservations, have been shown to be a particularly vulnerable group with respect to late diagnosis and are of special interest here.[3–7]

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The burden of travel from a patient's residence to his or her health care provider can be an important issue influencing access to preventive and treatment services for cancer. Adverse outcomes associated with greater distance and/or greater travel time to provider may include delay in treatment and discontinuity in follow-up care.[8] Cancer patients may be at particular risk, because delays in initiating treatment may result in more advanced and difficult-to-treat disease or in increased risk of relapse after treatment. Longer distances to treatment facilities have been associated with decreased likelihood of receiving treatment for breast cancer,[9–11] undergoing breast-conserving surgery, and with greater likelihood of later stage of diagnosis for melanoma and colorectal cancer (CRC).[12–15]

Most studies that have found associations between distance to provider and cancer diagnosis or treatment have measured distance by using either straight-line distance or driving distance based on Geographic Information System (GIS) software.[9–15] The results of one study were based on distances derived from patient surveys.[16] Because travel distances do not necessarily correlate with travel time, we used software tools to test the hypothesis that for Medicaid populations, including AI/ANs and other vulnerable groups, longer travel times to PCPs were associated with (1) later stage at cancer diagnosis, (2) less frequent receipt of recommended surgery for initial cancer treatment, and (3) for those who received recommended surgery, greater number of days between the date of cancer diagnosis and the date of surgery.

We further explored whether driving time or driving distance better predicted access to care. We hypothesized that driving time would be more important than driving distance.

Methods

Study population

The study population consisted of Washington State Medicaid enrollees ages 18–64 who were diagnosed with breast, lung, or colorectal cancer between January 1, 1997, and December 31, 2003. Incident cases of cancer among Medicaid enrollees were identified by linking the Washington State Cancer Registry (WSCR) with Medicaid enrollment files over the years of interest. The WSCR is a statewide registry of all new cancers, excluding non-melanoma skin cancers. It has been funded since 1995 through the Centers for Disease Control and Prevention's National Program of Central Cancer Registries. Because Medicaid sometimes enrolls low-income individuals shortly after a cancer diagnosis, we included individuals enrolled at any time between January 1, 1996, and December 31, 2005, who were either enrolled at the time of diagnosis or enrolled within 6 months after diagnosis. We included only those individuals (1) whose breast, lung, or colorectal cancers were their first reported malignancies, (2) for whom cancer stage information was available, and (3) who had a non-HMO Medicaid claim within 12 months after diagnosis. Such a claim demonstrated that the patient was using Medicaid benefits and that procedure-level data were available.

To address possible coding inaccuracies, missing data, and grouping of multiple individuals under the same insurance record, we used a probabilistic method to match Medicaid and WSCR databases.[17] Linking variables included Social Security number, date of birth, gender, full name, city, zip code, and race. Each linking variable was evaluated for the likelihood of the variables agreeing in a correct match and the likelihood of accidental agreement in an unmatched pair of records, and then a weight was assigned to represent the informational content contributed by each variable. The weights were used during the linking process to derive a total score that measured the statistical probability of a match. Incomplete or questionable matches identified by this method were checked by manual review.

Race

Information about patients' race was available in both the Medicaid and WSCR databases. Additionally, as part of a Tribal Registry Project, the Northwest Portland Area Indian Health Board (NPAIHB) regularly links its tribal and health records to the WSCR data to help identify misclassified AI/AN patients. The NPAIHB is a non-profit tribal advisory organization comprising 43 federally recognized tribes in Washington, Oregon, and Idaho. This linkage was updated before matching WSCR data with the Medicaid database. When we found discrepancies, we classified the patient as AI/AN, if any data source identified the patient as AI/AN. This process reduced the under-reporting of AI/AN race classification observed in many analyses using administrative and registry-derived data.

Calculation of travel burden

Travel burden was assessed by using driving time and driving distance according to the online mapping service MapQuest (http://www.mapquest.com).[18] For each patient, travel burden was measured in terms of the distance between the patient's residential ZIP code and the ZIP code of the patient's PCP.

Patient ZIP code was identified through WSCR data and reflects the patient's location at the time of diagnosis. Provider ZIP code was identified through Medicaid claims records. Provider procedure codes were searched for provider specialties that would indicate a PCP (general practice, family practice, internal medicine, and clinic). Provider ZIP code was defined as the location of the PCP specified in the claim filed closest to the time of diagnosis, searching first in the 12 months before diagnosis and then in the 12 months after diagnosis.

There are 2 kinds of ZIP codes. A 9-digit ZIP code is a point location nearly identical to the location of a mailing address. A 5-digit ZIP code is an area that encompasses all 9-digit ZIP codes that share the same first 5 digits with the 5-digit ZIP code. Nine-digit ZIP codes were used when available. Five-digit ZIP codes were used in the remaining cases. For some patients who had only 5-digit ZIP codes, the patient ZIP code and the provider ZIP code were the same. Rather than assign a distance value of zero in these cases, we used the average distance between 9-digit patient ZIP codes and 9-digit provider ZIP codes that lie within the same 5-digit ZIP code.

Stage at diagnosis

The WSCR records 4 possible values for stage at diagnosis: *in situ*, local, regional, and distant. To evaluate the association between travel burden and stage at diagnosis, we dichotomized stage as either local or regional/distant. *In situ* cases were excluded.

Likelihood of treatment

For all cancers, treatment was defined as surgical resection. Receipt of treatment was determined through (1) WSCR records of initial treatment and (2) Current Procedural Terminology (CPT) codes and International Classification of Diseases, 9th Edition (ICD-9) procedure and diagnosis codes in the Medicaid claims files for the 12 months following each patient's diagnosis (Table 1).

Time to first treatment after cancer diagnosis

Time to treatment was defined as the number of days from the date of diagnosis to the date of first treatment, according to Medicaid records. If the day of the month was missing, the 15th was the assumed date. If this assumption resulted in a negative value for time to treatment, we defined time to treatment as zero.

Analysis

We examined the association between travel burden and (1) stage at diagnosis, (2) likelihood of surgical treatment, and (3) time to first surgical treatment after diagnosis. We used multivariable logistic regression models to test the hypotheses that driving time and distance to PCP are positively associated with stage at diagnosis and with likelihood of treatment. We calculated odds ratios (ORs). All reported *P* values are 2-sided. We also used multivariable linear regression to test the hypothesis that travel burden is associated with time to first treatment. Because surgery is not always recommended for patients with distant disease, the likelihood of treatment and time-to-treatment models were restricted to patients with local or regional disease at diagnosis.

To control for confounding, our final models included age at diagnosis (continuous), gender (CRC and lung cancer models only), race, ethnicity, and diagnosis year. For the likelihood of treatment and time-to-treatment models, we also included stage at diagnosis (local or regional). As many Medicaid clients in the sample did not enroll until after their cancer diagnosis, we were not able to account for comorbidities that may have been present before diagnosis as a potential factor influencing time to first treatment. Model fit for the driving distance and driving time models was assessed by using Akaike's Information Criterion (AIC).[19] Model fit was compared for each outcome.

Results

We identified 4,413 persons ages 18–64 years who were diagnosed with breast, CRC, or lung cancer in Washington State during 1997–2003, and who were enrolled in the Medicaid program at the time of, or shortly after, diagnosis (Table 2). Only 3,917 patients had complete location and treatment information; missing information was more common among patients with lung cancer.

Of the 4,413 patients for whom we had Medicaid records, 496 (11%) lacked information on either patient residence or provider location. The excluded and included patients had nearly identical distributions for the values of race, ethnicity, surgical treatment, and stage at diagnosis. Of the remaining 3,917 patients, 274 were missing 9-digit ZIP codes. To 217 of these patients we assigned the driving distance and time between centroids of available 5-digit ZIP codes. The remaining 57 patients resided in the same 5-digit ZIP codes as their PCP's location. We assigned these patients an average driving distance of 3.02 miles and an average driving time of 6.45 minutes. These were the average driving distances and times for patients with 9-digit ZIP codes who lived in the same 5-digit ZIP codes as their PCPs.

Table 2 lists the demographic characteristics of the cohort with complete information. The mean age was 52.5 years (SD 8.4 years); 66% were female, 83% were white and 5% were AI/AN. The group with the largest proportion of individuals who received surgery within 12 months of diagnosis was CRC patients (98.6%), followed by breast cancer patients (95.7%) and lung cancer patients (44.3%). The mean number of days from diagnosis to surgery among patients who received surgery was 21.4. Patients who received surgery in the same month that they were diagnosed, but with an unknown day of diagnosis, comprised 35% of all surgery patients. Driving distance to PCP averaged 19 miles (SD 31.3) and driving time averaged 27 minutes (SD 35.2). A majority of patients lived within 25 miles and 30 minutes of their PCP (78% and 74%, respectively); however, nearly 10% lived more than 50 miles and 60 minutes from their PCP. At 11% and 13%, these percentages were slightly higher for AI/ANs.

Travel burden and stage at diagnosis

In multivariate logistic regression analyses, for every hour increase in driving time to PCP, the odds of a breast cancer patient being diagnosed at a later stage increased by 27 percent ($P = .02$) (Table 3). Driving distance to the PCP was also associated with later stage at diagnosis: for every 100-mile increase in driving distance to the PCP, the odds of a breast cancer patient being diagnosed at a later stage increased by 49 percent ($P = .04$). Travel burden was not significantly associated with later stage at diagnosis for CRC or for lung cancer patients (CRC: OR = 1.08, $P = .67$; lung: OR = 1.04, $P = .75$ using driving time, and CRC: OR = 1.12, $P = .73$; lung: OR = 1.09, $P = .70$ using driving distance). The complete regression results using driving distance are available from the authors on request.

Other characteristics associated with later stage at breast cancer diagnosis included race (Asian/Pacific Islander and Black patients had later stage at diagnosis relative to white patients: OR = 1.74, $P = .02$ and OR = 1.69, $P = .03$, respectively) and older age at diagnosis (OR = 0.99 per year, $P = .02$). Among breast cancer patients, the model using driving time achieved a slightly better AIC value than the model using driving distance (1945.051 vs 1946.544).

Travel burden and likelihood of treatment

In multivariate logistic regression analyses, driving time to PCP was not significantly associated with the likelihood of receiving treatment for breast or lung cancer (OR = 0.93, $P = .75$ and OR = 0.99, $P = .93$, respectively) (Table 4). Similarly, driving distance to PCP was not significantly associated with the likelihood of treatment for breast or lung cancer (OR = 0.90, $P = .81$ and OR = 0.97, $P = .90$, respectively). Likelihood of treatment for breast cancer was associated with being Black (OR = 0.25, $P < .01$). Likelihood of treatment for lung cancer was associated with AI/AN race (OR = 0.40, $P = .04$), age (OR = 0.98, $P = .04$) and local stage at diagnosis (OR = 8.75, $P < .01$). Nearly every CRC patient received surgical treatment within one year of diagnosis, so estimates of the association between travel burden and likelihood of treatment could not be completed for those patients.

Travel burden and time to first treatment

After we adjusted for socio-demographic characteristics, year of diagnosis, and cancer stage, we found an association between driving time to PCP and the time to first treatment following cancer diagnosis for a CRC patient. For every 1-hour increase in driving time, diagnosis was delayed by 5.9 days ($P = .02$) (Table 5). For every 100-mile increase in driving distance to PCP, the time-to-treatment for a CRC patient increased by 14.6 days ($P < .01$). Hispanic ethnicity was also associated with time-to-treatment among CRC patients (time-to-treatment was 16.78 days later among Hispanic patients compared to non-Hispanic patients; $P < .01$). Travel burden to PCP was not significantly associated with time-to-treatment for breast or lung cancer patients (breast: 1.37 days per driving hour, $P = .44$ and lung: 0.82 days per driving hour, $P = .84$; breast: 3.02 days per 100 driving miles, $P = .39$; lung: 4.84 days per 100 driving miles, $P = .54$). Among CRC patients, the model using driving distance achieved a better AIC value than the model using driving time (4810.871 vs 4815.087).

Discussion

Distance traveled to a PCP influences the use of many cancer care services. To our knowledge, this is the first study to examine the relationship between travel burden for primary care and cancer treatment among a Medicaid population. We hypothesized that for low-income people with cancer, travel distance to their PCP would influence both the likelihood and the timeliness of receiving initial surgical treatment as well as the stage at

which the cancer was diagnosed. We found that greater driving distance predicted later stage at diagnosis for breast cancer patients and greater time-to-treatment after diagnosis for CRC patients. We did not find a significant association between travel burden to PCP and the likelihood of receiving treatment for any of the cancer types.

Previous studies have found associations between AI/AN race and later stage at diagnosis for breast cancer and CRC,[3,4] but not for lung cancer.[20] After adjusting for travel distance we did not find significant associations between AI/AN race and stage at diagnosis, likelihood of treatment, or time-to-treatment for breast cancer or CRC patients; however, we did find an association between likelihood of treatment and AI/AN race for lung cancer patients. This suggests that the associations between stage at diagnosis and AI/AN race found in previous studies may be due in part to travel burden.

Of the 3 types of cancer in this study, breast cancer and CRC are the only types included in routine screening; however, CRC screening detects many precancerous lesions that are not classified as incidences of cancer and, once removed, prevent the development of cancer. This might explain why we found an association between stage at diagnosis and travel burden for breast cancer but not for the other cancers.

Our findings of an association between race and age at diagnosis and later stage at diagnosis for breast cancer patients were similar to other studies that have examined distance to provider and cancer treatment and diagnosis, as were our findings of an association between Hispanic ethnicity and increased time between diagnosis and initial treatment for CRC. In previous studies, in addition to travel burden, other factors associated with cancer treatment and diagnosis included age,[9–11,13,14] insurance status,[13] race/ethnicity,[11,13] Metropolitan Statistical Area size,[12] poverty rate,[14] personal financial costs and cancer characteristics.[10,11,16]

A second goal of this study was to determine whether driving time did a better job than driving distance of predicting stage at cancer diagnosis or time to first treatment. For example, driving time may be a more important factor when considering shorter distances in dense urban areas. Also, driving time takes into account areas with particularly slow means of transportation, such as ferries over bodies of water or unimproved rural roads. Time may also be less disparate than distance for rural and urban patients traveling to cancer treatment facilities. Both driving time and distance predicted the stage at diagnosis for breast cancer patients and the time to first treatment for CRC patients. The AIC value was better (ie, lower) for the breast cancer stage model that used driving time, but it was also better for the CRC time-to-treatment model that used driving distance. Of the 8 models (3 for stage at diagnosis, 2 for likelihood of treatment, and 3 for time to first treatment), 5 obtained a lower AIC value when driving distance was used instead of driving time. In general, we did not find driving time to be a better predictor of earlier diagnosis or more timely treatment than driving distance. Therefore, using either measure of travel burden appears to be adequate.

In our models, we used a categorical variable to control for year instead of a linear variable. This specification allowed for a more flexible functional form at a cost of only 6 degrees of freedom per model. There was no discernable pattern in the values of the categorical year variable.

This study has several important limitations. Our findings represent Washington State and may not be representative of the experience of Medicaid enrollees in other areas. We measured travel distance and time by using MapQuest.com, which is more accurate than estimates based on straight-line distances. However, we did not have precise location data for all patients; specifically most had 9-digit ZIP codes, but 5-digit codes were only available for a substantial minority of individuals. Using the centroid of a 5-digit code

provides somewhat less accurate travel time and distance information than the centroid of 9-digit codes, but we do not believe this had a substantial effect on our estimates. Travel time and distance were calculated on the assumption that all patients used private automobiles. Some low-income patients may rely on public transportation, which may have different travel times or distances than assigned in this study.

Provider ZIP codes available from Medicaid claims records may represent the provider's billing ZIP code instead of the ZIP code for the location of service delivery. This misclassification could be unique to urban locations, which could lead to a misrepresentation of travel times for urban residents included in the study population. Furthermore, some ZIP codes (residential or provider) may refer to post office boxes rather to physical street addresses.

It is possible that some of the patients in our study lived closer to other PCPs than those that cared for them, but the patients could not access those PCPs because they did not accept Medicaid enrollees. We did not have general information about available PCPs in the area, or information about PCPs that accepted Medicaid enrollees (other than those the patients visited). In practice it is difficult to track availability of PCPs to Medicaid enrollees: PCPs often make changes to their policies on accepting Medicaid enrollees over time (eg, some "cap" the number of Medicaid patients they see and some drop all Medicaid enrollees when payments fall) and also change practice locations. Moreover, even with more than one available provider, it is not clear that Medicaid enrollees choose PCPs based on distance alone. The influence of availability of PCPs and patient preferences as a factor determining driving distance among Medicaid enrollees is an area worthy of future study.

Other studies using administrative data have found that health care claims (eg, Medicare claims) are reliable for assessing cancer-related treatment, including surgery.[21] A study using linked data from the Ohio Cancer Incidence Surveillance System and Ohio Medicaid claims to assess breast cancer incidence found that the use of both diagnosis and procedure codes (as in the present study) contributed to the accuracy of case identification.[22] The completeness of Medicaid claims for surgery is expected to be high because of the financial incentives associated with billing for surgical procedures; however, differential biases associated with errors in Medicaid claims could exist (eg, certain providers may be more likely than others to have inaccuracies in administrative coding), leading to over- or under-estimation of the association between travel burden, receipt of treatment, and time to first treatment.

Time to treatment for Medicaid patients may be influenced by the number of physicians accepting Medicaid patients relative to the number of Medicaid patients needing treatment, particularly for specialized care. Likewise, time to treatment for Hispanic/Latino patients might be influenced by the availability of Spanish-speaking practices. We did not have information as to whether providers accepted Medicaid patients, nor their language fluencies.

Other variables that were not captured in the claims or WSCR data may be important but unknown predictors of time to first cancer treatment. We were unable to measure marital status, an indicator of social support that is relevant to travel, including travel to health care services. Nor did we include urban or rural location as a covariate, given its association with travel distance. However, rural locations may contribute additional travel burdens unrelated to distance, such as an increased burden associated with travel in inclement weather.

Travel time may represent a substantial portion of the total time burden associated with a cancer diagnosis. In this study we did not examine other time-related factors, such as the time spent waiting for appointments, the time associated with recovery following surgery, or

the time spent receiving adjuvant treatments such as chemotherapy or radiation. Because these treatments usually require multiple visits over a defined period, the impact of travel distance on their use and completion may be more substantial.

Travel time can be considered a direct cost of cancer treatment that is usually borne solely by patients and their families. As such, time costs associated with travel are an important component of the full economic burden of cancer. A recent study used Medicare data to estimate the patient time costs associated with cancer care, including travel time, time spent waiting for treatment appointments, and time spent receiving care. Patient time costs for the initial phase (first 12 months) of cancer care were substantial. For the 3 cancers examined in the present study, costs were $1,008 for breast, $3,708 for colorectal, and $4,141 for lung.[23] Travel may be of particular importance for socioeconomically disadvantaged persons, because time costs associated with care may strain limited resources, and lower provider accessibility or transportation barriers may result in longer travel times for low-income individuals. Future studies could investigate the increased travel burden for cancer patients who rely on public transportation, such as buses and subways.

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Table 1

Diagnostic and Procedure Codes for Breast, Colorectal and Lung Cancer.

Tumor Location	Code Type	Code Values
Breast	CPT-4	19120, 19125, 19126, 19160, 19162, 19180–19255
	ICD-9	85.20–85.23, 85.33–85.48
Colorectal	CPT-4	44110, 44140–44160, 44204–44208, 44210–44213, 44310, 44320, 44392–44394, 45110–45121, 45123, 45126, 45160–45180, 45308, 45309, 45315, 45320, 45333, 45338, 45339, 45383–45385
	ICD-9	45.41–45.49, 45.7, 45.71–45.76, 45.79–45.89, 46.01, 46.03, 46.10–46.24, 48.31–48.35, 48.40–48.69
Lung	CPT-4	31640, 31641, 32440–32525, 32520, 32657, 32663, 32999
	ICD-9	32.20, 32.28, 32.29, 32.30–32.99

Table 2

Summary Characteristics of Study Subjects

	Breast		CRC		Lung	
Variable	**n**	**%**	**n**	**%**	**n**	**%**
N	1,407		723		1,787	
Age: < 55	890	63.3	379	52.4	768	43.0
Age: 55 – 64	517	36.7	344	47.6	1,019	57.0
Gender: Female	1,407	100.0	322	44.5	852	47.7
Gender: Male	0	0.0	401	55.5	935	52.3
Race: White	1,127	80.1	577	79.8	1,540	86.2
Race: AI/AN	73	5.2	37	5.1	70	3.9
Race: Asian/PI	88	6.3	54	7.5	73	4.1
Race: Black	87	6.2	43	5.9	97	5.4
Race: Other	4	0.3	0	0.0	2	0.1
Race: Unknown	28	2.0	12	1.7	5	0.3
Hispanic: Yes	102	7.2	42	5.8	47	2.6
Hispanic: No	1,277	90.8	671	92.8	1,738	97.3
Hispanic: Unknown	28	2.0	10	1.4	2	0.1
Dx Year: 1997	162	11.5	78	10.8	219	12.3
Dx Year: 1998	182	12.9	90	12.4	230	12.9
Dx Year: 1999	177	12.6	93	12.9	249	13.9
Dx Year: 2000	205	14.6	93	12.9	246	13.8
Dx Year: 2001	215	15.3	111	15.4	266	14.9
Dx Year: 2002	226	16.1	131	18.1	276	15.4
Dx Year: 2003	240	17.1	127	17.6	301	16.8
Stage at Dx: Local	644	45.8	149	20.6	200	11.2
Stage at Dx: Regional	625	44.4	362	50.1	498	27.9
Stage at Dx: Distant	138	9.8	212	29.3	1,089	60.9
Driving miles: < 4	352	25.0	212	29.3	526	29.4
Driving miles: 4 – 9.9	380	27.0	194	26.8	496	27.8
Driving miles: 10 – 24.9	362	25.7	180	24.9	423	23.7

	Breast		CRC		Lung	
Variable	**n**	**%**	**n**	**%**	**n**	**%**
Driving miles: ≥ 25	313	22.2	137	18.9	342	19.1
Driving minutes: < 15	612	43.5	357	49.4	892	49.9
Driving minutes: 15 – 19.9	197	14.0	96	13.3	235	13.2
Driving minutes: 20 – 29.9	234	16.6	103	14.2	261	14.6
Driving minutes: ≥ 30	364	25.9	167	23.1	399	22.3
Surgery*: Yes	1,214	95.7	504	98.6	309	44.3
Surgery*: No	55	4.3	7	1.4	389	55.7
Days to surgery: 0	382	31.5	232	46.0	88	28.5
Days to surgery: 1–19	369	30.4	161	31.9	65	21.0
Days to surgery: ≥ 20	435	35.8	100	19.8	143	46.3
Days to surgery: Unknown	28	2.3	11	2.2	13	4.2

*Local and regional stages only.

Table 3

Logistic Regression Models of Cancer Stage at Diagnosis

	Breast		CRC		Lung	
Variable	**OR**	***P* val**	**OR**	***P* val**	**OR**	***P* val**
Travel hours	**1.270**	.016	1.076	.667	1.038	.749
Age	**0.986**	.022	0.981	.079	**0.964**	.002
Female	-	-	0.954	.805	**0.715**	.028
Race						
White	1.000	-	1.000	-	1.000	-
AI/AN	0.990	.969	1.679	.297	1.139	.750
Asian/PI	**1.738**	.018	1.164	.683	1.749	.237
Black	**1.687**	.026	1.012	.976	1.161	.680
Other	1.013	.990	-	-	-	-
Unknown	2.884	.367	0.433	.443	0.233	.240
Hispanic origin						
Non-Hispanic	1.000	-	1.000	-	1.000	-
Hispanic	1.261	.278	0.659	.265	1.029	.954
Unknown	0.236	.222	1.280	.840		
Diagnosis Year						
1997	1.000	-	1.000	-	1.000	-
1998	1.105	.650	0.957	.922	1.149	.642
1999	1.015	.945	0.561	.164	1.160	.614
2000	1.026	.903	0.499	.090	1.251	.456
2001	1.155	.496	0.465	.053	1.301	.373
2002	0.841	.409	0.531	.104	1.025	.930
2003	0.912	.657	0.702	.377	0.926	.774
AIC	1,945.051		753.1092		1,259.766	

Note: Figures in bold are statistically significant at the 5% level.

Table 4

Logistic Regression Models of Receipt of Surgical Resection in the First 12 Months Following Diagnosis

	Breast		Lung	
Variable	**OR**	***P* val**	**OR**	***P* val**
Travel hours	0.929	.750	0.989	.932
Age	1.016	.347	**0.975**	.043
Female	-	-	0.870	.423
Local stage at Dx	1.077	.803	**8.748**	< .001
Hispanic	2.016	.349	0.486	.252
Race				
White	1.000	-	1.000	-
AI/AN	1.297	.730	**0.402**	.044
Asian/PI	0.573	.285	2.069	.083
Black	**0.247**	.001	1.710	.198
Other	0.259	.306		
Diagnosis Year				
1997	1.000	-	1.000	-
1998	**9.355**	< .001	1.145	.684
1999	**8.609**	< .001	0.900	.749
2000	**13.679**	< .001	0.984	.961
2001	**7.835**	< .001	1.093	.783
2002	**5.846**	< .001	0.865	.666
2003	**12.892**	< .001	0.736	.328
AIC	412.949		835.374	

Note: Figures in bold are statistically significant at the 5% level.

Table 5

Linear Regression Models of Time to First Treatment After Cancer Diagnosis

	Breast		CRC		Lung	
Variable	**Coeff.**	***P* val**	**Coeff.**	***P* val**	**Coeff.**	***P* val**
Travel hours	1.37	.442	**5.86**	.018	0.82	.843
Age	0.17	.111	0.07	.680	0.62	.109
Female			0.49	.866	0.31	.952
Local stage at Dx	−2.53	.193	0.38	.903	−1.20	.816
Race						
White	-	-	-	-	-	-
AI/AN	1.26	.766	−6.14	.357	−3.32	.833
Asian/PI	−0.15	.971	10.22	.060	−1.42	.903
Black	**18.59**	< .001	−3.68	.553	13.82	.222
Other	−13.45	.484			−25.93	.554
Unknown	−2.92	.863	4.79	.767	58.14	.183
Hispanic origin						
Non-Hispanic	-	-	-	-	-	-
Hispanic	0.38	.918	**16.78**	.004	3.04	.877
Unknown	1.14	.946	−19.71	.279	-	-
Diagnosis Year						
1997	-	-	-	-	-	-
1998	**−9.15**	.027	3.25	.586	12.57	.213
1999	−7.23	.084	−0.94	.873	0.96	.924
2000	−5.91	.141	2.40	.688	3.14	.756
2001	−6.55	.105	6.06	.283	12.13	.222
2002	3.89	.326	3.32	.545	**37.83**	< .001
2003	5.80	.146	**15.94**	.006	**27.43**	.005
Intercept	**15.00**	.023	2.26	.812	−15.62	.493
AIC	11,685.490		4,815.087		3,080.847	

Note: Figures in bold are statistically significant at the 5% level.