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Disproportionate demographics and tumor characteristics of cancer cases treated in Commission on Cancer (CoC) versus non-CoC hospitals in Georgia

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B.S., Sewanee: The University of the South, 2012

Master of Science of Public Health, Epidemiology

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Abstract

Disproportionate demographics and tumor characteristics of cancer cases treated in Commission on Cancer (CoC) versus non-CoC accredited hospitals in Georgia

By Anh T. Phan

The National Cancer Data Base (NCBD) collects records of cancer cases solely from Commission on Cancer (CoC) accredited hospitals. A large proportion of cancer cases reported to the Georgia Cancer Registry (GCR) are from CoC hospitals, even though they only make up 25-30% of all facilities in Georgia. The authors examined whether cancer cases reported by CoC accredited facilities in Georgia are representative of all cancer patients in Georgia by using cross-sectional data from the GCR between 2008 and 2011. CoC and non-CoC accredited hospitals were compared with respect to demographics and tumor characteristics (e.g. age, insurance status, tumor staging, etc.). Further stratified analyses were conducted on selected characteristics that showed a *large* difference between CoC and non-CoC approved hospitals. The study cohort included 133,629 (84%) cancer cases that received treatment at *any* CoC accredited hospitals and 26,076 (16%) cases that received treatment *only* from non-CoC accredited hospitals. The authors observed that males were more likely to go to non-CoC accredited hospitals, while females more often received treatment at CoC accredited hospitals. A larger proportion of those living in metropolitan areas received care at CoC hospitals, compared to those living in micropolitan areas, small towns, or rural areas. Similarly, those with high SES tend to receive care at CoC accredited hospitals, while those in low SES are more likely to have received care from non-CoC accredited hospitals. Cancer cases reported by CoC approved hospitals in Georgia are more likely to be females, those living in or near an urban city, or those of high SES, compared to the cases reported by non-CoC hospitals. Studies that are conducted in Georgia using the NCBD should be aware of this limitation.

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INTRODUCTION

The National Cancer Data Base (NCDB) collects data from Commission on Cancer (CoC) accredited hospitals and cancer centers in the United States (1). CoC accreditation was established by the American College of Surgeons (ACoS) in 1922 with the goal of improving cancer care, patient survival and quality of life. A survey is completed every 3 years by cancer programs to be evaluated for renewal. The process is most often completed by a physician surveyor who is qualified to assess compliance with the 34 standards required for accreditation (2). The broad criteria that hospitals/centers are required to fulfill include, but are not limited to, providing a large scope of cancer-specific services and specialists, meeting clinical trial accrual standards, completing a variety of quality improvement activities throughout the year, and having community outreach programs related to cancer (3; 4).

The NCDB is a hospital-based registry that includes cancer cases from approximately 1,500 CoC-accredited hospitals throughout the country, which is only approximately 30% of all hospitals in the U.S. However, these reported cancer cases represent approximately 70% of all cancer cases diagnosed annually in the U.S. (5). These hospitals receive timely reports from the NCDB, once data are submitted, on their patient's demographics, treatment performance, and other quality factors compared to the other CoC hospitals in the nation (1). As expected, based on the expenses associated with accreditation and the rigorous requirement for program development and adhering to numerous standards, CoC accredited hospital/centers tend to be larger facilities clustered around large urban areas. Additionally, they typically have greater collaboration with other cancer organizations and offer a wider range of cancer-related services (including cancer screening, chemotherapy, and radiation therapy), and compared to non-CoC hospitals (4).

Most publications on CoC hospitals assessed the program in terms of the types of treatment available, patient capacity, quality of service, outcomes of treatment, etc. A study conducted by Merkow et al. concluded that cancer centers with any accreditation, either from CoC or elsewhere, perform better in processes of care, patient-reported experiences or cost

overall; however, they performed worse on outcome measures when compared to non-accredited centers (6). This inconsistency between quality of care and patient outcome could possibly be due to accredited hospitals treating a higher proportion of cancer typically considered fatal or patients presenting at more advanced stage of disease, compared to those at non-accredited hospitals. However, there are few publications to support this claim, since most studies have not directly assessed the demographics and clinical tumor characteristics of patients treated at different facilities. The objective of this study was to determine whether patients treated at CoC accredited hospitals in Georgia are representative of all cancer patients treated in Georgia in terms of demographic and tumor characteristics, by comparing CoC and non-CoC hospitals using data from the Georgia Cancer Registry (GCR). If cancer cases treated by CoC hospitals are representative of cancer cases treated in Georgia then this implies that CoC and non-CoC hospitals do not differ in terms of patient demographic and tumor characteristics. We hypothesize that patients at CoC accredited hospitals are not representative of cancer patients treated in Georgia (i.e. there are differences in the demographics and tumor characteristics between the two types of hospitals).

Population-based cancer surveillance in Georgia began in 1976 through the creation of the Surveillance Epidemiology and End Result (SEER) program. The SEER program was established by the National Cancer Institute (NCI), as a result of the National Cancer Act of 1971. SEER called for the collection, analyses and dissemination of data in the US to help describe and better understand the diagnosis, treatment, and outcome of patients. In contrast to the NCDB, SEER is a population-based program that collects data from different regions throughout 15 states. SEER registries cover about 28% of the U.S population but their data are generally representative of the current demographics in the U.S. The SEER program is the primary source of population-based registry data in the U.S that has detailed historical information on stage of cancer at the time of diagnosis and patient survival information. Although the SEER registry in Georgia originally covered only the metropolitan area of Atlanta, population-based cancer

registration in Georgia expanded statewide in 1995 through additional funding from the government with the establishment of the National Program for Cancer Registries. The GCR collect data from all facilities in Georgia involved in the diagnosis and/or treatment of cancer patients, regardless of accreditation status (7).

METHODS

Data Collection and Study Population

Patients were identified from the GCR, which documents all cancer cases in Georgia, collects demographic information, and records diagnoses and treatments made by attending physicians. The study population was restricted to patients treated with cancer in the state of Georgia between 2008 and 2011; all types of cancers were included. The procedure to acquire access to the dataset did not require IRB approval since all identifiable information, such as patient names, addresses, birthdates, etc., were redacted by the GCR before the data were made available. The cancer registry originally identified 193,893 eligible patients. Source records were examined for these patients to identify the facility providing treatment. We excluded those who were treated outside of hospitals or missing information on place of treatment (17.6%). The remaining 159,705 patients were included in the data analysis.

Analytic Variables

The dependent variable is where the patient received treatment, either at any CoC hospital or only at non-CoC hospitals. Hospitals were considered as CoC if their cancer programs were accredited by the American College of Surgeons (ACoS) at any time during the study period. Cancer is a reportable disease in Georgia and all individuals involved in the diagnosis and/or treatment of cancer patients are required to report data monthly to the GCR. Larger facilities have their own registry staff and report their data in a standardized electronic format. Smaller facilities utilize contract abstractors to record and report the data. The GCR tracks all

incoming data submission and can be identify if the source of all incoming records (CoC and non-CoC).

The independent variables were separated into two categories: subject demographics and tumor characteristics. These variables abstracted from source medical records at the facility providing patient care. All variables were coded according to the standards of the North America Association of Central Cancer Registries (NAACCR) (8), with a few exceptions. The demographic variables included age at diagnosis, gender, ethnicity, race, percentage of individuals in the patient's census tract living below the poverty level, insurance status at the time of treatment, and residential density area (e.g. metropolitan, small town, etc.). The three categories for gender were male, female, and others (i.e. hermaphrodites and transsexual); however, hermaphrodites and transsexuals were excluded from the analyses given the small number in the data. Ethnicity was coded using the NAACCR Hispanic Identification Algorithm (NHIA), which includes the following: non-Hispanic, Mexican, Puerto Rican, Cuban, South or Central American, Dominican Republic, other specified Spanish/Hispanic origins, NHIA surname match only and not otherwise specified (NOS) Spanish, Hispanic, or Latino. In addition to ethnicity, race was also considered in the study (White, Black, Asian, Hawaiian/Pacific Islander, and American Indian/Alaska Native). An area-based measure of socioeconomic was used because cancer registries do not collect individual measures of SES. The percentage of individuals in the patient's census tract living below the poverty level was determined using the American Community Survey (ACS) data for 2010 (9), which was then categorized into 4 groups (less than 5%, between 5% and 10%, between 10% and 20% and above 20%) according to the NAACCR guidelines. The subject's primary method of payment at the time of treatment was used to proxy their insurance status, which includes not insured, insured with private insurance, Medicaid, Medicare, and others (TRICARE, military, Veterans Affairs, and Indian/Public Health Services). The Rural-Urban Commuting Area Codes (RUCA) used the 2010 census tract data to measure

population density. The variable was used to describe the patient's area of residency (metropolitan area, micropolitan area, small town, and rural area).

The variables used to describe the cancer cases include the primary site of the cancer, tumor stage, tumor behavior, tumor grade, and the method of diagnostic confirmation. The tumor stage at diagnosis was defined using the American Joint Committee on Cancer (AJCC) definition (10), which was categorized into four stages (stage I, stage II, stage III, and stage IV). Tumor behavior was defined as benign neoplasm, neoplasm of uncertain and unknown status, *in situ* neoplasm, or malignant neoplasm stated or presumed to be primary using the WHO ICD-O-3 definition (11). The diagnostic confirmation methods of the cases were dichotomized into microscopically confirmed (positive histology, positive cytology, positive histology plus positive immunophenotyping and/or positive genetic studies, and positive microscopic confirmation) and not microscopically confirmed (positive laboratory test/marker study, direct visualization without microscopic confirmation, radiography and/or other imaging techniques without microscopic confirmation, and clinical diagnosis). The percentage of tumors that were not microscopically confirmed is an indication of whether the case finding for the subject included sources outside of the pathology reports. The SEER database combined histology and site coding, recommended by the WHO ICD-0-3 to smaller site groups that describe primary sites (digestive system would include esophagus, stomach, small intestine, and etc.) (12). The tumor grade (grade I to grade IV, T-cell, B-cell, others, and unknown) is an indication of how much the cancer cells resemble the surrounding unaffected tissue, with grade 1 being recognizable and grade 4 being extremely differentiated (13).

Statistical Analysis

Age at diagnosis was categorized into 10 years increments (birth to age 9, age 10 to age 19, and etc.), with the exception of the first and last group, which includes from birth to 19 years old in the first group and all those older than 90 years old in the last group. There were too few observations in the three-way analysis when the first group was separated into two 10 year

increment groups (birth to age 9 and age 10 to 19) and when the last age group included only those older than 100 years old. The primary cancer sites were grouped into broader categories (oral cavity and pharynx, digestive system, respiratory system, bones and joints, soft tissues including the heart, skin excluding basal and squamous, breast, female genital system, male genital system, urinary system, eye and orbit, brain and other nervous systems, endocrine system) or they were grouped by broad categories like lymphoma, myeloma, leukemia, mesothelioma, Kaposi sarcoma and others. This broad categorizing of the site prevents sparse observations in the analysis.

All data analysis was done using SAS 9.4 (Cary, NC). Univariate descriptive statistics were completed for all analytic variables. The initial univariate analysis indicated that a large proportion of the patients was missing their place of treatment, the main variable of interest. After reevaluating the dataset by comparing it to SEER data, place of treatment was found for 11, 571 patients out of the 34,188 patients (34%) with missing documentation for place of treatment.

We calculated the frequency of participants within categories of age, gender, race/ethnicity, residential area, poverty level indicator, insurance coverage, diagnostic confirmation, tumor grade, stage of tumor, behavior of tumor and the primary site in the total study population. To compare the characteristics of patients treated at CoC and non-CoC hospitals, the percentage of each hospitals within the independent variables was calculated. Chi-square statistical tests were used to assess whether there is a significant difference between CoC and non-CoC hospitals for each independent variables ($\alpha = 0.05$). To further assess the comparison between CoC and non-CoC hospitals, we compared the weighted column percentage for each group within the independent variables for a percentage difference greater than 5%. A 5% percentage difference between CoC and non-CoC was seen in at least one category of gender, residential density area, poverty level indicators, stage at diagnosis, and the primary site of cancer development.

A three way cross-tabulation was performed between CoC and non-CoC hospitals for each independent variable, while individually controlling for variables that had shown, in at least one category, a noticeable difference, in terms of percentage, between CoC and non-CoC hospitals in the two-way analysis. A weighted column percentage of the distribution of the categories within each independent variable for CoC and non-CoC hospitals was calculated, while controlling for one of the variables previously found to have a difference of at least 5%. A chi-square statistic test was used to assess whether there were significant differences between CoC and non-CoC hospitals for each independent variable while stratifying on selected variables. Only categories, within variables that were stratified on, that showed at least a 5% difference in the percentages in the two-way analysis were reported. To determine whether there was a *large* difference (at least 10% or more) between the two types of hospitals, we compared the column percentages of each category within the independent variables. For example, to determine whether there is at least a 10% difference between CoC and non-CoC hospitals in any category of the residential areas among males, we first compared the proportion of males living in metropolitan areas that received treatments at any CoC hospitals and only non-CoC hospitals, which was 82.7% and 72.7%, respectively. We concluded that a *large* difference was observed between the two types of hospitals in terms of males living in metropolitan areas. We repeated the comparison among males for the remaining categories of residential areas (micropolitan areas, small towns, and rural areas). We only reported the three way analysis results for the category within the variable that originally showed a difference between CoC and non-CoC hospitals in the two-way analysis.

A sensitivity analysis was conducted between the two types of hospitals and the poverty level indicator. For the purpose of the sensitivity analysis, we let the exposure be the census tract poverty level indicator, which is dichotomized into poverty (those in the 20% or higher poverty level) and not in poverty (those in the 19% or less poverty level), and we let the outcome remain CoC versus non-CoC. The bias model to correct for non-differential exposure misclassification

bias uses sensitivity and specificity values that were obtained from an external source. The expected truly exposed and unexposed were calculated using the observed data and the specificity and sensitivity. The bias parameters were based on a pilot study that field-tested questions related to poverty as a case-finding tool to assist primary care providers in identifying poverty and SES (13). This study is an appropriate external source for the bias analysis since SES for an individual is estimated through poverty type questions. A multidimensional bias analysis was completed using different combinations of sensitivity and specificity to estimate the direction and magnitude of non-differential independent misclassification bias.

RESULTS

Table 1 and table 2, respectively, display patients' demographics and tumor characteristics for the overall study population and for the two types of hospitals. The percentages shown are weighted column percentages of the distribution of the independent variables for each type of hospital. Approximately 84% of the 159,706 participants received treatment at any CoC hospital (n=133,629) and the remaining 16% received care only at non-CoC hospitals (n=26,076). The average age of the study population was 63 years old (standard deviation =15 years) with the majority being white (71%), from either a metropolitan or micropolitan area in Georgia (93%), and either with insurance coverage or on Medicare at the time of treatment (85%). The top primary sites for cancer cases were in the digestive system (17%), respiratory system (15%), breast (19%), and the male genital system (14%) with half of the total study population diagnosed with either grade I or grade II tumor and either during stage I or stage II.

All independent variables were significant using the chi-square statistical test for comparing CoC and non-CoC hospitals in the two-way analysis. There were slight differences in percentages between CoC and non-CoC hospitals in terms of age, race/ethnicity, insurance, diagnostic confirmation methods, grade of tumor, and behavior of tumor. However, at least a 5% percentage

difference between CoC and non-CoC hospitals in the two-way analysis, in at least one category of the variable, was observed in gender, residential density area, poverty level indicator, stage at diagnosis, and general primary site.

Table 3 summarizes the important trends and percentage differences in the three-way analysis, when independently stratified for gender, residential density area, poverty level indicator, stage at diagnosis, and general primary site. Please refer to Appendix 1 through Appendix 10 for more details on the results of the three-way analysis (i.e. the exact percentage value) if needed. A noticeable percent difference between CoC and non-CoC was observed among those with stage II cancer in the male genital system and those with breast cancer living in a metropolitan area. The smallest percent difference was seem among females in a poverty level higher than 20%, among those in the 20% or higher poverty level who are white or black, in those with stage I cancer in a poverty level of 20% or higher, and those with breast cancer with insurance coverage.

Among several of the variables that were stratified on (e.g. gender, poverty level, and etc.), those living in a metropolitan area were more likely to receive treatment at CoC hospitals; however, those living in the other three residential areas (i.e. micropolitan, small town, and rural) were more likely to receive treatment in non-CoC hospitals. Similarly, an association between gender and types of hospitals was observed in the stratified data: males were more likely to go to non-CoC hospitals, while females more often went to CoC hospitals. In addition, it was observed that those with cancer in the male genital system more likely received treatment at non-CoC hospitals, especially those of high SES or those with stage II tumor. There was no association between insurance status at the time of diagnosis and the place of treatment in the two-way analysis or the three-way analysis.

Of the three demographics and two tumor characteristics that we controlled for in the three-way analysis, we observed that a higher percentage of those between the age of 20 and 59 received treatment at CoC hospitals. While a larger proportion of those who are younger than 19

years old and older than 60 received treatment at non-CoC hospitals. However, the differences between CoC and non-CoC hospitals observed among the age categories was less than 10% in all demographic or tumor characteristic variables.

For the sensitivity analysis, the crude risk of receiving treatment at a non-CoC hospital is 1.24 times more likely among those that have low socioeconomic status (SES) compared to those that have high SES (95% confidence interval: 1.22, 1.27). The external source reported an average sensitivity of 98% and a specificity of 60%. Since our data uses census tract data and not a self-reported questionnaire, we expect the specificity for our data to be a little higher. The risk ratio resulted from the multidimensional bias analysis ranges from 1.31 to 2.41, all of which are higher than the crude risk ratio. The sensitivity analysis suggested that the crude estimate was biased towards the null (Table 4).

DISCUSSION

In Georgia, CoC hospitals only make up about 25-30% of the facilities (4), but report a larger number of the total cases submitted to the GCR. Currently, it is estimated that three out of every four cancer patients receive care or service at a CoC accredited hospital in Georgia (14). Since a large proportion of the hospitals in Georgia are CoC accredited and report their cancer cases to the NCDB, it could be assumed that the data are representative of all cancer cases in Georgia. This study sought to compare CoC accredited hospitals to non-CoC hospitals based on patients' demographics and tumor characteristics at the time of diagnosis for Georgia patients treated within these facilities. We discovered a number of differences between the two types of hospital related to patient's age, gender, location of residence, socioeconomic status (SES), stage of the tumor at the time of diagnosis, and the primary site of the tumor (specifically, breast or cancer in the male genital system).

In an earlier study, Bilimoria et al compared CoC and non-CoC approved hospitals in the U.S. using only two-way analysis, with hospitals as the base unit rather than patients. The study

considered many hospital characteristics that cannot be considered in the current study, such as the size of the hospitals, oversight agencies, and types of oncology services available, etc. The study concluded that a considerable proportion of CoC accredited hospitals are located in or near urban areas in the U.S. Therefore, it is not surprising that those living in or close to a large city (i.e. metropolitan areas) are more likely to receive treatment at a CoC approved hospitals, while those farther way from the city received care at non-CoC hospital. This association is strengthened if the individuals have breast cancer (if they are female), are in low SES, during the early stage (i.e. stage I) of cancer, or during the later stage (i.e. stage III and IV) regardless of gender.

A larger proportion of females received treatment at CoC accredited hospitals, in contrast to males who more likely received treatment at non-CoC hospitals. The association between gender and types of hospital for treatment was further observed among those living in a metropolitan area, those in the upper middle SES (10% or less on the poverty level) or those with stage II cancer. While area of residence, SES, and stage of cancer are reasonable explanations for the association, it might not fully describe the association unless more information is available. A more plausible explanation for the association could be that a higher percentage of those with cancer in the male genital system received treatment at non-CoC hospitals and those with breast cancer received treatment at CoC hospitals. There are several possible explanations for this such as non-CoC accredited hospitals may 1) provide more treatment options for cancer in the male genital system, 2) have lower cost of treatment than CoC accredited hospitals, or 3) have quality of treatment/the outcome is better at non-CoC hospitals. Since little information is available, it would be interesting to examine the types of treatment available and treatment success rate of breast cancer and cancer in the male genital system between CoC and non-CoC approved hospitals.

Surprisingly, there was no association between type of hospital and insurance status at the time of diagnosis, but an association was observed with age at diagnosis. We have expected that

those with insurance would be more likely to receive care at CoC approved hospitals, and those on Medicaid and Medicare go to non-CoC approved hospitals, since more often than not insurance status is one proxy for SES. However, no such association was seen even after stratification. This suggests that insurance status is not a factor that would heavily influence where an individual received treatment. The trend between place of treatment and age was not as strong as the other characteristics, but it was observed in all stratified characteristics. This implies that while age at diagnosis is not strongly associated with determining where to receive treatment, future studies should be aware that there could be some underlying relationship that was not observed in the current study.

There was a concern for misclassification bias of the poverty level variable, defined by NAACCR, as a proxy for individual socioeconomic status, specifically income. The poverty level indicator estimated an individual poverty level based on the address in relation to neighbors, using census tract data. There are several circumstances for an individual to live in a lower poverty area that inaccurately represent their income and wealth (i.e. closer to family members, a shorter commute to work, and etc.). We expected non-differential exposure misclassification of poverty level because the degree of error in classification would be the same regardless of where the patients received treatment. The crude data shows that there is a weak association between SES and place of treatment (RR=1.24, 95% CI: 1.22, 1.27). The adjusted risk ratio after multidimensional bias analysis ranges from 1.31 to 2.41, all of which are higher than the crude risk ratio. This suggests that the exposure misclassification weakened the association between SES and place of treatment, however the magnitude of the bias differs greatly depending on the specificity. Table 4 indicates that the non-differential misclassification of poverty level weakens the association but not meaningfully when the specificity is high (80-90%). However, when the specificity is low (approximately 70%), the non-differential misclassification of poverty level does decrease the association by a considerable amount. An internal validation study, selecting a

subgroup of patients to answer a questionnaire about their income, would be an appropriate next step to settle the uncertainty of the bias parameters.

Strengths and Limitations

There are several strengths and limitations in the current study that need to be addressed. A strength of this study was that it was unnecessary to verify the information from the reporting hospitals for misclassification. The cancer registry collects patient's information and tumor characteristics from all hospitals in Georgia, regardless of CoC approval status, as previously described and the information is verified by the registry. In addition, tumor information was readily available so no extra cost or effort was needed to obtain the information. A limitation of this study was that it only considered place of treatment being that a larger percentage of cases were missing place of diagnosis for varies reason. This study is based on data between 2008 and 2011 on the account that the most current data is not available for analysis. While the dataset is not up to date with the current number of accredited hospitals and the population demographics in Georgia, it still reveals any trend that exists between CoC and non-CoC hospitals.

A lower percentage of cases are collected by NCDB if the tumor's primary site is commonly diagnosed and/or treated in an outpatient setting and a higher percentage if the case required hospitalization or invasive surgery for treatment (15). Therefore, tumors that do not necessitate hospitalization for treatment are proportionally underrepresented in the NCBD (e.g. early-stage melanoma and prostate cancer) (16). This study cohort only considers cases that required treatments in a hospital, excluding cancer centers and private practices, since they are not required to report to the cancer registry. The cases that do not demand intensive care are likely to be under-represented in our study, especially those cases from CoC-hospitals.

To further explore the difference between the two types of hospital, it would be interesting to examine whether getting diagnosed at a certain type of cancer facility affects the patient's decision to receive treatment at either a CoC or non-CoC hospital. The demographics and tumor characteristics trends observed between the two types of hospitals in this current study pertain

specifically to Georgia and it may not be appropriate to assume that same characteristics exist in other states. Thus, it would be worthwhile to replicate this study using cancer registry data from other states to investigate whether similar trends exist in other the states (i.e. determine whether all cancer cases reported to NCDB from CoC hospitals are representative of all cancer cases in the U.S).

One major difference between the cancer registries and the NCBD cancer data is that with the Rapid Quality Reporting System (RQRS), the NCBD can provide real-time assessment of hospital quality-of-cancer-care measure and allows them to report data on patients concurrently, at least for a small select group of cancers (16). While data from the cancer registries is important for benchmarking and quality improvement effort, it does not have the same impact as data from the NCBD, since there is normally a 2 year delay in the availability of data from cancer registries. Most researchers prefer the up-to-date data reporting by the NCBD to ensure that their findings would affect the care of patients represented in the dataset. However, cancer-related studies conducted using data from CoC accredited hospitals in Georgia should be aware that the data do not necessarily represent all cancer cases in Georgia. It is likely that there is an over-representation of cancer patients who are female, those living in a metropolitan area, or those of high SES. While this over-representation of certain demographics does not affect the NCBD data quality, it is crucial to be aware of this limitation.

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TABLES

Table 1. Characteristics of a Cohort of Georgia Cancer Residents for the Overall Study Population and by type of hospitals for treatment, using Data from the Georgia Cancer Registry (2008-2011)

	Study Participants (N= 159,705)		Any CoC[ε] Hospitals (N= 133,629)		Only Non-CoC Hospitals (N=26,076)		p-value[d]
	No.	%	No.	%	No.	%	
Age at Diagnostic, years							<.001
00-19	1,929	1.2	845	0.6	1,084	4.2	
20-29	2,314	1.4	2,054	1.5	260	1.0	
30-39	6,197	3.9	5,566	4.2	631	2.4	
40-49	17,289	10.8	15,351	11.5	1,938	7.4	
50-59	34,995	21.9	29,943	22.4	5,052	19.4	
60-69	46,586	29.2	39,035	29.2	7,551	29.0	
70-79	33,503	21.0	27,279	20.4	6,224	23.9	
80-89	14,939	9.4	12,047	9.02	2,892	11.1	
90+	1,953	1.2	1,509	1.1	444	1.7	
Gender							
Male	77,957	48.8	63,291	47.4	14,666	56.2	<.001
Female	81,736	51.2	70,327	52.6	11,409	43.8	
Other	**	**	**	**	**	**	
Not Stated	**	**	**	**	**	**	
Race							<.001
Non-Hispanic White	115,631	72.4	96,033	71.9	19,598	75.2	
African American	41,383	25.9	35,250	26.4	6,133	23.5	
Asian	2,237	1.4	2,009	1.5	228	0.9	
Hawaiian/Pacific Islander	66	0.04	48	0.04	18	0.07	
American Indian/Alaska Native	99	0.1	79	0.06	20	0.08	
Missing	289	0.2	210	0.2	79	0.3	
Ethnicity							<.001
Non-Hispanic	155,819	97.6	130,274	97.5	25,545	98.0	
Mexican	542	0.3	482	0.4	60	0.2	
Puerto Rican	174	0.1	160	0.1	**	**	
Cuban	85	0.1	77	0.06	**	**	
Dominican Republic	59	0.0	43	0.03	16	0.06	
South or Central American	374	0.2	343	0.3	31	0.1	
Other specified Spanish/Hispanic Origin	155	0.1	140	0.1	**	**	
NOS[b] Spanish, Hispanic, and Latino	1,765	1.1	1,494	1.1	271	1.0	
Surname Match Only	732	0.5	616	0.5	116	0.4	

Residential Area[c]							<.001
Metropolitan Areas	130,028	81.4	111,843	83.7	18,185	69.7	
Micropolitan Areas	18,051	11.3	13,652	10.2	4,399	16.9	
Small Town	7,170	4.5	5,134	3.8	2,036	7.8	
Rural Areas	4,452	2.8	2,997	2.2	1,455	5.6	
Missing	**	**	**	**	**	**	
Poverty Level							<.001
0% - <5% poverty	17,863	11.2	16,126	12.1	1,737	6.7	
5% - <10% poverty	34,038	21.3	29,298	21.9	4,740	18.2	
10% - <20% poverty	53,070	33.2	43,732	32.7	9,338	35.8	
20% - 100% poverty	54,722	34.3	44,462	33.3	10,260	39.4	
Unknown	**	**	**	**	**	**	
Insurance							<.001
Not insured	7,917	5.0	7,085	5.3	832	3.0	
Has Insurance	66,488	41.6	56,492	42.3	9,996	38.3	
Medicaid	9,246	5.8	7,629	5.7	1,617	6.2	
Medicare	68,548	42.9	56,428	42.2	12,120	46.5	
Others	4,892	3.1	4,034	3.0	858	3.3	
Missing	2,614	1.6	1,961	1.5	653	2.5	

[b] NOS (not otherwise specified) or "unspecified" indicate that there is insufficient information in the medical record to assign a more specific code.

[c] Metropolitan Areas: at least 10% primary flow to a urbanized area. Micropolitan Areas: at least 10% primary flow to an urbanized area of 10,000 to 49,999 people. Small Town: at least 10% primary flow to an urban cluster of 2,500 and 9,999 people. Rural Area: primary flow to a tract outside an urbanized area or unban cluster

[d] Comparing CoC and non-CoC hospitals using chi-square significance test

[ε] Commission on Cancer

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

Table 2. Characteristics of Cancer Diagnosed from 2008 to 2011 by type of hospital for treatment, using Data from the Georgia Cancer Registry

	Study Participants (N= 159,705)		Any CoC[ε] Hospitals (N=133,629)		Only Non-CoC Hospitals (N=26,076)		p-value[h]
	No.	%	No.	%	No.	%	
Diagnostic Confirmation							<.001
Microscopically confirmed	152,429	95.4	128,050	95.8	24,379	93.5	
Not microscopically confirmed	7,071	4.4	5,451	4.1	1,620	6.2	
Missing	205	0.1	128	0.1	77	0.3	
Grade of Tumor							<.001
Grade I	14,615	9.2	12,524	9.4	2,091	8.0	
Grade II	43,013	26.9	36,044	27.0	6,969	26.7	
Grade III	38,080	23.8	31,531	23.6	6,549	25.1	
Grade IV	5,266	3.3	4,594	3.4	672	2.6	
T-cell	519	0.3	406	0.3	113	0.4	
B-cell	6,024	3.8	4,979	3.7	1,045	4.0	
Others[b]	33	0.02	23	0.02	**	**	
Unknown	52,155	32.7	43,528	32.6	8,627	33	
Stage at Diagnostic							<.001
Stage 0	11,764	7.4	9,737	7.3	2,027	7.8	
Stage I	38,334	24.0	33,176	24.8	5,158	19.8	
Stage II	39,473	24.7	31,436	23.5	8,037	30.8	
Stage III	20,853	13.1	18,105	13.6	2,748	10.5	
Stage IV	25,617	16.0	21,897	16.4	3,720	14.3	
Missing	23,664	14.8	19,278	14.4	4,386	17.8	
Behavior of Tumor							<.001
Benign neoplasms	4,027	2.5	3,523	2.6	504	2	
Neoplasms is uncertain or unknown status	479	0.3	394	0.3	85	0.3	
In situ neoplasms	11,349	7.1	9,421	7.1	1,928	7.4	
Malignant neoplasms [c]	143,850	90.1	120,291	90.0	23,559	90.4	
General Primary Site[d]							<.001
Oral Cavity and Pharynx	4,108	2.6	3,475	2.6	633	2.4	
Digestive System	26,486	16.6	22,367	16.7	4,119	15.8	
Respiratory System	23,083	14.5	19,629	14.7	3,454	13.3	
Bones and Joints	298	0.2	232	0.2	66	0.3	
Soft Tissues including the heart	1,045	0.7	878	0.7	167	0.6	
Skin excluding basal and squamous	5,298	3.3	4,368	3.3	930	3.6	
Breast	30,230	18.9	26,375	19.7	3,855	14.8	
Female Genital System	8,966	5.6	8,043	6.0	923	3.5	
Male Genital System	22,837	14.3	16,840	12.6	5,997	23.0	
Urinary System	11,442	7.16	9,526	7.1	1,916	7.4	
Eye and Orbit	305	0.2	234	0.2	71	0.3	
Brain and other Nervous System	5,190	3.2	4,443	3.3	747	2.9	

Endocrine System	5,720	3.6	5,084	3.8	636	2.4
Lymphoma	5,864	3.7	4,941	3.7	923	3.5
Myeloma	1,863	1.2	1,632	1.2	231	0.9
Leukemia	2,958	1.9	2,323	1.7	635	2.4
Mesothelioma	204	0.1	181	0.1	23	0.09
Kaposi Sarcoma	207	0.1	190	0.1	17	0.07
Others (Miscellaneous)	3,597	2.3	2,864	2.1	733	2.8
Missing	**	**	**	**	-	0.0

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[b] Consist of null cell and natural killer cell

[c] the malignant neoplasms was either stated or presumed to be primary

[d] Created by grouping the ICD-O-3 Primary Site and ICD-O-3 Histology together

[h] Comparing CoC and non-CoC hospitals using chi-square significance test

[ε] Commission on Cancer

Table 3. Summary of the Demographics and Tumor Characteristics that Exhibit a Noticeable[a] Different or Trend Between CoC[ε] and non-CoC Hospitals in the Stratified Analysis, using data from GCR[b] from 2008 to 2011

Stratified on	Among	Noticeable difference between hospital types	Percent Differences[c] (%)	Hospitals with the higher percentages
Gender	Male	Stage II	13	non-CoC
		Male Genital System	14	non-CoC
	Female	20% to 100% poverty level	10	non-CoC
	Both gender	Metropolitan area	**	CoC
		Micropolitan area, small town, rural	**	non-CoC
		10% to 100% poverty level	**	non-CoC
Residential Density Area	Metropolitan	Males	12	non-CoC
		Female	12	CoC
		Stage II	12	non-CoC
		Male Genital System	12	non-CoC
Poverty Level	0% to 5% poverty level	Males	18	non-CoC
		Females	18	CoC
		Stage II	20	non-CoC
		Breast Cancer	13	CoC
		Male Genital System	22	non-CoC
	5% to 10% poverty level	Males	14	non-CoC
		Females	14	CoC
		Stage II	14	non-CoC
		Male Genital System	16	non-CoC
	20% to 100 % poverty level	Whites	10	non-CoC
		Blacks	10	CoC
		Metropolitan Area	21	CoC
		Micropolitan area, small town, rural	**	non-CoC
Tumor Stage at Diagnosis	Stage I	Metropolitan	16	CoC
		Micropolitan area, small town, rural	**	non-CoC
		20% to 100 poverty	10	non-CoC
	Stage II	Males	15	non-CoC
		Females	15	CoC
		Male Genital System	25	non-CoC
	Stage III	Metropolitan Area	14	CoC
		Breast Cancer	12	CoC
		Micropolitan area, small town, rural	**	non-CoC
	Stage IV	Metropolitan Area	15	CoC
		Micropolitan area, small town, rural	**	non-CoC
General Site	Breast Cancer	0% to 5% poverty level	14	CoC
		20% to 100% poverty level	13	non-CoC
		have insurance	10	CoC
		Metropolitan Area	23	CoC
		Micropolitan area, small town, rural	**	non-CoC

[a] A percent difference greater than 10% when comparing CoC and non-CoC
[b] Georgia Cancer Registry
** This is a trend that consist of several percent differences
[ε] Commission on Cancer

Table 4: Results of the multidimensional bias analysis[a] to assess the impact of non-differential misclassification of exposure on the association between poverty level and place of treatment, using data from GCR[b] from 2008 to 2011

Sensitivity	Specificity	Risk Ratios
1.0	0.70	2.37
1.0	0.80	1.47
1.0	0.90	1.31
0.95	0.70	2.39
0.95	0.80	1.48
0.95	0.90	1.32
.90	0.70	2.41
.90	0.80	1.49
.90	0.90	1.33

[a] Analysis done using sensitivity and specificity from an external validation study
[b] Georgia Cancer Registry

APPENDIX

Appendix 1. Characteristics of a Cohort of Georgia Cancer Residents by Type of Hospital for Treatment Sorted by Gender, using Data from the Georgia Cancer Registry (2008-2011)

	Male				Female			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Age at Diagnostic, years								
00-19	435	0.8	555	3.8	392	0.6	592	4.6
20-29	883	1.4	120	0,8	1,171	1.7	139	1.0
30-39	1,775	2.8	198	1.4	3,789	5.4	433	4.8
40-49	5,240	8.3	799	5.5	10,110	14.4	1,139	10.0
50-59	14,213	22.5	2,864	19.5	15,727	22.4	2,188	19.2
60-69	20,834	32.9	4,803	32.8	18,200	25.9	2,748	24.1
70-79	14,132	22.3	3,744	25.5	13,144	18.7	2,480	21.7
80-89	5,252	8.3	1,432	9.8	6,794	9.7	1,460	12.8
90+	509	0.8	151	1.0	1,000	1.4	293	2.6
Race[γ]								
Non-Hispanic White	45,921	72.7	10,944	74.9	50,106	71.4	8,653	76.0
African American	16,450	26.0	3,527	24.1	18,796	26.8	2,606	22.9
Asian	776	1.23	126	0.9	1,233	1.8	102	0.9
Ethnicity								
Non-Hispanic	6,1834	97.7	14,382	98.1	68,429	97.3	11,162	97.8
Hispanic[b]	1,457	2.3	284	1.9	1,898	2.7	247	2.2
Residential Area[c]								
Metropolitan Areas	52,312	82.7	10,660	72.7	59,520	84.6	7,525	66.0
Micropolitan Areas	6,930	11.0	2,216	15.1	6,722	9.6	2,183	19.1
Small Town	2,492	3.9	1,011	6.9	2,642	3.8	1,024	9.0
Rural Areas	1,556	2.5	778	5.3	1,441	2.1	677	5.9
Poverty Level								
0% - <5%	7,467	11.8	1,125	7.7	8,657	12.3	612	5.7
5% - <10%	13,629	21.5	2,865	19.5	15,664	22.3	1,875	16.4
10% - <20%	20,786	32.8	5,310	36.2	22,946	32.6	4,028	35.3
20% - 100%	21,402	33.8	5,365	36.6	23,058	32.8	4,894	42.9
Insurance								
Not insured	3,698	5.5	475	3.2	3,387	4.8	357	3.1
Has Insurance	24,637	38.9	5,607	38.2	31,848	45.3	4,389	38.5
Medicaid	2,912	4.6	705	4.8	4,717	6.7	911	8.0

Medicare	28,222	44.6	6,872	47.0	28,203	40.1	5,248	46.0
Others	2,820	4.5	578	3.9	1,213	1.7	280	2.5

[b] Includes Mexican, Puerto Rican, Cuban, Dominican Republic, South and Central American, Other specified Spanish/Hispanic Origin, and NOS Spanish, Hispanic, and Latino. These groups were combined for this analysis due to spared data.

[c] Metropolitan Areas: at least 10% primary flow to a urbanized area. Micropolitan Areas: at least 10% primary flow to an urbanized area of 10,000 to 49,999 people. Small Town: at least 10% primary flow to an urban cluster of 2,500 and 9,999 people. Rural Area: primary flow to a tract outside an urbanized area or unban cluster

[γ] The other two categories (Hawaiian/Pacific Islander, American Indian/Alaska Native) was not included in this analysis due to spared data.

Appendix 2. Characteristics of Cancer Diagnosed by Type of Hospital for Treatment Sorted by Gender, using data from the Georgia Cancer Registry (2008-2011)

	Male				**Female**			
	Any CoC Hospitals		**Only Non-CoC Hospitals**		**Any CoC Hospitals**		**Only Non-CoC Hospitals**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Diagnostic Confirmation								
Microscopically confirmed	60,646	95.9	13,865	94.8	67,394	95.9	10,513	92.4
Not microscopically confirmed	2,578	4.1	757	5.2	2822	4.1	863	7.6
Grade of Tumor								
Grade I	3,018	4.8	664	4.5	9,506	13.5	1,427	12.5
Grade II	17,010	26.9	4,284	29.2	19,030	27.1	2,685	23.5
Grade III	16,062	25.4	4,263	29.1	15,466	22.0	2,285	23.0
Grade IV	2,596	4.1	400	2.7	1,997	2.8	272	2.4
T-cell	248	0.4	62	0.4	158	0.2	51	0.5
B-cell	2,820	4.5	557	3.8	2,159	3.1	488	4.3
Stage at Diagnostic								
Stage 0	2746	5.1	830	6.6	6,990	12.6	1,197	13.0
Stage I	10,644	19.8	1,987	15.9	22,531	37.3	3,170	34.5
Stage II	19,467	36.1	6,193	49.6	11,967	19.8	1,844	20.0
Stage III	8,513	15.8	1,342	11.0	9,592	15.9	1,406	15.3
Stage IV	12,497	23.20	2,141	17.0	9,397	15.5	1,579	17.2
Behavior of Tumor								
Benign neoplasms	1,287	2.0	181	1.2	2,235	3.2	323	2.8
In situ neoplasms	2,591	4.1	780	5.3	6,829	9.7	1,148	10.1

Malignant neoplasms[b]	59,224	93.6	13,669	93.2	61,058	86.8	9,889	86.7
General Primary Site[c]								
Oral Cavity and Pharynx	2,501	4.0	453	3.1	974	1.4	180	1.6
Digestive System	12,395	19.6	2,213	15.1	9,971	14.2	1,906	16.7
Respiratory System	11,341	17.9	2,049	14.0	8,288	11.8	1,405	13.3
Bones and Joints	129	0.2	38	0.3	103	0.2	28	0.3
Soft Tissues including the heart	481	0.8	81	0.6	397	0.6	86	0.8
Skin excluding basal and squamous	2,572	4.1	553	3.8	1,796	2.6	377	3.3
Breast	164	0.3	35	0.2	26,208	37.3	3,819	34.0
Female Genital System	-	0.0	-	0.0	8,043	11.4	923	8.1
Male Genital System	16,838	26.6	5,997	40.9	-	0.0	-	0.0
Urinary System	6,531	10.3	1,343	9.2	2,994	4.3	573	5.0
Eye and Orbit	136	0.2	36	0.3	98	0.1	35	0.3
Brain and other Nervous System	1,930	3.1	328	2.2	2,511	3.6	419	3.7
Endocrine System	1,557	2.5	208	1.4	3,527	5.0	428	3.8
Lymphoma	2,748	4.3	208	1.4	2,193	3.1	432	3.8
Myeloma	918	1.0	116	.08	714	1.0	115	1.0
Leukemia	1,296	2.1	330	2.3	1,026	1.5	305	3.0
Mesothelioma	138	0.2	**	**	43	0.1	**	**
Kaposi Sarcoma	179	0.3	**	**	**	**	**	**
Others (Miscellaneous)	1,433	2.3	366	2.3	1,431	2.0	367	3.2

[b] the malignant neoplasms was either stated or presumed to be primary

[c] Created by grouping the ICD-O-3 Primary Site and ICD-O-3 Histology together

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

Appendix 3. Characteristics of a Cohort of Georgia Cancer Residents by Type of Hospital for Treatment Sorted by Residential Density Area, using Data from the Georgia Cancer Registry (2008-2011)

	Metropolitan Areas				Micropolitan Areas			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Age at Diagnostic, years								
00-19	709	0.6	946	5.2	91	0.7	94	2.4
20-29	1,799	1.6	190	1.0	161	1.8	40	0.9
30-39	4,905	4.4	462	2.5	454	3.3	109	2.5
40-49	13,391	12.0	1,434	7.9	1,223	9,0	304	6.9
50-59	25,286	22.6	3,554	19.5	2,908	21.3	889	20.2
60-69	32,296	28.9	5,286	29.1	4,213	31.9	1,213	27.6
70-79	22,189	19.8	4,211	23.1	3,133	23.0	1,058	24.1
80-89	9,994	8.9	1,853	10.2	1,315	9.6	586	13.3
90+	1,274	1.1	249	1.4	154	1.1	106	2.4
Gender								
Male	52,312	46.8	10,660	58.6	6,930[≠]	51.8[≠]	2,215[≠]	50.4[≠]
Female	59,520	53.2	7,525	41.4	6,722[≠]	49.2[≠]	2,183[≠]	46.6[≠]
Race[γ]								
Non-Hispanic White	78,977	70.6	13,597	74.8	10,752	78.8	3,212	73.0
African American	30,628	27.4	4,299	23.6	2,826	20.7	1,150	26.1
Asian	1,929	1.7	191	1.1	58	0.4	27	0.6
Hispanic								
Non-Hispanic	108,768	97.3	17,748	97.6	13,454[≠]	98.6[≠]	4,341[≠]	98.7[≠]
Hispanic[b]	3,075	2.8	437	2.4	198[≠]	1.4[≠]	58[≠]	1.3[≠]
Poverty Level								
0% - <5%	16,033	14.3	1,700	9.4	31	0.2	**	**
5% - <10%	2,822	25.2	4,405	24.2	841	6.2	204	4.6
10% - <20%	37,154	33.2	7,176	39.5	43	31.6	1,205	27.4
20% - 100%	30,424	27.2	4,904	30.0	8,462	62.0	2,980	67.7
Insurance								
Not insured	5,824	5.2	535	3.0	715	5.2	175	4.0
Has Insurance	49,368	44.1	7,523	41.4	4,536	33.2	1,420	32.3
Medicaid	6,088	5.4	1,061	5.4	977	7.2	355	8.1
Medicare	45,371	40.6	7,870	4.3	6,921	50.7	2,291	52.1
Others	3,499	3.1	692	3.8	335	2.5	108	2.5

[b] Includes Mexican, Puerto Rican, Cuban, Dominican Republic, South and Central American, other specified Spanish/Hispanic origin, and NOS Spanish, Hispanic, and Latino. These groups were combined for this analysis due to spared data.

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[γ] The other two categories (Hawaiian/Pacific Islander, American Indian/Alaska Native) was not included in this analysis due to spared data.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 4. Characteristics of Cancer Diagnosed by Type of Hospital for Treatment Sorted by Residential Density Area, using Data from the Georgia Cancer Registry (2008-2011)

	Metropolitan Areas				Micropolitan Areas			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Diagnostic Confirmation								
Microscopically confirmed	107,172	95.9	17,164	94.7	13,070	95.9	3,987	90.9
Not microscopically confirmed	4,578	4.1	971	5.4	559	4.1	398	9.1
Grade of Tumor								
Grade I	10,558	9.4	1,265	7.0	1,286	9.4	472	10.7
Grade II	30,186	27.0	4,934	27.1	3,678	26.9	1,094	24.9
Grade III	26,283	23.5	4,920	27.1	3,174	23.3	882	20.1
Grade IV	3,834	3.4	448	2.5	465	3.4	121	2.8
T-cell	341	0.3	94	0.5	42	0.3	**	**
B-cell	4,183	3.7	733	4.0	518	3.8	198	4.5
Stage at Diagnostic								
Stage 0	8,427	8.8	1,278	8.4	846	7.3	396	11.2
Stage I	27,959	29.2	3,510	23.0	3,279	28.1	909	25.6
Stage II	26,347	27.5	6,082	39.9	3,228	27.7	1,050	29.6
Stage III	14,926	15.6	1,872	12.3	1,940	16.6	505	14.2
Stage IV	18,038	18.9	2,494	16.4	2,367	20.3	688	19.4
Behavior of Tumor								
Benign neoplasms	3,010	2.7	379	2.1	338	2.5	76	1.7
In situ neoplasms	8,154	7.3	1,218	6.7	823	6.0	373	8.5
Malignant neoplasms[b]	100,357	89.7	16,523	90.9	12,448	91.2	3,939	89.5
General Primary Site[c]								
Oral Cavity and Pharynx	2,897	2.6	429	2.4	356	2.	108	2.5
Digestive System	18,576	16.6	2,620	14.4	2,375	17.4	884	20.1
Respiratory System	15,663	14.0	2,341	12.9	2,464	18.1	610	13.9
Bones and Joints	196	0.2	50	0.3	19	0.1	**	**
Soft Tissues including the heart	747	0.7	118	0.7	80	0.6	26	0.6
Skin excluding basal and squamous	3,698	3.3	697	3.8	420	3.1	122	2.8
Breast	22,775	20.4	2,447	13.5	2,263	16.6	747	17.0
Female Genital System	6,707	6.0	567	3.1	806	5.9	205	4.7
Male Genital System	14,238	12.7	4,816	26.5	1,659	12.2	598	13.6
Urinary System	7,867	7.0	1,272	7.0	1,042	7.6	362	8.2
Eye and Orbit	186	0.2	54	0.3	21	0.2	**	**

Brain and other Nervous System	3,728	3.3	573	3.2	447	3.3	102	2.3
Endocrine System	4,436	4.0	479	3.6	393	2.9	85	1.9
Lymphoma	4,203	3.8	647	3.6	468	3.4	167	3.8
Myeloma	1,371	1.2	143	0.8	161	1.2	51	1.2
Leukemia	1,894	1.7	483	2.7	294	2.3	105	2.4
Mesothelioma	142	0.1	**	**	26	0.2	**	**
Kaposi Sarcoma	186	0.2	17	0.09	**	**	-	0.0
Others (Miscellaneous)	2,329	2.1	418	2.3	355	2.6	201	4.6

[b] the malignant neoplasms was either stated or presumed to be primary

[c] Created by grouping the ICD-O-3 Primary Site and ICD-O-3 Histology together

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

Appendix 5. Characteristics of a Cohort of Georgia Cancer Residents by Type of Hospital for Treatment Sorted by Poverty Level Indicator, using Data from the Georgia Cancer Registry (2008-2011)

	Less Than 5% poverty				20% to 100% poverty			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Age at Diagnostic, years								
00-19	97	0.6	145	8.4	295	0.7	342	3.2
20-29	183	1.1	17	1.0	748	1.7	95	0.9
30-39	657	4.1	49	2.8	1,696	3.8	233	2.3
40-49	2,163	13.4	131	7.5	4,608	10.4	733	7.1
50-59	3,666	22.7	316	18.2	10,027	22.6	1,978	19.3
60-69	4,572	28.4	533	30.7	13,122	29.5	2,853	27.8
70-79	3,121	19.4	372	21.4	9,335	21.0	2,503	24.4
80-89	1,482	9.2	159	9.2	4,088	9.2	1,291	12.6
90+	185	1.2	15	0.9	543	1.2	232	2.2
Gender								
Male	7,467	46.3	1,125	64.8	21,402	48.1	5,365	52.3
Female	8,657	53.7	612	35.2	23,058	51.9	4,894	47.6
Race[y]								
Non-Hispanic White	14,416	89.4	1,502	86.5	25,240	56.8	6,880	67.1
African American	1,292	8.0	195	11.2	18,700	42.1	3,275	31.9
Asian	358	2.2	31	1.8	428	1.0	69	0.7
Hispanic								
Non-Hispanic	15,677[≠]	97.2[≠]	1,695[≠]	97.6[≠]	43,380	97.6	10,060	98.1
Hispanic[b]	449[≠]	2.8[≠]	42[≠]	2.4[≠]	1,082	2.4	200	2.0

Residential Area[c]								
Metropolitan Areas	16,033	99.4	1,700	98.0	30,424	68.4	4,904	47.8
Micropolitan Areas	31	0.2	**	**	8,462	19.0	2,980	29.0
Small Town	-	0.0	-	0.0	4,059	9.1	1,644	16.0
Rural Areas	62	0.4	27	2.0	1,515	3.4	732	7.0
Insurance								
Not insured	364	2.3	27	1.6	3,305	7.6	415	4.1
Has Insurance	8,876	55.7	873	54.4	14,678	33.6	3,319	33.1
Medicaid	290	1.8	55	3.3	3,997	9.2	820	8.2
Medicare	6,048	38.0	643	38.6	20,252	46.4	5,137	51.3
Others	349	2.2	67	4.0	1,413	3.2	349	3.5

[b] Includes Mexican, Puerto Rican, Cuban, Dominican Republic, South and Central American, Other specified Spanish/Hispanic Origin, and NOS Spanish, Hispanic, and Latino. These groups were combined for this analysis due to spared data.

[c] Metropolitan Areas: at least 10% primary flow to a urbanized area. Micropolitan Areas: at least 10% primary flow to an urbanized area of 10,000 to 49,999 people. Small Town: at least 10% primary flow to an urban cluster of 2,500 and 9,999 people. Rural Area: primary flow to a tract outside an urbanized area or unban cluster

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[γ] The other two categories (Hawaiian/Pacific Islander, American Indian/Alaska Native) was not included in this analysis due to spared data.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 6. Characteristics of Cancer Diagnosed by Type of Hospital for Treatment Sorted by Poverty Level Indicator, using Data from the Georgia Cancer Registry (2008-2011)

	Less Than 5% poverty				**20% to 100% poverty**			
	Any CoC Hospitals		**Only Non-CoC Hospitals**		**Any CoC Hospitals**		**Only Non-CoC Hospitals**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Diagnostic Confirmation								
Microscopically confirmed	15,606[≠]	98.9[≠]	1,660[≠]	96.8[≠]	42,355	95.4	9,442	92.3
Not microscopically confirmed	508[≠]	3.0[≠]	66[≠]	4.0[≠]	2,046	4.6	786	7.7
Grade of Tumor								
Grade I	1,753	10.9	102	5.9	3,677	8.0	932	9.1
Grade II	4,424	27.4	467	26.9	11,584	26.7	2,621	25.6
Grade III	3,652	22.7	503	30.0	10,836	24.4	2,420	23.6
Grade IV	496	3.1	47	2.7	1,528	3.4	276	2.7
T-cell	38	0.2	**	**	146	0.3	41	0.4
B-cell	612	3.8	93	5.4	1,699	3.8	401	3.9

Stage at Diagnostic								
Stage 0	1,475	10.6	110	7.7	2,646	7.0	830	9.9
Stage I	4,624	33.1	323	22.5	9,776	25.9	2,041	24.3
Stage II	3,874	27.8	694	48.4	10,419	27.6	2,751	32.7
Stage III	1,943	13.9	131	9.1	6,422	17.0	1,171	13.9
Stage IV	2,039	14.6	176	12.3	8,524	22.4	1,613	19.2
Behavior of Tumor								
Benign neoplasms	437	2.7	35	2.5	1,130	2.5	**	**
In situ neoplasms	1,439	8.9	105	6.0	2,544	5.7	784	7.6
Malignant neoplasms[b]	14,206	88.1	1,589	91.5	40,651	91.4	9,239	90.1
General Primary Site[c]								
Oral Cavity and Pharynx	411	2.6	38	2.2	1,205	2.7	255	2.5
Digestive System	2,255	14.0	189	10.9	8,112	18.3	1,845	18.0
Respiratory System	1,721	1.7	140	8.1	7,606	7.1	1,493	14.6
Bones and Joints	26	0.2	**	**	73	0.2	24	0.2
Soft Tissues including the heart	99	0.6	**	**	286	0.6	61	0.6
Skin excluding basal and squamous	837	5.2	94	5.4	940	2.1	271	2.6
Breast	3,709	23.0	186	10.7	7,849	17.7	1,622	15.8
Female Genital System	896	5.6	33	1.9	2,852	6.4	441	4.3
Male Genital System	2,259	14.0	618	35.6	5,499	12.0	1,877	18.3
Urinary System	1,142	7.1	118	6.8	2,971	6.7	800	7.8
Eye and Orbit	29	0.2	**	**	60	0.1	26	0.3
Brain and other Nervous System	541	3.4	64	3.7	1,371	3.1	279	2.7
Endocrine System	820	5.1	48	2.8	1,329	3.0	233	2.3
Lymphoma	616	3.8	76	4.4	1,637	3.7	348	3.4
Myeloma	178	1.1	**	**	653	1.5	108	1.1
Leukemia	258	1.6	58	3.3	796	1.8	243	2.4
Mesothelioma	26	0.2	-	0.0	64	0.1	**	**
Kaposi Sarcoma	**	**	**	**	98	0.2	**	**
Others (Miscellaneous)	295	1.8	33	1.9	1,060	2.4	321	3.3

[b] The malignant neoplasms was either stated or presumed to be primary

[c] Created by grouping the ICD-O-3 Primary Site and ICD-O-3 Histology together

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 7. Characteristics of a Cohort of Georgia Cancer Residents by Type of Hospital for Treatment Sorted by Stage of Tumor at Diagnostic, using Data from the Georgia Cancer Registry (2008-2011)

	Stage 2				Stage 3			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Age at Diagnostic, years								
00-19	71	0.4	59	0.7	55	0.3	26	1.0
20-29	259	0.8	24	0.3	224	1.2	18	0.7
30-39	931	3.0	119	1.5	652	3.6	57	210
40-49	3,165	10.1	482	6.0	2,035	11.2	226	8.2
50-59	7,406	23.6	1,715	21.3	4,273	23.6	564	20.5
60-69	10,782	34.3	2,880	35.8	5,289	29.2	777	28.3
70-79	6,398	20.4	2,055	25.6	3,717	20.5	704	25.6
80-89	2,157	6.9	612	7.6	1,672	9.2	327	11.9
90+	267	0.9	91	1.1	188	1.0	49	1.8
Gender								
Male	19,467	61.9	6,193	77.1	8,513[≠]	47.0[≠]	1,342[≠]	48.8[≠]
Female	11,967	38.1	1,844	22.9	9,592[≠]	53.0[≠]	1,406[≠]	51.2[≠]
Race[y]								
Non-Hispanic White	21,519	68.5	5,666	71.7	13,049	72.1	2,113	76.9
African American	9,456	30.1	2,267	28.0	4,730	26.3	606	22.1
Asian	400	1.3	70	0.9	292	1.6	24	0.9
Hispanic								
Non-Hispanic	30,666	97.6	7,899	98.3	17,628	97.4	2,704	98.4
Hispanic[b]	770	2.0	138	1.7	477	2.7	44	1.6
Residential Area[c]								
Metropolitan Areas	26,347	83.8	6,082	75.7	14,926	82.4	1,872	68.1
Micropolitan Areas	3,228	10.3	1,050	13.1	1,940	10.7	505	18.4
Small Town	1,173	3.7	491	6.1	784	4.3	226	8.2
Rural Areas	688	2.2	414	5.2	455	2.5	145	5.3
Poverty Level								
0% - <5% poverty	3,874	12.3	694	8.6	1,943	10.7	131	4.8
5% - <10% poverty	6,896	21.9	1,669	20.8	3,838	21.2	439	16.0
10% - <20% poverty	10,247	32.6	2,923	36.4	5,898	32.6	1,007	36.6
20% - 100% poverty	10,419	33.1	2,751	34.2	6,422	35.5	1,171	42.6
Insurance								
Not insured	1,137	3.7	158	2.0	1,176	6.6	103	3.3
Has Insurance	14,179	45.7	3,334	42.7	7,038	39.3	903	33.5
Medicaid	1,409	4.5	244	3.1	1,331	7.4	200	7.4
Medicare	13,069	42.1	3,776	48.3	7,789	45.0	1,414	52.4
Others	1,240	4.0	299	3.8	560	3.1	79	2.6

[b] Includes Mexican, Puerto Rican, Cuban, Dominican Republic, South and Central American, Other specified Spanish/Hispanic Origin, and NOS Spanish, Hispanic, and Latino. These groups were combined for this analysis due to spared data.

[c] Metropolitan Areas: at least 10% primary flow to a urbanized area. Micopolitan Areas: at least 10% primary flow to a urbanized area of 10,000 to 49,999 people. Small Town: at least 10% primary flow to an urban cluster of 2,500 and 9,999 people. Rural Area: primary flow to a tract outside an urbanized area or unban cluster

[γ] The other two categories (Hawaiian/Pacific Islander, American Indian/Alaska Native) was not included in this analysis due to spared data.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 8. Characteristics of Cancer Diagnosed by Type of Hospital for Treatment Sorted by Stage of Tumor at Diagnostic, using Data from the Georgia Cancer Registry (2008-2011)

	Stage at Diagnostic-Stage 2				Stage at Diagnostic-Stage 3			
	Any CoC Hospitals		Only Non-CoC Hospitals		Any CoC Hospitals		Only Non-CoC Hospitals	
	No.	%	No.	%	No.	%	No.	%
Diagnostic Confirmation								
Microscopically confirmed	31,169[≠]	99.2[≠]	7,963[≠]	99.0[≠]	17,715	97.9	2,598	94.6
Not microscopically confirmed	254[≠]	0.8[≠]	62[≠]	0.8[≠]	382	2.1	147	5.4
Grade of Tumor								
Grade I	1,931	6.1	350	4.4	967	5.3	163	5.9
Grade II	12,833	40.8	3,425	42.6	5,155	28.5	735	26.8
Grade III	12,140	38.6	3,397	42.7	5,483	30.3	820	29.8
Grade IV	778	2.5	128	1.6	911	5.0	106	3.9
T-cell	37	0.1	13	0.2	70	0.4	**	**
B-cell	571	1.8	106	1.3	652	3.6	110	4.0
General Primary Site[c]								
Oral Cavity and Pharynx	399	1.3	86	1.1	506	2.8	79	2.9
Digestive System	4,971	15.8	819	10.2	4,225	25.0	712	25.9
Respiratory System	1,054	3.4	147	1.8	4,739	26.2	871	31.8
Bones and Joints	63	0.2	16	0.2	**	**	**	**
Soft Tissues including the heart	146	0.5	22	0.3	187	1.0	16	0.6
Skin excluding basal and squamous	687	2.2	95	1.2	440	2.4	41	1.5
Breast	7,052	22.4	1,038	12.9	2,528	14.0	387	1.1
Female Genital System	807	2.6	94	1.2	1,706	9.4	146	5.3

Male Genital System	13,824	44.0	5,289	65.8	1,184	6.5	176	6.4
Urinary System	1,103	3.5	200	2.5	872	4.8	115	4.2
Eye and Orbit	62	0.02	**	**	-	0.0	-	0.0
Brain and other Nervous System	-	0	-	0.0	-	0.0	-	0.0
Endocrine System	297	0.9	36	0.5	389	2.3	37	1.4
Lymphoma	945	3.0	182	2.3	974	5.4	163	5.6
Myeloma	-	0.0	-	0.0	-	0.0	-	0.0
Leukemia	-	0.0	-	0.0	-	0.0	-	0.0
Mesothelioma	24	0.01	**	**	31	0.2	**	**
Kaposi Sarcoma	-	0.0	-	0.0	-	0.0	-	0.0
Others (Miscellaneous)	-	0.0	-	0.0	-	0.0	-	0.0

[b] The malignant neoplasms was either stated or presumed to be primary

[c] Created by grouping the ICD-O-3 Primary Site and ICD-O-3 Histology together

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 9. Characteristics of a Cohort of Georgia Cancer Residents by Type of Hospital for Treatment Sorted by the Primary Site of the Tumor, using Data from the Georgia Cancer Registry (2008-2011)

	Breast				**Male Genital System**			
	Any CoC Hospitals		**Only Non-CoC Hospitals**		**Any CoC Hospitals**		**Only Non-CoC Hospitals**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Age at Diagnostic, years								
00-19	**	**	**	**	23	0.1	19	0.3
20-29	132	0.5	**	**	192	1.1	37	0.6
30-39	1,330	5.0	153	4.0	225	1.3	36	0.6
40-49	5,005	19.0	531	13.8	891	5.3	228	3.8
50-59	6,769	25.7	906	23.5	4,240	25.2	1,286	21.4
60-69	7,036	26.7	1,006	26.1	7,152	42.5	2,454	40.9
70-79	4,171	15.8	793	20.6	3,457	20.5	1,600	26.7
80-89	1,735	6.6	390	10.1	619	3.7	316	5.3
90+	194	0.7	63	1.6	41	0.2	21	0.4
Gender								
Male	164[≠]	0.6[≠]	35[≠]	0.9[≠]	16,838[≠]	100[≠]	5,997[≠]	100[≠]
Female	26,208[≠]	99.4[≠]	3,819[≠]	99.1[≠]	-	0.0[≠]	-	0.0[≠]

Race[γ]								
Non-Hispanic White	18,548	70.5	2,843	73.8	11,031	65.6	4,047	67.8
African American	7,257	27.6	978	25.4	5,652	33.6	1,863	31.2
Asian	490	2.0	24	0.6	119	0.7	51	0.9
Hispanic								
Non-Hispanic	25,648	97.2	3,800	98.6	16,449[≠]	97.7[≠]	5,878[≠]	98.0[≠]
Hispanic[b]	727	2.8	55	1.4	391[≠]	2.3[≠]	119[≠]	2.0[≠]
Residential Area[c]								
Metropolitan Areas	22,775	86.4	2,447	63.5	14,238	84.6	4,816	80.3
Micropolitan Areas	2,263	8.6	747	19.4	1,659	9.9	598	10.0
Small Town	859	3.3	391	10.1	585	3.5	299	5.0
Rural Areas	478	1.8	270	7.0	358	2.1	283	4.7
Poverty Level								
0% - <5% poverty	3,709	14.1	186	4.8	2,259	13.4	618	10.3
5% - <10% poverty	6,351	24.1	655	17.0	3,743	22.2	1,354	22.6
10% - <20% poverty	8,465	32.1	1,392	36.1	5,339	31.7	2,147	3.8
20% - 100% poverty	7,849	39.8	1,622	42.1	5,499	32.7	1,877	31.3
Insurance								
Not insured	624	2.4	56	1.5	513	3.1	95	1.6
Has Insurance	14,305	54.7	1,694	44.5	7,930	47.9	2,567	44.3
Medicaid	1,926	7.4	309	8.1	354	2.1	104	1.8
Medicare	8,766	33.5	1,637	43.1	6,829	41.2	2,770	47.8
Others	534	2..	109	2.9	942	5.7	258	4.5

[b] Includes Mexican, Puerto Rican, Cuban, Dominican Republic, South and Central American, Other specified Spanish/Hispanic Origin, and NOS Spanish, Hispanic, and Latino. These groups were combined for this analysis due to spared data.

[c] Metropolitan Areas: at least 10% primary flow to a urbanized area. Micropolitan Areas: at least 10% primary flow to a urbanized area of 10,000 to 49,999 people. Small Town: at least 10% primary flow to an urban cluster of 2,500 and 9,999 people. Rural Area: primary flow to a tract outside an urbanized area or unban cluster

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[γ] The other two categories (Hawaiian/Pacific Islander, American Indian/Alaska Native) was not included in this analysis due to spared data.

[≠] Not significant in Chi-square significant test (p-value > .05)

Appendix 10. Characteristics of Cancer Diagnosed by Type of Hospital for Treatment Sorted by the Primary Site of the Tumor, using Data from the Georgia Cancer Registry (2008-2011)

	Breast				Male Genital System			
	Any CoC Hospital Treatment		Non CoC Hospital Treatment		Any CoC Hospital Treatment		Non CoC Hospital Treatment	
	No.	%	No.	%	No.	%	No.	%
Diagnostic Confirmation								
Microscopically confirmed	26,315	99.8	3,826	99.3	16,724[≠]	99.4[≠]	5,939[≠]	99.3[≠]
Not microscopically confirmed	57	0.2	26	0.7	97[≠]	0.6[≠]	42[≠]	0.7[≠]
Grade of Tumor								
Grade I	5,226	19.8	771	20.0	128	0.8	55	0.9
Grade II	9,950	37.7	1,299	34.0	6,576	39.0	2,575	43.0
Grade III	9,120	34.6	1,311	34.0	8,957	53.0	3,010	50.0
Grade IV	147	0.6	26	0.7	53	0.3	**	**
Stage at Diagnostic								
Stage 0	5,410[≠]	21.0[≠]	712[≠]	19.2[≠]	39	0.2	**	**
Stage I	9,889[≠]	38.0[≠]	1,402[≠]	37.7[≠]	463	2.8	103	1.8
Stage II	7,052[≠]	27.0[≠]	1,038[≠]	27.9[≠]	13,824	84.0	5,289	91.4
Stage III	2,528[≠]	9.7[≠]	387[≠]	10.4[≠]	1,184	7.2	176	3.0
Stage IV	1,143[≠]	4.4[≠]	179[≠]	4.8[≠]	953	5.8	225	3.9
Behavior of Tumor								
Benign neoplasms	-	0.0	-	0.0	-	0.0[≠]	-	0.0[≠]
In situ neoplasms	5,386	20.4	710	18.4	38[≠]	0.2[≠]	10[≠]	0.2[≠]
Malignant neoplasms[b]	20,989	19.6	3,145	82.6	16,802[≠]	99.8[≠]	5,987[≠]	99.8[≠]

[b] The malignant neoplasms was either stated or presumed to be primary

**These values were not reported to comply with the GA Department of Public Health terms of the data use agreement stating that cells with 15 or less patients not be reported.

[≠] Not significant in Chi-square significant test (p-value > .05)