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Receipt of guideline-concordant care does not explain breast cancer mortality disparities by race in Metropolitan Atlanta

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Abstract

Background: Racial disparities in breast cancer mortality in the U.S. are well-documented. Non-Hispanic Black (NHB) women are more likely to die of their disease than their non-Hispanic White (NHW) counterparts. The disparity is most pronounced among women diagnosed with prognostically favorable tumors, which may be due—in part—to variations in receipt of guideline care. In this study, we sought to estimate the effect of guideline concordant care (GCC) on prognosis, and to evaluate whether receipt of GCC modified racial disparities in breast cancer mortality.

Methods: Using the Georgia Cancer Registry, we identified 2784 NHB and 4262 NHW women diagnosed with a stage I–III first primary breast cancer in the Metropolitan Atlanta area (2010–2014). Women were included if they received surgery and information was available on breast tumor characteristics; all others were excluded. Receipt of recommended therapies (chemo-, radiation, endocrine, and anti-HER2 therapies) as indicated was considered GCC. We used Cox proportional hazards models to estimate the impact of receiving GCC on breast cancer mortality overall and by race, with multivariable adjusted hazard ratios (HR).

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Specific Contributions: LEM and LJC contributed to the study design and conceptualization; LEM, LJC, KG, PS, JL, MT, and JL contributed to the methodology; LJC, LEM, MY, RJ, KCW, JMS, and JMK contributed to the data analysis, curation and interpretation; LJC and LEM contributed to the original manuscript preparation; LEM and KCW were responsible for funding ascertainment; all authors participated in the review and editing of the manuscript for publication.

Results: We found that NHB women were more likely to receive GCC (63% vs. 56%) compared with NHW women. Failure to receive GCC was associated with an increase in the hazard of breast cancer mortality (HR=1.34, 95%CI=1.06, 1.69). However, racial disparities in breast cancer mortality persisted whether or not GCC was received (HR_{GCC}=2.08, 95%CI=1.54, 2.80; HR_{Non-GCC}=1.95, 95%CI=1.38, 2.76 comparing NHB vs. NHW women).

Conclusion: Although receipt of guideline-care is important for breast cancer outcomes, racial disparities in breast cancer mortality did not diminish with receipt of GCC; as the Black-White differences in mortality persisted across strata of GCC.

Keywords

Breast Cancer Outcomes; Health Disparities; Guideline Concordant Care

INTRODUCTION

In the U.S., racial disparities in breast cancer outcomes are well documented, wherein non-Hispanic Black (NHB) women are more likely to die from their disease than their non-Hispanic White (NHW) counterparts.^{1–3} The disparity is, in part, attributed to stage and subtype—as NHB women are more likely to be diagnosed with a metastatic cancer, and/or triple negative subtype; both of which have poor prognosis due to limited treatment options.^{4,5} However, we recently reported that the most pronounced racial disparities in breast cancer mortality were observed among women with non-metastatic, estrogen receptor (ER) positive tumors.^{6,7} Such tumors are known to have a favorable prognosis, given multiple highly effective biomarker-driven treatment regimens.⁸ One explanation for such paradoxical findings is that disparities in survival outcomes among women with early stage or ER+ disease may be due to factors downstream of their cancer diagnosis, such as failure to receive guideline-concordant care (GCC).⁹

Clinical guidelines for women diagnosed with stage I–III breast cancer are developed based on results from multiple clinical trials, and failure to receive guideline care has adverse effects on breast cancer outcomes.^{10–13} Adherence to guidelines could arise from multiple factors including structural racism, barriers to access, tumor and patient characteristics, or clinician and patient preferences.¹¹ Therefore, non-adherence to clinical guidelines may be a contributing factor to the observed race disparity in breast cancer mortality.^{9,14} Observational studies assessing adherence to clinical guidelines are important in understanding patient outcomes; however, few studies have examined receipt of guideline care as a possible driver of disparate outcomes in a population-based setting.

To address this knowledge gap, we sought to evaluate how failure to receive GCC contributes to breast cancer mortality, overall, and to disparities in breast cancer mortality among NHB and NHW women diagnosed with a first primary stage I–III breast cancer in the Metropolitan Atlanta area.

METHODS

Study Population

Using the Georgia Cancer Registry (GCR), we identified women diagnosed with breast cancer between 2010 and 2014 while residing in Metropolitan Atlanta (*i.e.*, Fulton, DeKalb, Gwinnett, Cobb or Clayton county). Breast cancer patients were included if they were diagnosed with an invasive stage I–III first primary breast tumor and were classified as being NHW or NHB. Race was based on U.S. Census Bureau definitions and Hispanic ethnicity was determined by the NAACR Hispanic Identification Algorithm.^{15,16} Additional criteria required that women had information available for assigning tumor subtype (ER, progesterone receptor [PR] used to define women as hormone receptor [HR]-positive or negative, and human epidermal growth factor receptor-2 [HER2] expression), and received surgery as part of their local therapy. HR and HER2 status were used to assign women as HR+/HER2–, HR+/HER2+, HR–/HER2+, or HR–/HER2–. Detailed information on the differences between women who received surgery (94.6%) compared to those who did not (5.4%) are reported in the online digital content (Supplemental Tables 1–3). Follow-up information was available on patients through December 31, 2016. The outcome of interest was breast cancer mortality (ICD10-C50), which was determined from death certificate data.

Exposure Assessment

Guideline Care—Determination of receipt of guideline care was defined based on the National Comprehensive Cancer Network's (NCCN) 2011 Invasive Breast Cancer Clinical Practice Guidelines in Oncology (Figure 1).¹⁷ The NCCN guidelines were used to inform the indication for each type of breast cancer therapy for every patient in our dataset. Information regarding type of surgery received (mastectomy vs. breast conserving surgery), tumor receptor status (ER, PR, and HER2 expression), tumor size, lymph node involvement, and 21-gene recurrence score data (obtained via direct linkage with Genomic Health), were ascertained from the GCR (Supplemental Tables 4–7).

We first grouped women based on their breast cancer subtype: as HR+/HER2–, HR+/HER2+, HR–/HER2+, or HR–/HER2– as described above. These derived tumor subtypes inform the type of biomarker driven therapies (endocrine therapy and anti-HER2 therapy) a patient should receive. We then examined the possible combinations of surgery type, tumor size, lymph node status and 21-gene recurrence score to determine treatment indications. Based on these patient-level data in the GCR, each woman was classified as indicated, discretionary, not indicated, or indeterminate (missing) for each type of therapy. The latter occurred among 6.6% of NHB and 5.2% of NHW women.

Once the indication for each therapy was determined, we assessed whether the patient received therapy consistent with NCCN guidelines using GCR treatment data. The GCR regularly collects information on surgery type, and initiation of chemotherapy, radiation, and endocrine therapies. Anti-HER2 therapies were captured as chemotherapy in the GCR analytic database until 2013, and then coded as immunotherapy in subsequent years. Using natural language processing (NLP) we searched the treatment-related text fields of the GCR database for specific character strings related to an indication of trastuzumab receipt prior to

2013.¹⁸ Additionally, there were 271 (3.6%) women who did not have information available on initiation of endocrine therapy. For these women we used NLP to identify receipt of endocrine therapy in treatment-related text fields.

Patients who were indicated for a treatment regimen and did not receive it, or who received therapy without an indication, were classified as having not received guideline care for that treatment modality. Conversely, if a patient's indication was consistent with receipt or non-receipt of a specific therapy, they were classified as guideline concordant. Among women for whom a therapy was discretionary (based on NCCN guidelines), any value (e.g., receipt, non-receipt, and missing/unknown value) resulted in classification of guideline concordant for that therapy.

Our primary exposure of interest was receipt of GCC across all treatment modalities. We assessed receipt of GCC for concordance of all treatment modalities and for each individual treatment modality. In a sensitivity analyses, we allowed for each patient to have any one therapy not meeting guideline care.

Covariates—We collected information on age at diagnosis (continuous), stage (I–III), derived breast cancer subtype (HR+/HER2–, HR+/HER2+, HR–/HER2+, or HR–/HER2–), a census-derived area-based measure of socioeconomic status [SES] (0%–<5%, 5%–<10%, 10%–<20%, 20%–100% below poverty), marital status (single, married, divorced/separated/other), and insurance status (private, Medicare, Medicaid, Military/other, and uninsured). SES status is based on census tract-level poverty data that is published annually from the American Community Survey,¹⁹ and has been used widely in population-based studies.^{20,21}

Statistical Methods

Descriptive statistics were calculated as median values with interquartile ranges, or numbers (%) for covariates of interest across NHB and NHW population subgroups. We additionally report the frequency (%) of women who failed to receive GCC by treatment modality.

Follow-up was defined as time in months, from the date of surgery until the first of a) mortality event, b) last date of contact in registry, or c) December 31, 2016. We used multivariable-adjusted Cox proportional hazard models to calculate the hazard ratios (HR) and 95% confidence intervals (CIs) for the association between receipt of GCC for joint concordance of all treatment modalities and each treatment modality independently with breast cancer mortality.

To address our second aim, we estimated the association between race and breast cancer mortality, and whether this association was modified by receipt of GCC (yes/no). Interaction describes differences in the effect of one exposure across strata of another exposure, which depends on the scale.^{22,23} In this analysis, we assessed additive and multiplicative interaction for the effect of race on breast cancer mortality by receipt of GCC.²⁴ The presence of interaction between race and GCC was estimated with the common referent approach to calculate the relative excess risk due to interaction (RERI), evaluating departure of the effect on the additive scale.^{24,25} We calculated the 95%CI for the RERI using the delta method.^{23,26,27} The presence of multiplicative interactions, indicating if the combined

effect of race and GCC is greater than the product of the individual effects, was assessed by comparing stratum-specific effect estimates.²⁵

We verified the proportional hazards assumption for all variables by checking the In-In survival curves for any gross violation.²⁸ Potential confounders included in the models were based on *a priori* knowledge and graphical-based methods (DAG).²⁹ For the association between receipt of GCC and breast cancer mortality, confounders included race, stage, age at diagnosis, SES, derived breast cancer subtype, and insurance status (Supplemental Figure 1). For the interaction model including race and GCC, age at diagnosis was the only confounder identified, based on our graphical assessment (Supplemental Figure 2). The other covariates (e.g., stage, SES, derived breast cancer subtype, and insurance status) are on the causal path between race and breast cancer mortality and including them in the model could potentially induce bias.³⁰ However, to be consistent with prior studies of race disparities in breast cancer outcomes, we present additional results from analyses adjusting for stage, SES, derived breast cancer subtype, and insurance status.

The association between GCC and breast cancer mortality may be susceptible to immortal person-time bias.^{31,32} This is due to exposure assignment after the initiation of follow-up, which could lead to a mortality event occurring before the start of an indicated treatment. To evaluate the potential bias, we performed landmark analyses. We extended the initiation of follow-up in 3-month intervals, up until 12-months after the recorded date of surgery for each treatment modality and combination. All analyses were conducted using R version v3.5 (Vienna, Austria) and SAS v9.4 (Cary, NC).

RESULTS

We identified 7046 (2784 NHB and 4262 NHW) study eligible women treated with surgery, in the metropolitan Atlanta area. On average, NHB women were younger (median 56 vs. 60, years of age), less likely to have private health insurance (57% vs. 64%) and less likely to live in a high-SES neighborhood (6.2% vs. 32%) compared with NHW women (Table 1). NHB women were more likely to receive overall GCC (59% vs. 53%) (Table 2). Receipt of overall GCC was similar for NHB and NHW women with HR+/HER2- or HR+/HER2+ breast cancer (56% vs. 52% and 54% vs. 53% respectively). NHB women diagnosed with HR-/HER2+ or HR-/HER2- breast cancer were more likely to receive GCC compared with NHW women (59% vs. 53% and 92% vs. 67% respectively). Across individual treatment modalities, NHB and NHW women were nearly equally likely to receive guideline-concordant radiation (88% vs. 91%), endocrine (83% vs. 80%), and HER2-targeted (94% vs. 95%) therapies. Yet, guideline-concordant receipt of chemotherapy differed by race (78% vs. 71% for NHB and NHW women, respectively) (Table 2).

Main Effects

We observed an increase in the hazard of breast cancer mortality among GCC-discordant women (HR=1.60, 95% CI 1.26, 2.04) compared with GCC-concordant women. We similarly found an increase in the hazard of breast cancer mortality among women who were discordant for chemotherapy (HR=1.39, 95% CI 1.02, 1.90), radiation therapy (HR=1.92, 95% CI 1.36, 2.71), endocrine therapy (HR=1.70, 95% CI 1.29, 2.24), anti-HER2 therapy

(HR=1.79, 95%CI 1.20, 2.67) (Table 3). Mutual adjustment of the individual treatment modalities yielded similar results (**data not shown**).

In our sensitivity analysis, defining GCC as having received at least three treatment modalities consistent with guidelines, we observed a slightly more pronounced estimate of association (HR=2.23, 95%CI 1.59, 3.12). These results suggest that potential misclassification of GCC is not an explanation for our observed results. In our landmark analyses, we saw similar, HR estimates as we increased the time since surgery for receipt of GCC. Our findings are thus robust to any potential immortal person-time bias (Supplemental Table 8).

Race Disparities

The overall racial disparity in breast cancer mortality in our cohort was 1.98 (95%CI 1.59, 2.46) [Table 4],⁷ which persisted even within strata of receipt of overall GCC. Among women who received concordant care across all treatment modalities, we observed a two-fold increase in the NHB-NHW hazard of breast cancer mortality (HR=2.08, 95%CI 1.54, 2.64). Similarly, among those who did not receive GCC, the NHB-NHW HR was 1.95 (95%CI: 1.38, 2.76) (Table 4). In the common referent approach to assess departure on the additive scale, NHW women receiving discordant care had no greater risk of mortality compared with NHW women receiving concordant care. Conversely, NHB women had a 2-fold increase mortality rate regardless of whether they received overall concordant or discordant care. While NHB women were consistently more likely to die from their disease compared with NHW women, most pronounced race disparities were among those who received concordant care for most independent therapeutic regimens (Table 4). One exception was for endocrine therapy where NHB women classified as discordant had a 2.35-fold increased hazard of breast cancer mortality compared with discordant NHW women (95%CI: 1.48, 3.73). The disparity among women concordant for endocrine therapy was less pronounced (NHB vs. NHW HR=1.95 95%CI: 1.50, 2.45). There was no evidence of additive or multiplicative interaction between race and receipt of GCC in breast cancer mortality. In models additionally adjusting for stage, insurance, derived breast cancer subtype, and SES, we observed similar, although attenuated, associations in the disparities across treatment modalities (Table 4).

DISCUSSION

We observed that, as clinical guidelines would suggest, failure to receive guideline concordant care was associated with an increased hazard of breast cancer mortality. This was observed for receipt of guideline care, overall, and across each treatment modality. Despite the importance of GCC on health outcomes, receipt of GCC did not appear to influence racial disparities in breast cancer mortality. While NHB women were more likely to receive care consistent with guidelines for all treatment modalities combined, they had nearly a 2-fold increase in breast cancer mortality compared with their NHW counterparts within strata of GCC receipt.

There are few previous population-based studies on receipt of GCC in relation to racial disparities in breast cancer mortality. The most recent, a study among women residing in

rural Georgia, reported that NHB women were more likely to receive GCC compared with NHW women—which is consistent with our findings.³³ However, authors did not evaluate treatment modalities in combination with racial disparities in breast cancer mortality. Early investigations (c. 1990–2005) have reported that minority women are less likely to receive appropriate adjuvant therapy, although findings appear to be mixed and few studies report survival disparities.^{34,35}

Although our study captured guideline care based on indication and receipt of breast cancer therapies, we did not capture information on other aspects of the quality of care, such as treatment facility characteristics or healthcare access, that may have influenced the observed results.³⁶ Higher quality care may lead to additional work-up by tumor boards or care coordination, leading to better treatment timelines—which may not be equitable across race/ethnic groups.³⁷ The largest difference in receipt of guideline care was observed for chemotherapy, primarily driven by NHW women who were indicated for, but did not receive, chemotherapy. NHW women who were discordant for chemotherapy were more likely to have breast cancer diagnoses with limited lymph node involvement and slightly larger tumors. Non-receipt of chemotherapy may reflect structural inequities in barriers in access to care, or patient/provider preferences which are not captured in this study. Moreover, NHW women were more likely to be discretionary for chemotherapy (9.7% vs. 7.2%), which likely reflects the older age at diagnosis of NHW women compared with NHB women. Regardless, the race disparities in breast cancer mortality were strikingly similar among those who received concordant or discordant chemotherapy. In the CDC's Patterns of Care Study, investigators likewise reported a greater proportion of NHB women received guideline care for chemotherapy.³⁸

We acknowledge several limitations of this study. Our intent was to understand the association between receipt of guideline-concordant first-line therapy on breast cancer mortality and potential race disparities; however, we did not account for timing of treatment initiation, duration, or completion of adjuvant therapies—which have been associated with patient outcomes and may be differential by race.^{39–41} We excluded women who did not receive surgery, which likely represents a population with poor outcomes compared with women who did receive surgery. Further exploration of the decision to forego surgical treatment is important for future research. We similarly did not have information on adherence to endocrine therapy. In the US, poor adherence and early discontinuation of endocrine therapy have previously been reported, with some studies suggesting race differences.^{42–44} These may be important considerations for future investigations as we work to identify multi-level targets for intervention. We assumed that women who were discretionary for a treatment modality received GCC, but further exploration of the decision to forgo adjuvant therapy (and potential racial disparities within that decision) may be important for future research. Receipt of anti-HER2 therapy was determined using NLP from GCR treatment text fields among women diagnosed prior to 2013, which could result in misclassification of anti-HER2 therapy. To evaluate the ability of our NLP to correctly classify women as having received/not received anti-HER2 therapy, we compared results to the GCR treatment variable for women diagnosed after 2013. Results were largely consistent; we observed a 99% specificity and 97% sensitivity using the GCR treatment variable as the gold standard. While treatment-related data in cancer registries are often

underreported, and may be subject to misclassification,⁴⁵ our findings are similar to those of Guy et. al., which used chart abstraction to identify first-line therapy.³³ Finally, we were unable to collect information on comorbid conditions, which may impact both treatment adherence and efficacy.³² Women with coronary artery disease or diabetes at diagnosis often have poor completion of taxane-based chemotherapy and are more likely to have adverse events from breast cancer treatments, which may affect prognosis.⁴⁷ Such comorbidities are more likely to present among NHB women, which could—in part—contribute to the observed disparity.⁴⁸

Race disparities in breast cancer survival outcomes are complex.⁴⁹ In this study, we observed that although GCC was important for patient prognosis overall, we did not find evidence that differences in receipt of GCC contributed to disparate cancer outcomes between NHB and NHW breast cancer patients. Rather, NHB patients consistently had worse breast cancer survival outcomes than NHW, regardless of GCC status. Future studies may be strengthened from a multi-level approach to incorporate information on healthcare access, neighborhood characteristics, characteristics of the treating facilities, treatment duration and completion, as well as the presence and management of comorbid conditions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Tumor Subtype	Neoadjuvant	Surgery	Node Status	Tumor Size	Radiation	21-gene recurrence score	Chemo Recommendation	Trastuzumab Indication	Endocrine Therapy Indication				
ER-/HER2-	No	Mastectomy	Pos	Tumor <5	Discretionary	n/a	Yes	None Indicated	None				
			Neg	Tumor ≥5	Yes								
	Yes	BCS	Pos/neg	Tumor <5	No								
			ALL	Pos/neg	Discretionary								
ER-/HER+	No	Mastectomy	Pos	Tumor <5	Discretionary	n/a	Yes	Yes	None				
			Neg	Tumor ≥5	Yes								
	Yes	BCS	Pos/neg	Tumor <5	No								
			ALL	Pos/neg	Discretionary								
ER+/HER2+	No	Mastectomy	Node negative	≤0.5	No	n/a	Discretionary Chemo	Yes	Yes				
				0.6-1	Yes								
				1-5	No								
		Mastectomy		1-5	No								
				≥5	Discretionary								
				≥5	Discretionary								
	BCS	1-5	Yes										
		≥5	Yes										
		≥5	Discretionary										
	Yes	ALL	Node negative	≤0.5	Discretionary		n/a			Discretionary Chemo	Yes	Yes	
				0.6-1	Discretionary								
				1-5	Discretionary								
Node Positive			1-5	Discretionary									
			0.6-1	Discretionary									
			1-5	Discretionary									
ER+/HER2-	No	Mastectomy	Node Negative	≤0.5	No	Consider score	n/a	None Indicated	Yes				
				0.5-5	No								
				≥5	Yes								
		Mastectomy		0.5-5	Discretionary								
				≥5	Discretionary								
				≥5	Discretionary								
	Yes	ALL	Node Negative	≤0.5	Discretionary		n/a			Consider score	n/a	None Indicated	Yes
				0.5-5	Discretionary								
				≥5	Discretionary								
			Node Positive	≤0.5	Discretionary								
				0.5-5	Discretionary								
				≥5	Discretionary								

Figure 1: NCCN 2011 summary to determine treatment indication for chemotherapy, radiation, endocrine, and anti-HER2 therapies by type of surgery, tumor, and patient characteristics.

Table 1.

Patient demographic, clinicopathological, and treatment characteristics among 7046 non-Hispanic White (NHW) and Black (NHB) women diagnosed with stage I–III breast cancer in metro-Atlanta between 2010–2014 and registered with the Georgia Cancer Registry.

	NHB (N=2784)		NHW (N=4262)	
	Median	IQR	Median	IQR
Age at Diagnosis (years)	56	47, 64	60	50, 68
Length of Follow-up (months)	43	28, 59	44	29, 61
Time to event (months)	23	15, 37	28	14, 42
	N	%	N	%
Breast Cancer-Specific Death Stage	190	6.8	150	3.5
I	1230	44	2493	58
II	1151	41	1393	33
III	403	14	376	8.8
Tumor Grade				
1	418	15	1192	28
2	1029	37	1810	42
3+	1269	46	1150	27
Unknown	68	2.4	110	2.6
Tumor size (cm)				
0.5	231	8.3	471	11
0.6–1	382	14	813	19
>1 to <5	1857	67	2724	64
5	306	11	242	5.7
Unknown	8	0.3	12	0.3
Lymph Node				
Node negative	1741	63	2986	70
Node positive	919	33	1122	26
1–3	617	22	830	19
4	216	7.8	238	5.6
Unknown number	86	3.1	54	1.3
No nodes examined	121	4.4	154	3.6
Unknown node status	3	0.1	0	0.0
Estrogen Receptor Status				
ER– tumor	718	26	540	13
ER+ tumor	2066	74	3722	87
Derived Tumor Subtype				
HR+/HER2–	1771	64	3272	77
HR+/HER2+	341	12	482	11
HR–/HER2+	141	5.1	143	3.4
HR–/HER2–	531	19	365	8.6

		NHB (N=2784)		NHW (N=4262)	
		Median	IQR	Median	IQR
Receipt of neoadjuvant therapy					
	No	2189	79	3783	89
	Yes	595	21	478	11
Surgery					
	Breast Conserving Surgery	1474	53	2327	55
	Mastectomy	1309	47	1933	45
Receipt of Guideline Concordant Care					
21-gene recurrence score as indicated					
	<u>Not indicated</u> not received	1300	47	1520	36
	<u>Not indicated</u> and received	414	15	621	18
	Indicated and received				
	<18	340	12	759	18
	18–30	217	7.8	453	11
	>30	59	2.1	93	2.8
	Indicated and not received	391	14	697	16
	Unknown(nodes/ tumor size)	63	2.3	119	2.8
Chemotherapy as Indicated					
	<u>Not indicated</u> not received	465	17	1106	26
	<u>Not indicated</u> and received	53	1.9	79	1.9
	<u>Not indicated</u> and unknown	9	0.3	23	0.5
	Discretionary				
	No	124	4.5	290	6.8
	Yes	73	2.6	110	2.6
	unknown	3	0.1	12	0.3
	Indicated and not received	459	16	1109	24
	Indicated and received	1516	54	1508	35
	Indicated and unknown	35	1.3	51	1.2
	Can't determine indication	47	1.7	74	1.7
Radiation as Indicated					
	<u>Not indicated</u> not received	431	15	909	21
	<u>Not indicated</u> and received	64	2.3	63	1.5
	<u>Not indicated</u> and unknown	16	3.1	23	0.5
	Discretionary				
	No	281	10	440	10
	Yes	550	20	509	12
	unknown	61	2.2	61	1.4
	Indicated and not received	136	4.9	178	4.2
	Indicated and received	1131	41	1971	46
	Indicated and unknown	65	2.3	50	1.2
	Can't determine indication	49	1.8	58	1.4

	NHB (N=2784)		NHW (N=4262)	
	Median	IQR	Median	IQR
Receipt of Endocrine Therapy				
<u>Not indicated</u> not received	647	23	491	12
<u>Not indicated</u> and received	25	0.9	17	0.4
Indicated and received	1658	60	2899	68
Indicated and not received	454	16	855	20
Receipt of Trastuzumab[*]				
<u>Not indicated</u> not received	2263	81	3597	84
<u>Not indicated</u> and received	39	1.4	40	0.9
Indicated and received	361	13	434	10
Indicated and not received	121	4.4	191	4.5
Demographic Characteristics				
Marital Status				
Single	840	30	516	12
Married (common law and unmarried domestic)	1036	37	2674	63
Other (divorced, widowed, separated)	784	28	966	23
Unknown	124	4.5	106	2.5
Socioeconomic Index				
0% – <5% poverty	173	6.2	1344	31
5% – <10% poverty	360	13	1265	30
10% – <20% poverty	1030	37	1130	27
20% – 100% poverty	1221	44	523	12
Insurance Type				
Uninsured	87	3.1	41	1.0
Private	1596	57	2735	64
Medicaid	376	14	111	2.6
Medicare	631	23	1289	30
Military	47	1.7	35	0.8
Unknown	47	1.7	51	1.2

* Data abstracted from text fields of GCR database

Table 2.

Receipt of overall guideline concordant care and individual treatment modalities among non-Hispanic Black (NHB) and White (NHW) women diagnosed with stage I–III breast cancer in metro-Atlanta between 2010–2014 and registered with the Georgia Cancer Registry.

Receipt of Guideline care	NHB (N=2784)		NHW (N=4262)	
	N	%	N	%
Derived Tumor Subtype				
HR+/HER2–	987	56	1699	53
HR+/HER2+	183	54	256	53
HR–/HER2+	83	59	76	53
HR–/HER2–	382	72	246	67
Individual Treatment Modalities				
All Modalities				
Guideline Concordant	1635	59	2277	53
Discordant	965	35	1765	41
Unknown	184	6.6	220	5.2
Radiation				
Guideline Concordant	2454	88	3890	91
Discordant	200	7.2	241	5.7
Unknown	130	4.7	131	3.1
Chemotherapy				
Guideline Concordant	2181	78	3026	71
Discordant	512	18	1088	26
Unknown	91	3.3	148	3.5
Endocrine Therapy				
Guideline Concordant	2305	83	3390	80
Discordant	479	17	872	20
HER2-targeted Therapy				
Guideline Concordant	2624	94	4031	95
Discordant	160	5.8	231	5.4

Table 3:

Multivariable-adjusted association between receipt of guideline concordant care and breast cancer mortality among 7046 women diagnosed with stage I–III breast cancer in metro-Atlanta (2010–2014).

Guideline Therapy	Events	HR (95% CI)*
Guideline Concordant Care		
Discordant	131	1.60 (1.26, 2.04)
Concordant	178	Reference
Chemotherapy		
Discordant	61	1.39 (1.02, 1.90)
Concordant	261	Reference
Radiation		
Discordant	38	1.92 (1.36, 2.71)
Concordant	284	Reference
Endocrine therapy		
Discordant	74	1.70 (1.29, 2.24)
Concordant	266	Reference
Anti-HER2 therapy		
Discordant	32	1.79 (1.20, 2.67)
Concordant	308	Reference
Any three modalities		
Discordant	62	2.23 (1.59, 3.12)
Concordant	278	Reference

* Adjusted for race, age, stage, SES, subtype, and insurance

Association between receipt of guideline concordant care and breast cancer mortality among non-Hispanic black (NHB) and non-Hispanic white (NHW) women diagnosed with stage I–III breast cancer, who received surgery, in metro-Atlanta (2010–2014).

Table 4:

Treatment Modality	No. Deaths		Common Referent HR (95% CI)		RERI (95% CI)	NHB vs. NHW Stratified Effects	
	NHW	NHB	NHW	NHB		HR (95% CI) ¹	HR (95% CI) ²
Overall Race Disparity	136	173	--	--	--	1.98 (1.59, 2.46)	--
Overall Guideline Care							
Discordant	63	68	1.06 (0.75, 1.49)	2.07 (1.49, 2.88)	-0.06 (-0.74, 0.61)	1.95 (1.38, 2.76)	1.28 (0.89, 1.85)
Concordant	73	105	Reference	2.08 (1.54, 2.80)	--	2.08 (1.54, 2.80)	1.20 (0.87, 1.66)
Chemotherapy							
Discordant	34	27	0.89 (0.60, 1.31)	1.53 (1.00, 2.34)	-0.52 (-1.31, 0.27)	1.72 (1.03, 2.85)	1.26 (0.74, 2.12)
Concordant	104	157	Reference	2.13 (1.66, 2.73)	--	2.13 (1.67, 2.73)	1.28 (0.97, 1.69)
Radiation							
Discordant	17	21	2.41 (1.45, 4.01)	3.15 (1.98, 5.00)	-0.26 (-2.08, 1.55)	1.31 (0.69, 2.49)	0.95 (0.49, 1.83)
Concordant	128	156	Reference	2.00 (1.58, 2.53)	--	2.00 (1.58, 2.53)	1.21 (0.93, 1.58)
Endocrine therapy							
Discordant	33	41	0.95 (0.64, 1.40)	2.24 (1.56, 3.20)	0.36 (-0.47, 1.19)	2.35 (1.48, 3.73)	1.64 (1.01, 2.64)
Concordant	117	149	Reference	1.92 (1.50, 2.45)	--	1.92 (1.50, 2.45)	1.14 (0.87, 1.49)
HER2 Therapy							
Discordant	15	17	1.92 (1.13, 3.28)	3.13 (1.89, 5.19)	0.16 (-1.65, 1.97)	1.63 (0.81, 3.26)	1.16 (0.58, 2.34)
Concordant	135	173	Reference	2.05 (1.63, 2.57)	--	2.05 (1.63, 2.57)	1.24 (0.96, 1.60)
Any Three modalities							
Discordant	29	28	1.55 (1.03, 2.33)	2.78 (1.84, 4.20)	0.15 (-1.08, 1.38)	1.80 (1.06, 3.03)	1.51 (0.81, 2.79)
Concordant	118	160	Reference	2.08 (1.64, 2.64)	--	2.08 (1.64, 2.64)	1.21 (0.92, 1.59)

¹ Adjusted for age

² Adjusted for age; stage; insurance; SES; subtype