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Correlates of Triple Negative Breast Cancer and Chemotherapy Patterns in Black and White Women with Breast Cancer

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Abstract

Background—Triple negative breast cancer (TNBC), tumors are estrogen receptor-negative, progesterone receptor-negative and HER2-negative. TNBC is responsive to chemotherapy but may be underutilized by some patient subgroups. The goal of this study was to characterize patterns of chemotherapy use (uptake and completion) in TNBC patients.

Methods—Women with primary invasive, non-metastatic breast cancer were recruited in Washington and Detroit. Data were collected via a standardized telephone survey that captured socio-cultural and healthcare process factors. Clinical data were abstracted from medical records. Chi-square tests were used to assess the association between receipt of chemotherapy use (initiation and completion) and categorical variables while t-tests were used for continuous variables. Logistic regression models evaluated factors associated with chemotherapy uptake.

Results—Women with TNBC (16% of sample) were more likely to be Black vs. White (68% vs. 32%; $p < .05$). Among women with TNBC, 60% had chemotherapy. Chemotherapy uptake was higher in Black vs. White (48.3% vs. 11.7%; $p = .01$) and in women without (vs. with) healthcare discrimination (35% vs. 25%; $p = .04$). In multivariable models, only race was associated with receipt of chemotherapy. Black women were more likely to receive chemotherapy than Whites. The odds ratio of receiving chemotherapy by race was 4.1 (95% CI: 1.3, 13.1). Per one year increase in age was associated with being less likely to complete chemotherapy (OR=0.9, 95% CI: 0.826–0.981, $p = .02$). People with at least some college were less likely to complete chemotherapy than other education levels ($p = .02$).

Conclusion—A substantial number of TNBC patients failed to receive and/or complete chemotherapy. Differences in chemotherapy uptake by race and socio-cultural factors diminished in multivariable models but age and stage remained significant.

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The authors declare no potential conflicts of interest.

Impact—Suboptimal treatment among women with TNBC may contribute to adverse outcomes. Future investigations are necessary to assess if non-initiation and/or non-completion of chemotherapy is clinically warranted.

Keywords

Non-initiation; Discontinuation; Chemotherapy; Triple Negative Breast Cancer

Introduction

Triple negative breast cancers (TNBC) account for 10–17% of all breast cancers and are defined by the lack of expression of receptors for estrogen (ER), progesterone (PR) and human epidermal growth factor (HER2)¹. The risk of TNBC appears to be higher in women who are obese, have higher number of births, and who are physically inactive¹. Women diagnosed with TNBC have a poorer prognosis and inferior outcomes compared with women diagnosed with other subtypes².

There are no standard targeted therapies to treat TNBC; chemotherapy has been shown to effectively treat these tumors³. Neoadjuvant chemotherapy is used to improve subsequent surgical interventions and TNBC patients in particular, have responded well in the neoadjuvant setting, with rates of pathological complete response (pCR) commonly higher than for other breast tumor types⁴. However, still more than half of TNBC patients do not achieve a pCR and have a very poor prognosis⁴. Thus, chemotherapy is recommended for most women with TNBC⁵. Beyond clinical trial settings, relatively little is known about patterns of chemotherapy use among TNBC patients. Furthermore, as most reports have relied on administrative databases⁶ or retrospective analyses⁷, few have included patient-reported factors such as ratings of communication about chemotherapy among women with TNBC. The study aimed to describe characteristics of women diagnosed with TNBC and to assess the influence of clinical, socio-demographic, and healthcare factors on chemotherapy use among TNBC patients. Findings may identify potentially mutable targets to improve cancer prevention and control in these patients.

Patients and Methods

Setting and Population

The study has been previously detailed⁸. Briefly, women diagnosed with breast cancer were recruited from hospitals in Washington, DC and Detroit, MI and via community outreach between July 2006 and April 2011. Study procedures were approved by Institutional Review Boards at all institutions. We included Black or White women over age 21 that were diagnosed with invasive non-metastatic disease for whom systemic adjuvant therapy would be considered with curative intent. Women with ductal and lobular carcinoma in-situ, distant metastasis, recurrent disease, second primaries, who were not English speakers, who were of other races, or who could not give informed consent were excluded. Of the 477 eligible women 395 (82.8%) consented; 36 were excluded from subsequent analyses due to missing clinical data. The final analytic sample includes 359 women.

Data Collection

Potentially eligible hospital patients were identified from surgery logs, pathology reports, and electronic appointment systems; patients responding to outreach recruitment self-referred to the study. Clinical research assistants confirmed eligibility and obtained consent for interviews and chart reviews. Interviews were conducted centrally by trained staff using a standardized computer-assisted telephone survey; on average, interviews lasted about 50 minutes. Medical records were monitored for up to 18 months post interview. Participants received a \$25.

Measures

Chemotherapy use was obtained from medical records and assessed by chemotherapy initiation, (yes vs. no) of any chemotherapy regimen⁸ and chemotherapy completion (yes vs. no). Secondary measures used to describe chemotherapy were time to initiation (in days), and chemotherapy delay (≥ 90 days). Days to chemotherapy initiation was measured among patients who initiated therapy as the number of days between a patient's last definitive surgery and her first cycle of adjuvant chemotherapy. The third outcome, initiation delay, was defined as ≥ 90 days from surgery to start of chemotherapy in accordance with reports that have linked this length of delay with decrements in survival⁹.

Clinical factors included estrogen receptor (ER) status (positive vs. negative), surgery type (lumpectomy or mastectomy), nodal status (positive or negative), pathological tumor size, and human epidermal growth factor receptor (Her2/neu), which was categorized similar to other reports as positive, negative⁹. Comorbidity was measured using the Charlson comorbidity index score¹⁰. Body mass index was calculated from data in the medical charts and categorized as either obese ($\text{kg/m}^2 \geq 30$) or non-obese ($\text{kg/m}^2 < 30$)¹¹. Based on tumor characteristics and NCCN practice guidelines, participants were grouped according to treatment indication status (indicated versus considered)¹².

Demographic variables were age, education, marital status, and employment status. Factors related to patient-centered interactions with physicians were collected via self-report. The Makoul Communication Scale (7-items) was adapted to assess self-reported communication with oncologists about chemotherapy (Cronbach's alpha: overall = .83)¹³. To measure patients' level of trust in their oncologist, we adapted items from the Primary Care Assessment Survey, which has shown good reliability (.86) in cancer settings and was reliable in our sample (Cronbach's alpha overall = .81)¹⁴. Perceived healthcare discrimination was assessed using the Race-Based Experiences scale and was categorized as any versus none¹⁵. The Group-Based Medical Mistrust Scale measured the perceived level of group distrust in healthcare systems and practices (alpha = .84)¹⁶.

Sociocultural factors included religiosity and chemotherapy attitudes. Religiosity was measured using nine items from Lukwago and colleagues (alpha overall = .95) and was dichotomized at the median with higher scores indicating high religiosity¹⁷. To measure attitudes about chemotherapy¹⁸, items captured women's perceptions about the efficacy of therapy ("chemotherapy does not help you live longer") and about side effects ("the side

effects of chemotherapy are worse than the disease”) (Cronbach’s alpha overall= .60). Scores above the median reflected positive attitudes and those below were negative.

Statistical Analysis

Descriptive statistics were employed to display variable characteristics. We used t-tests and chi-square tests to assess bivariate relationships between chemotherapy initiation and study variables. Stepwise logistic regression was employed to model initiation. Selection of variables for inclusion in regression models was based on bivariate significance ($P < .05$). We tested for the presence of interactions between variables of interest and race. The goodness-of-fit and the predictive capability of the logistic models were evaluated using the Hosmer-Lemeshow test and the C-statistic measure. Post-hoc analyses compared receipt of all treatments by race among women with TNBC. All analyses were conducted using SAS 9.

Results

Among all patients recruited, 75% were ER positive, 66% were PR positive and 15% were Her2 positive. The prevalence of TNBC in all patient recruited was 16%. Women diagnosed with TNBC tended to be Black (vs White) ($p = .09$). The mean age of patients was 55, and 64% of them were greater than 50 years old. Women with TNBC had larger tumors ($p < .05$); no differences were noted in positive versus negative nodal status or number of nodes ($p > .05$) (Table 1). As expected women, with TNBC were indicated to have chemotherapy compared to their non-TNBC counterparts ($p < .05$). More women with TNBC had chemotherapy than those without TNBC ($p = .0003$). Time to chemotherapy (days) was similar for those with TNBC ($m = 72.4$, $SD = 78.0$) and without TNBC ($m = 73.1$, $SD = 51.4$; $p > .05$) (Table 1). Patterns of surgery and radiation were also similar across the two groups. There were no significant differences in the time to definitive surgery for women with and without TNBC ($p > .05$).

Patterns of Chemotherapy Use among TNBC Patients

Among women diagnosed with TNBC, 60% had chemotherapy (25% neo-adjuvant and 75% adjuvant). Fifty-percent of regimens were Anthracycline-based (A), [(A + Cyclophosphamide (AC) (35%) or AC + Taxane (T), 15%); TC (10%), T only (3%) and the remaining were other combinations.

In univariate analysis, chemotherapy use was higher in Black vs White (70.7% vs 36.8%) and the mean age of women with chemotherapy was slightly lower ($m = 51.8$; $SD = 11$) than those without chemotherapy ($m = 58.2$; $SD = 12.6$; $p = .04$). Most socio-cultural factors were not associated with receipt of chemotherapy. Perceptions of discrimination was the only significant sociocultural factor; women with greater perceptions of healthcare discrimination had higher use of chemotherapy ($p = .04$) (Table 2).

In the multivariable stepwise logistic regression to examine factor associated with receipt of chemotherapy variables significant at $p < .05$ were entered into the model. Only race was associated with receipt of chemotherapy. Black women were more likely to receive chemotherapy than White among patients with TNBC. The odds ratio of receiving chemotherapy by race was 4.1 (95% CI: 1.3, 13.1).

The rate of completion of chemotherapy was 72.2% among TNBC patients who initiated chemotherapy. Per one year increase in age was associated with being less likely to complete chemotherapy (OR=0.9, 95% CI: 0.826–0.981, $p=.02$). People with at least some college were less likely to complete chemotherapy than other education levels ($p=.02$). Among women with TNBC, the average age for Whites was higher than Blacks (58.5 versus 52.3) but this was not significant ($p=.4638$). There were no race differences in surgery type (lumpectomy versus mastectomy; $p=.4311$), radiation uptake ($p=.1715$), or radiation with lumpectomy or mastectomy alone ($p=.3560$) (data not shown).

Discussion

To our knowledge, factors associated with receipt of chemotherapy in TNBC patients outside of clinical trials have not been well described. This study expands knowledge about TNBC patients' chemotherapy patterns by examining socio-cultural and healthcare factors and also describing chemotherapy completion rates. While most women received chemotherapy, a notable proportion of women did not. Demographic factors such as age and education were associated with receipt of chemotherapy in univariate analysis but race remained the most robust predictor in multivariable analyses. We examined a host of socio-cultural and process of care factors that have been suggested to impact uptake of systemic therapies (e.g., medical mistrust, self-efficacy, etc.); most were not related to chemotherapy uptake in women with TNBC. Women who reported perceptions of healthcare discrimination were less likely to receive chemotherapy but this effect was diminished after controlling for other covariates.

The higher uptake of chemotherapy among Black women with TNBC contradicts studies that have reported lower receipt of systemic therapy or equivalent uptake of chemotherapy⁹. Most reports of chemotherapy use have not focused on women with TNBC making comparisons of chemotherapy use across existing studies difficult. In an assessment of treatment in various breast cancer subtypes, Hassett and colleagues (2016) found that Black women were more likely to receive recommended chemotherapy (but less likely to have recommended radiation and surgery) than Whites¹⁹ which would support our finding in women with TNBC. Age, sociocultural influences, or patient-provider interactions may also explain some of the differences we observed by race. For example, Morimoto (2010)²⁰ and others found that older age was associated with less chemotherapy use. Thus, one explanation for the higher rate of chemotherapy could be differences in age distribution between and within racial groups; Black patients tend to be younger. Although it did not reach statistical significance, among women with TNBC in our sample, the average age for whites was higher than blacks (58.5 versus 52.3) but this was not statistically significant ($p=.463$).

Black women in our study may have perceived that they were at high risk of recurrence and/or mortality.⁸ Ashing-Giwa (2004) found that “word-of-mouth” and cultural factors influenced cancer decisions in the Black community.²¹ Given the high rates of breast cancer mortality among Black women (particularly in our Atlanta, and Washington, DC sites), chemotherapy and/or TNBC may be well known in these communities. Future studies that capture the influence of community norms, practices, and experiences will be useful.

Beyond patient-level factors, process of care factors such as patient-provider communication about chemotherapy may differ for Blacks than Whites; reports to suggest that Black patients desire more information from their providers than Whites.²²

It is unclear if the lower uptake of chemotherapy in White patients was clinically warranted given that they had TNBC. Reports have suggested the Black patients may have different communication preferences related to chemotherapy compared to their White counterparts⁸. Further investigation is needed to collect detailed information about patient-provider communication and to empirically examine the decision-making processes among Black and White cancer patients. Women with higher stage were more likely to complete chemotherapy. This may suggest that women with higher stage disease perceived their diagnosis with more severity and that treatment outcomes would be equivocal compared to those with lower stage disease²³. It is also possible that physicians were more persuasive in discussions about chemotherapy among women with greater stage disease. Post-hoc analysis suggest that women with higher stage reported greater communication about chemotherapy with their providers ($p < .05$).

The prevalence of TNBC in this sample (16%) was within ranges reported in other studies⁶. Similar to other reports, women with TNBC had more aggressive tumor characteristics and more were Black (vs. White)²⁴. However, TNBC was not associated with weight status²⁵; we did not measure waist-hip-ratio which may account for this difference.

It is well known that patients with TNBC have an increased likelihood of distant recurrence and death compared to women with other types of breast cancer²⁶. Despite advances in identifying potential biomarkers and their corresponding therapeutic compounds in the ongoing TNBC clinical trials, an effective and approved target therapy for these tumors is not yet available²⁷. However, relatively little research has focused on assessing whether women indicated for chemotherapy have it as one possible explanation for observed outcomes among women with TNBC. Our findings suggest that not all women indicated to have chemotherapy complete it. Understanding reasons for non-completion will be important. Particularly since 36 women who initiated chemotherapy 10 (28%) did not complete it.

Conclusion

This study has several strengths that include having a high proportion of Black patients, assessing numerous socio-cultural, and evaluating healthcare process factors hypothesized to impact receipt of cancer treatments. Nevertheless, results should be interesting in light of several limitations. Women in this study may not represent experiences of women who are uninsured, from rural regions, or with less education. Moreover, we do not have specific information about patient-provider conversations and some women may have elected to forgo chemotherapy based on input from their providers, preexisting conditions or reasons not captured in our study. Providers were not interviewed and thus we cannot verify the conversations between providers and patients with TNBC. Future studies that focus on patient-provider dyads may add to our understanding of treatment patterns among TNBC patients. Understanding the impact of patient-provider communication and how it may vary

among women with TNBC may be useful. Communication about chemotherapy (risks and benefits) was not associated with chemotherapy uptake in TNBC patients although it has been found to be associated with uptake of chemotherapy among women with breast cancer in general. It is possible that the oncologists' recommendation was consistent across patients within this subtype. On the other hand it appeared that communication may have impacted completion of therapy.

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Clinical Practice Points

TNBC is characterized as being clinically aggressive and displaying poor long-term survival. When studies have controlled for treatment in women with TNBC, 100% compliance is often assumed. We found that a substantial number of women failed to receive it. Non-compliance to therapy is complex and multilevel approaches are needed. While more research is critical to better understand the problem from various perspectives, some actions may be warranted. First, patient-provider discussions about the benefits of chemotherapy and the harms of non-compliance in the treatment of TNBC should occur early and throughout the treatment process. Upfront discussions about potential side effects and managing side effects may also be useful. Patient navigators may aid in helping support the timely receipt and completion of cancer care²⁸. Leveraging opportunities to engage caregivers either via conversations or provision of materials may boost social support for patients and enable them to complete therapy.²⁹ Clinically-based interventions Under treatment of women with TNBC may contribute to some of the adverse outcomes in this group and warrants further examination. Important next steps may be to examine the contribution of non-compliance to risk of recurrence and/or mortality in women with TNBC.

Table 1

Characteristics of TNBC and Non-TNBC Study Participants

<i>Demographic Characteristics</i>	TNBC N=60 (16.7%)		Non-TNBC N=299 (83.3%)		p-value
	n	%	n	%	
Age					
≤50	23	38.3	106	35.5	0.671
>50	37	61.7	193	64.6	
Mean (SD)	54.4 (12.0)		54.9 (11.6)		0.758
Race					
White	19	31.7	130	43.5	0.090
Black	41	68.3	169	56.5	
Education					
No college education	19	31.7	59	19.7	0.109
Some college	17	28.3	89	29.8	
Bachelors and above	24	40.0	151	50.5	
Marital Status					
Married / Living as Married	29	48.3	153	51.2	0.688
Currently Single	31	51.7	146	48.8	
Employment					
Full Time Employed	21	36.8	106	37.9	0.885
Other	36	63.2	174	62.1	
Clinical Characteristics					
ER Status					
Positive	0	0.0	270	90.3	<0.0001
Negative	60	100.0	29	9.7	
PR Status					
Positive	0	0.0	236	78.9	<0.0001
Negative	60	100.0	63	21.1	
Her2 Status					
Positive	0	0.0	42	18.3	<0.0001

	TNBC N=60 (16.7%)		Non-TNBC N=299 (83.3%)		p-value
	n	%	n	%	
Negative	60	100.0	188	81.7	
Surgery					
Lumpectomy	42	70.0	188	63.3	0.328
Mastectomy	18	30.0	109	36.7	
Time from Diagnosis to Surgery (days) : Mean (SD)	71.6 (102.3)		61.9 (83.6)		0.454
Nodal Status					
Positive	22	36.7	105	38.9	0.749
Negative	38	63.3	165	61.1	
Tumor Size					
<2cm	24	40.0	154	57.0	0.017
2cm	36	60.0	116	43.0	
Chemotherapy Use					
Yes	36	60.0	105	35.1	0.0003
No	24	40.0	194	64.9	
Time from Surgery to Chemotherapy (days)					
<60 days	17	63.0	34	46.0	0.130
60 days	10	37.0	40	54.1	
Mean (SD)	72.4 (78.0)		73.1 (51.4)		0.970
Radiation Use					
Yes	39	65.0	175	58.5	0.351
No	21	35.0	124	41.5	
Chemotherapy Indicated **					
Indicated	60	100.0	127	46.5	<0.0001
Considered	0	0.0	146	53.5	
Comorbidities					
No comorbid disease	17	28.3	108	36.1	0.248
1 comorbid diseases	43	71.7	191	63.9	
Diabetes					
Yes	6	10.0	35	11.7	0.705
No	54	90.0	264	88.3	

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	TNBC N=60 (16.7%)		Non-TNBC N=299 (83.3%)		p-value
	n	%	n	%	
Hypertension					
Yes	21	35.0	100	36.9	0.782
No	39	65.0	171	63.1	
Body Mass Index (BMI)					
Not obese (<30 kg/m ²)	34	58.6	178	63.1	0.520
Obese (≥ 30 kg/m ²)	24	41.4	104	36.9	
Mean (SD)	29.7 (6.6)		28.8 (6.6)		0.351

P-values are obtained from Chi square tests and t-tests.

Percentages add up to 100 along columns for the “total”, TNBC and Non-TNBC.

Abbreviations: NCI =National Cancer Institute; ER= Estrogen Receptor; PR= Progesterone Receptor; SD= Standard Deviation

Table 2

Chemotherapy Initiation and Completion among TNBC Women

	Chemotherapy Uptake		Completion	
	Initiated N=36 (60%)	Not Initiated N=24 (40%)	Completed N=26 (72.2%)	Not Completed N=10 (27.8%)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Demographic Characteristics				
Age				
<=50	16 (44.4)	7 (29.2)	14 (53.9)	2 (20)
>50	20 (55.6)	17 (70.8)	12 (46.2)	8 (80)
Mean (SD) ^a	51.8 (11.0)	58.2 (12.6)	48.8 (10.4)	59.6 (8.8)
Race^a				
White	7 (19.4)	12 (50)	5 (19.2)	2 (20)
Black	29 (80.6)	12 (50)	21 (80.8)	8 (80)
Education^a				
Less than high school	15 (41.7)	4 (16.7)	13 (50.0)	2 (20)
Any college	7 (19.4)	10 (41.7)	2 (7.7)	5 (50)
Bachelors' and Above	14 (38.9)	10 (41.7)	11 (42.3)	3 (30)
Marital Status				
Married / Living as Married	15 (41.7)	14 (58.3)	12 (46.2)	3 (30)
Currently Single	21 (58.3)	10 (41.7)	14 (53.9)	7 (70)
Employment				
Full Time Employed	14 (38.9)	7 (33.3)	8 (30.8)	6 (60)
Other	22 (61.1)	14 (66.7)	18 (69.2)	4 (40)
Insurance				
Private	25 (71.4)	13 (65)	16 (64)	9 (90)
Public	10 (28.6)	7 (35)	9 (36)	1 (10)
Clinical Factors				
Breast Cancer Stage (AJCC)				
I	15 (41.7)	5 (20.8)	8 (30.8)	7 (70)
II	16 (44.4)	12 (50)	14 (53.9)	2 (20)
III	5 (13.9)	7 (29.2)	4 (15.4)	1 (10)
Surgery type				
Lumpectomy	25 (69.4)	17 (70.8)	17 (65.4)	8 (80)
Mastectomy	11 (30.6)	7 (29.2)	9 (34.6)	2 (20)
Tumor Size				
<2cm	15 (41.7)	9 (37.5)	10 (38.5)	5 (50)
2cm	21 (58.3)	15 (62.5)	16 (61.5)	5 (50)
Comorbidities (including hypertension)				
None	7 (19.4)	10 (41.7)	6 (23.1)	1 (10)
1-2	21 (58.3)	9 (37.5)	14 (53.9)	7 (70)

	Chemotherapy Uptake		Completion	
	Initiated N=36 (60%)	Not Initiated N=24 (40%)	Completed N=26 (72.2%)	Not Completed N=10 (27.8%)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
3	8 (22.2)	5 (20.8)	6 (23.1)	2 (20)
Mean (SD)	2.0 (1.9)	1.4 (1.7)	1.8 (1.7)	2.4 (2.2)
Diabetes				
Yes	5 (13.9)	1 (4.2)	2 (7.7)	3 (30)
No	31 (86.1)	23 (95.8)	24 (92.3)	7 (70)
Hypertension				
Yes	14 (38.9)	7 (29.2)	9 (34.6)	5 (50)
No	22 (61.1)	17 (70.8)	17 (65.4)	5 (50)
Body Mass Index (BMI)				
Normal (<25 kg/m ²)	6 (16.7)	8 (36.4)	3 (11.5)	3 (30)
Overweight/Obese (≥ 25 kg/m ²)	30 (83.3)	14 (63.6)	23 (88.5)	7 (70)
Mean (SD)	30.8 (6.7)	28.0 (6.2)	31.9 (7.1)	27.8 (4.7)
Perceived Discrimination^a				
None	21 (58.3)	20 (83.3)	17 (65.4)	4 (40)
Any	15 (41.7)	4 (16.7)	9 (34.6)	6 (60)
Religiosity: Mean (SD)	15.3 (5.0)	16.7 (7.7)	15.4 (4.4)	15.1 (6.8)
Medical Mistrust: Mean (SD)	29.4 (4.8)	27.5 (4.1)	30.2 (4.9)	27.5 (4.0)
Perceived Susceptibility: Mean (SD)	14.3 (2.2)	14.5 (2.4)	14.0 (2.3)	14.9 (1.9)
Perceived Severity: Mean (SD)	4.0 (0)	4.0 (0)	4.0 (0.0)	4.0 (0.0)
Chemotherapy Attitude: Mean (SD)	20.7 (4.0)	20.8 (4.0)	21.0 (3.8)	19.9 (4.4)
Positive Attitude: Mean (SD)	15.3 (1.4)	15.3 (1.4)	15.3 (1.6)	15.5 (0.9)
Participate in Care: Mean (SD)	15.1 (1.2)	15.5 (1.0)	15.3 (0.8)	14.7 (1.8)
Trust Oncologist: Mean (SD)	9.1 (1.6)	9.1 (2.3)	8.9 (1.7)	9.7 (0.8)
Health care barriers				
None	12 (33.3)	10 (41.7)	9 (34.6)	3 (30)
1–2 barriers	15 (41.7)	11 (45.8)	11 (42.3)	4 (40)
3 barriers	9 (25.0)	3 (12.5)	6 (23.1)	3 (30)
Mean (SD)	1.8 (1.6)	1.2 (1.5)	1.7 (1.6)	2.0 (1.7)
Process of Healthcare Factors				
Chemo communication: Mean (SD)	32.2 (4.7)	32.0 (4.1)	31.5 (5.2)	33.8 (2.6)
Interpersonal manner: Mean (SD)	4.2 (0.6)	4.4 (0.6)	4.2 (0.6)	4.3 (0.4)
PSQ Communication: Mean (SD)	4.0 (0.8)	4.2 (0.7)	4.0 (0.8)	4.0 (0.9)
Technical Quality: Mean (SD)	4.0 (0.6)	4.2 (0.6)	4.0 (0.6)	3.9 (0.5)
Financial aspects: Mean (SD)	4.0 (0.6)	4.0 (0.7)	4.1 (0.6)	3.7 (0.5)
Accessibility: Mean (SD)	4.0 (0.5)	4.2 (0.5)	4.0 (0.5)	4.0 (0.4)

^a:p-value<0.05

P-values are obtained from chi-square tests for categorical variables and t-tests for continuous variables.

Summary statistics are given as mean and standard deviation (SD) for continuous variables, and as count (n) and percent for categorical variables.

Counts and percentages are based on non-missing values; percentages add up to 100 along columns for categorical variables.

Abbreviations: AJCC, American Joint Committee on Cancer. The AJCC staging system is also called TNM staging system; BCS, Breast Conserving Surgery; AI's Aromatase Inhibitors; NCI, National Cancer Institute; SD, Standard Deviation.

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