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A prospective cohort study of early discontinuation of adjuvant chemotherapy in women with breast cancer: the breast cancer quality of care study (BQUAL)

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Abstract

For many women with non-metastatic breast cancer, adjuvant chemotherapy prevents recurrence and extends survival. Women who discontinue chemotherapy early may reduce those benefits, but little is known about what predicts early discontinuation. We sought to determine prospectively the rate and reasons for early discontinuation of adjuvant chemotherapy in women with breast cancer.

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Compliance with ethical standards

Conflict of interest Dr. Neugut has served as a consultant to Pfizer, Teva, Otsuka, and United Biosource Corporation. He is on the medical advisory board of EHE, Intl. No other authors report any potential conflicts of interest. All of the authors are responsible for the data analysis and interpretation.

We conducted a prospective cohort study among three U.S. health care organizations. Of 1158 women with newly diagnosed non-metastatic breast cancer, 2006–2010, we analyzed 445 (38.4 %) patients who initiated standard adjuvant chemotherapy as defined by accepted guidelines. We interviewed patients at baseline and twice during treatment regarding sociodemographic/psychosocial factors and treatment decision-making and collected clinical data. They were categorized according to the number of cycles required by the chemotherapy regimen they had initiated. The outcome was early discontinuation (<80 % of planned cycles). Of patients analyzed, 392 (88.1 %) completed the prescribed therapy. The strongest predictor was receipt of a regimen entailing >4 cycles of therapy (18.1 % for longer regimens, 7.4 % for 4 cycles) (odds ratio [OR] 2.59, 95 % CI 1.32–5.08), controlling for race, age, stage, hormone receptor status, social support, optimism, spirituality, stress, and physical symptoms. Higher levels of psychological symptoms on the Memorial symptom assessment scale also increased the odds of early discontinuation (OR 1.92, 95 % CI 0.998–3.68). The large majority of patients who initiated adjuvant chemotherapy for breast cancer completed their prescribed regimens, but early discontinuation was associated with lengthier regimens and, with borderline statistical significance, for those with psychological side effects.

Keywords

Breast cancer; Adjuvant chemotherapy; Early discontinuation; Non-persistence; Toxicity; Adherence

Background

Adjuvant chemotherapy reduces the risk of recurrence and death among women with resectable breast cancer who meet certain criteria [1]. For patients with non-metastatic breast cancer, guidelines developed by the National Comprehensive Cancer Network (NCCN) specify the clinical and demographic characteristics of those who should receive chemotherapy, those who should not, and those for whom it is a “judgment call” or discretionary [2]. Along with the evidence that specific adjuvant treatment regimens improve survival outcomes, a growing body of evidence suggests that significant deviations from those regimens may reduce the benefits of treatment [3–6].

Unfortunately, not all patients who should receive adjuvant therapy do so in appropriate and timely fashion [5, 7, 8]; some may not receive the recommended therapy at all [9, 10]; others may delay initiation [3, 4, 11], or discontinue therapy early [5, 12, 13]. More than two-thirds of premenopausal women with breast cancer [14, 15], but only 15–35 % of older women, aged ≥ 65 years, receive adjuvant chemotherapy [10, 14–18]. The Breast Cancer Quality of Care Study (BQUAL) is a multi-site prospective cohort study whose goal is to identify reasons for non-initiation, delay, and early discontinuation of adjuvant therapy among women with resected breast cancer [19]. In this paper, we examine the associations of demographic, clinical, and psychosocial factors and patient perceptions regarding decision-making with early discontinuation of chemotherapy.

Methods

The BQUAL study has been previously described [19]. We have reported on the rates and reasons for non-initiation of adjuvant chemotherapy [20]. Briefly, between 2006 and 2010, adult women, 20 years and older, who were newly diagnosed with primary breast cancer, stages I–III, from three sites (New York City [Columbia University Medical Center and Mount Sinai School of Medicine], metropolitan Detroit [Henry Ford Health System]), and Northern California [Kaiser Permanente Northern California]) were recruited into the study. Patients were excluded if they had a history of any cancer other than non-melanoma skin cancer, a history of significant memory deficit, did not speak English, were unable to provide informed consent, or did not have a telephone.

Only patients who initiated adjuvant chemotherapy were included in the present study. We did not include patients undergoing neoadjuvant chemotherapy in this study. Trained research assistants interviewed each subject by phone three times. The baseline interview was conducted within 3 months of diagnosis or prior to receipt of the third cycle of chemotherapy; the second was 4–6 weeks later; and the third was 12–24 weeks post diagnosis. Each participant provided written informed consent and HIPAA authorization prior to study entry. Patients with electronic pharmacy records were included in the present analysis (Kaiser Permanente Northern California and Henry Ford Health System). See the consort diagram (Fig. 1) and Results section for details.

All study procedures were approved by the institutional review board of each recruitment site as well as by the U.S. Army Medical Research and Materiel Command Office of Research Protections and Human Research Protection Office. All participants were required to provide informed consent.

Study variables

Demographic and tumor factors (baseline interview)—We collected self-reported demographic characteristics, including age, race/ethnicity, educational attainment, annual household income, employment, marital status, and site of recruitment. In addition, tumor characteristics (American Joint Committee on Cancer stage, tumor grade and size, nodal status, estrogen receptor/progesterone receptor (ER/PR) and HER2 status) and comorbidities reported from 12 months before to 3 months after diagnosis were abstracted from the medical record or obtained from administrative databases; a Charlson comorbidity index score was derived from these comorbidities [21].

Chemotherapy drugs and regimens—Whether a patient received adjuvant chemotherapy and the specific chemotherapy regimen prescribed for the patient was at the discretion of the oncologist. We used electronic pharmacy and infusion medication records to ascertain the chemotherapy regimens initiated and cycles completed by the subjects in the study. Twenty-seven patients were excluded from this study because they had a regimen that was not listed in the NCCN guidelines (www.NCCN.org/professionals/physician_gls/pdf/breast.pdf) (Fig. 1). The remainder received one of the eight standard breast cancer adjuvant regimens (Table 1).

Outcome measure—We defined early discontinuation as receipt of <80 % of the number of chemotherapy cycles for the regimen that the patient had initiated, based on the number of chemotherapy claims. Thus, if a patient were to receive four cycles of a given regimen, <80 % would be defined as missing one cycle or more. If the regimen called for six cycles, <80 % would be missing two or more cycles, and so on. We then grouped the regimens into three categories by number of prescribed cycles and classified patients as discontinuing early if they missed 1 or more cycles in category 1, 2 or more cycles in category 2, and 4 or more cycles in category 3 (Table 1). When we grouped the regimens by relative toxicity (according to DLH, a breast oncologist), they fell into the same three categories. The rankings by toxicity were consistent with the risk of hospitalization by adjuvant regimen as estimated from population-based administrative databases by Barcenas et al. [22], and also with adverse effect estimates in a meta-analysis by Fujii et al. [23]. When we conducted our analyses, we found that categories 2 and 3 were homogeneous with regard to outcomes (data not shown), so we combined them for all analyses as category 2/3. Patients who went more than 56 days between two chemotherapy claims were considered to have discontinued early. Trastuzumab was not included as part of the chemotherapy regimen for assessment of early discontinuation, but was evaluated separately in another manuscript [24].

Chemotherapy decision-making (baseline)—Level of chemotherapy decision difficulty was assessed with a single item: “How difficult was it to make your decision to take chemotherapy or not to take chemotherapy as treatment for your breast cancer?” Responses on a five-point Likert scale ranged from 1 = extremely difficult to 5 = very easy and were later regrouped as 1 = difficult, 2 = neither difficult nor easy, and 3 = easy. Participants were also asked 15 questions with yes/no response choices about factors they might have considered when making the decision regarding chemotherapy [25]. The factors included the cost of the treatment; what your friends and relatives thought about the treatment; your feelings about chemotherapy symptoms, such as nausea and vomiting; and your confidence in the value of chemotherapy.

Chemotherapy-related patient–physician communication (baseline)—To evaluate the quality of patient–physician communication related to the decision to undergo chemotherapy, participants were queried about their level of agreement (1 = very strongly agree to 6 = very strongly disagree) with seven face-valid items that evaluated whether or not the patient believed that she was given sufficient information to make her chemotherapy treatment decision, whether or not the risks and benefits of chemotherapy were fully explained, and the degree of patient involvement in the chemotherapy treatment decision [26].

Treatment-related factors (interview immediately preceding early discontinuation)—The treatment satisfaction questionnaire for medication [27] asked about the perceived effectiveness of chemotherapy, experience with side effects, the convenience of administration and global satisfaction with chemotherapy.

The Memorial symptom assessment scale [28] is composed of three measures: the Global Distress Index, the Physical Symptom Subscale, and the Psychological Symptom Subscale. A ten-item index measured Global Distress and included experience of four psychological

symptoms (worrying, feeling sad, feeling irritable, and feeling nervous) and distress caused by six physical symptoms, including lack of appetite and pain. Means for each subscale were calculated and higher scores indicate more and worse symptoms.

Psychosocial factors

Social support (baseline interview)—Using the 19-item social support subscale of the Medical Outcomes Study [29], we evaluated educational/informational support, tangible support, affectionate support, and positive social interactions.

Chemotherapy attitudes (baseline interview)—To measure attitudes toward chemotherapy treatment, we asked participants how much they agreed or disagreed with seven statements [26], including: “You are less likely to have the cancer come back if you have chemotherapy” and “The side effects of chemotherapy are worse than the disease.”

The Life Orientation Test [30] was used to assess optimism (baseline interview). This test utilizes four items that are positive in orientation, four that are negative, and four that are fillers. Participants are asked to indicate the extent to which they agree or disagree with each statement.

Benefit finding and spirituality (follow-up interview #2)—To assess positive outcomes emerging from their experience with a cancer diagnosis and chemotherapy, we used an instrument developed and validated by Tedeschi and Calhoun [31] examining how: the participant relates to others, sees new possibilities in life, has gained personal strength, has experienced a spiritual change and a new appreciation for life. Participants were asked 21 questions about specific changes they might have experienced (e.g., “You changed your priorities about what is important in life” and “You discovered that you are stronger than you thought you were”) and the intensity of the change.

Impact of events scale (interview immediately preceding early discontinuation)—Breast cancer-related distress was measured with a 15-item version of the Impact of Events Scale; [32] participants were queried about intrusive thoughts and avoidant behavior experienced over the past 7 days.

FACT-B quality of life scale (interview immediately preceding early discontinuation)—The functional assessment of cancer therapy-breast cancer (FACT-B) [33] instrument was used to measure quality of life. The FACT-B is a multidimensional measure that consists of subscales to assess physical, social, emotional, functional well-being, and a subscale specific to quality of life among breast cancer patients.

Data analysis

We compared the characteristics of chemotherapy continuers and early discontinuers using Fisher’s or Chi-square tests for categorical variables and Student’s *t* tests for continuous variables. We conducted univariate logistic regression analyses with early discontinuation as the outcome and the demographic and clinical variables, the treatment received, the decision-making scales, patient–physician communication scales, and psychosocial factors

as predictors. We conducted multivariable logistic regression analyses to assess the relationship of chemotherapy discontinuation with these same variables. Age, race, education, ER/PR status, and treatment category were entered in all analyses. A stepwise regression analysis was performed and no other covariate was found to be statistically significant. All analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC).

Role of the funding source participation

The BQUAL Study was funded by a Breast Cancer Center of Excellence Award from the Department of Defense (BC043120). The funding source had no involvement in the conception, design, analysis, conduct, or interpretation of this study, or the decision to submit the manuscript.

Results

We identified and contacted 1514 women with newly diagnosed non-metastatic breast cancer between May 2006 and June 2010. Of these, 134 (8.8 %) refused to participate and 222 (14.7 %) were ineligible. We excluded an additional eight women because they had DCIS, no chart data, or no baseline interview. An additional 462 women did not initiate chemotherapy, and 210 did not have electronic pharmacy records available. An additional 34 women were excluded because they actually had stage IV disease, were receiving chemotherapy for a recurrence, or received a non-standard adjuvant chemotherapy regimen (Fig. 1). Of the remaining 445 women, 289 (64.9 %) were interviewed prior to receiving any chemotherapy and 152 (34.2 %) received 1 or 2 cycles of chemotherapy prior to the interview. The mean age of participants was 54.5 years [SD 9.9] (range 28–84 years).

Table 1 presents the description of the chemotherapy regimens initiated in the 445 women included in the analysis. Overall, 53 (11.9 %) women discontinued therapy early (see Supplemental Table 1 for details). Table 2 presents the comparison of the characteristics of the early discontinuers and continuers. In the univariate logistic regression analyses, those who discontinued early were more likely to have received a chemotherapy regimen from group 2/3 than from group 1, to have a high school or higher education, and to be ER/PR negative.

Table 3 presents the comparison of continuers and early discontinuers with respect to treatment-related, decision-related, and psychosocial factors. Completion of one's chemotherapy regimen was associated with having a new appreciation of life, gaining personal strength, seeing new possibilities, and anticipating total benefits from chemotherapy.

In multivariable regression analysis (Table 4), the chemotherapy regimen remained a predictor of early discontinuation (OR 2.59, 95 % CI 1.32–5.08). There was also an association of early discontinuation with psychological symptoms from the Memorial Symptom Assessment scale (OR 1.92, 95 % CI 1.00–3.68).

Clearly, toxicity remains the main concern generally in terms of reasons for early discontinuation. Our questionnaire determined the extent of chemotherapy side effects for

both those who completed treatment ($n = 392$) and those who discontinued ($n = 53$). The overall association is shown in Table 3 under Treatment-related factors and shows no association with experience with treatment side effects. Of the 392 who finished treatment, 17 (4.3 %) had no response to the question, while 18 (4.6 %) reported no side effects, 68 (17.3 %) minor side effects, 163 (41.6 %) some side effects, and 126 (32.1 %) major side effects. In the early discontinuer group, 5 (9.4 %) did not respond, 6 (11.3 %) had no side effects, 6 (11.3 %) minor side effects, 16 (30.2 %) some side effects, and 16 (30.2 %) major side effects. The Memorial Symptom Assessment Scale also queried to what extent the patient suffered physical or psychological side effects. As noted previously (Table 4), there was an association of early discontinuation with psychological, but not with physical symptoms.

Discussion

In this cohort of women with localized breast cancer who initiated adjuvant chemotherapy, we found that only a small proportion (11.9 %) discontinued chemotherapy early. The main determinant of discontinuation was the duration and potential toxicity of the chemotherapy regimen. Only 7.4 % of those who initiated 4-cycle regimens, but 18.1 % of those who initiated longer duration regimens, discontinued early (Table 2). Early discontinuation was not associated with any of the psychosocial, decision-making, and physician-patient communication measures that we analyzed, except marginally with psychological toxicity ($p = 0.05$).

Our sample included only patients who had previously initiated chemotherapy. In our earlier paper on this subject [20], we found that patients who did not initiate chemotherapy were older and had more negative and pessimistic beliefs about chemotherapy than those who did. Those who did initiate chemotherapy had poorer prognostic indicators, such as more advanced stage or negative ER/PR status, and therefore had potentially more to gain from adjuvant chemotherapy. Therefore, this cohort of patients may have been particularly committed to chemotherapy. It may also be that variables such as older age, more advanced stage, or greater comorbidities were not found to be associated with early discontinuation in this study because the sample was limited to those who had already initiated chemotherapy.

Compliance with prescribed medications is a well-known issue in clinical care [34–36]. Patients frequently do not take their medications as prescribed or discontinue them early. However, given the evidence that prescribed oncology therapies prolong life, the extent of non-compliance with such therapies has been surprising. Studies have found a high rate of, and a variety of factors associated with non-compliance with adjuvant hormonal therapy, which is an oral agent, among women with resected breast cancer [37–48]. We also found a high rate of early discontinuation of hormonal therapy in the BQUAL cohort [49].

Much less research has been done on non-compliance with intravenous chemotherapy. Several studies have described early discontinuation of adjuvant therapy for stage III colon cancer, and some have found early discontinuation to be associated with a reduced survival benefit [50–54]. Early discontinuation of S-1 as adjuvant therapy for gastric cancer has also been found to be common and associated with worse survival [55]. Early discontinuation of

trastuzumab has been observed among HER2-positive breast cancer patients [56–58], including those in the BQUAL cohort [24]; 15 % in our sample did not complete adjuvant treatment with trastuzumab, the large majority because of cardiotoxicity.

In 1995, Bonadonna et al. suggested that receipt of less than 85 % of the total prescribed dose of chemotherapy was associated with loss of survival benefit attributable to chemotherapy [59]. Lyman et al. found, in a review of over 20,000 patients in community practices, that early discontinuation was more common in those receiving doxorubicin-containing regimens than in those receiving the standard CMF (cyclophosphamide/methotrexate/fluorouracil), ranging as high as 26 % [7]. We showed, in a retrospective observational study using data from the Henry Ford Health System, that among 472 women with early-stage breast cancer, 28 % discontinued chemotherapy early. Receipt of <75 % of the expected number of cycles was associated with poorer survival [5].

In this study, we found that patients initiating chemotherapy regimens requiring more than 4 cycles had a higher risk of early discontinuation than patients on other regimens. (Patients reporting psychological symptoms or side effects as a result of the chemotherapy were also marginally more likely than other patients to discontinue chemotherapy early.) Many chemotherapy trials, but no prior community-based studies such as this one, have found toxicity from chemotherapy and its impact on quality of life to contribute to early discontinuation [60, 61]. Our study of trastuzumab did show that early discontinuation occurred primarily as a consequence of cardiotoxicity [24]. The association of early discontinuation with the longer chemotherapy regimens in our analysis suggests that duration of chemotherapy plays a significant role in discontinuing chemotherapy early. This may be associated with more toxicity or with other factors, such as drug toxicity. Adjogatse et al. [62] reported on 128 patients who were 70 or older who received adjuvant chemotherapy. They found that 11 of 24 patients (46 %) who had an episode of febrile neutropenia, but only 16 of 104 patients (16 %) without febrile neutropenia, discontinued their chemotherapy prior to completion.

Another factor thought to influence early discontinuation is race; in our prior study in the Henry Ford Health Care System, we found that black patients were less compliant with their chemotherapy than white patients. The BQUAL study was designed in part to follow up on that finding, but among our study participants, 15 % of whom were black, we did not find that race was associated with early discontinuation, though statistical power was not very high. However, overall, only 53 of our 445 study participants (11.9 %) discontinued early. In a larger sample with a more common outcome, other factors might have emerged as predictive of early discontinuation.

One of the goals of our study was to determine the reasons for early discontinuation. Our questionnaire data indicate that there was not a major difference between those who persisted with the chemotherapy and those who discontinued with regard to degree of physical symptoms stemming from the chemotherapy, though there was a difference of borderline statistical significance with regard to psychological symptoms. Some of the differences may have reflected oncologist decisions, perhaps stemming from laboratory or

radiology data to which we did not have access, e.g., changes in cardiac output or hepatotoxicity.

This study has a number of strengths. Because we were able to recruit our study subjects prospectively at the time of breast cancer diagnosis or shortly thereafter, we were able to collect data on most patients prior to or early after initiation of chemotherapy. We used validated questionnaires to assess study questions. Despite being a smaller portion of the study population, thus limiting statistical power, the minorities enrolled in this study match closely with those seen in the population.

Our study had limitations as well. Most of our patients were insured, and all had telephones and spoke English. A few patients were not interviewed until after they initiated chemotherapy. Because the number who discontinued was small, there was insufficient power to find some possible effects. We were unable to define to what degree oncologist decisions stemming from laboratory or imaging adverse effects affected the decision to discontinue early, or whether the oncologist weighed the patient's perceived physical adverse effects differently than the patients. We also did not collect information on dose reduction that would have amplified our data on drug discontinuation.

In conclusion, in this prospective cohort study of women with early-stage breast cancer, we found that the large majority of women who initiated adjuvant chemotherapy continued it to completion. Longer duration of treatment was associated with increased premature discontinuation as were psychological side effects. This cohort continues to be followed to determine how early discontinuation may affect outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Fig. 1.
Consort diagram of subjects in the BQUAL study who were selected for the current analysis.
Asterisk denotes CAF = Cytosin + adriamycin + fluorouracil

Chemotherapy regimens for the treatment of invasive breast cancer, AJCC stages I–III, and study criteria for early chemotherapy discontinuation, BQUAL study

Table 1

Group	N (%)	Regimen ^a	Abbreviation	Discontinuation criteria	Regimen length (cycles)
1	146 (32.8)	Adriamycin + cytoxan	AC	<4 AC	4
1	111 (24.9)	Docetaxel + cytoxan	TC	<4 TC	4
2	32 (7.2)	Docetaxel + carboplatin	TCarbo	<5 TCarbo	6
2	26 (5.8)	Docetaxel + adriamycin + cytoxan	TAC	<5 cycles all	6
2	23 (5.2)	Adriamycin + cytoxan + docetaxel, dose dense	AC TAX DD	<4 AC or <4 TAX	8
2	50 (11.2)	Adriamycin + cytoxan + paclitaxel, dose dense	ACT DD	<4 AC or <4 T	8
3	3 (0.7)	Adriamycin + cytoxan + docetaxel, weekly	AC TAX W	<4 AC or <10 TAX	16
3	54 (12.1)	Adriamycin + cytoxan + paclitaxel, weekly	ACT W	<4 AC or <10 T	16

Trastuzumab for HER2 positive patients is not included in these regimens and is evaluated in a separate publication [24]

^aWe chose to use brand names because these regimens are commonly identified using those initials for the acronyms. Adriamycin = doxorubicin; Cytosan = cyclophosphamide; Docetaxel = taxotere; Paclitaxel = taxol

Table 2

Univariate analysis of the association between chemotherapy discontinuation and demographic, clinical, and tumor characteristics of women with non-metastatic breast cancer ($n = 445$) enrolled in the BQUAL study who initiated chemotherapy.

	Total $N = 445$ N (%)	Completed ($n = 392$, 88.1 %) N (%)	Discontinued ($n = 53$, 11.9 %) N (%)	p value	OR for discontinuation of chemotherapy	95 % CI
Chemotherapy regimen group ^a						
Group 1	257 (57.8)	238 (60.7)	19 (35.9)	<0.001	1.00	–
Group 2/3	188 (42.2)	154 (39.3)	34 (64.1)		2.63	1.24–5.54
Demographic factors						
Age, years						
<50 years	137 (30.8)	126 (32.1)	11 (20.8)	0.08	1.00	–
50–69 years	274 (61.6)	234 (59.7)	40 (75.5)		1.96	0.97–3.95
70 years	34 (7.6)	32 (8.2)	2 (3.8)		0.72	0.15–3.39
Race/ethnicity						
White	300 (67.4)	257 (65.6)	43 (81.1)	0.04	1.00	–
Black	67 (15.1)	60 (15.3)	7 (13.2)		0.70	0.30–1.63
Other ^b	78 (17.5)	75 (19.1)	3 (5.7)		0.24	0.07–0.79
Year diagnosed						
2006–2007	164 (36.9)	143 (36.5)	21 (39.6)	0.66	1.00	–
2008–2010	281 (63.2)	249 (63.5)	32 (60.4)		0.83	0.46–1.47
Education						
High school	98 (22.1)	92 (23.5)	6 (11.3)	0.04	1.00	–
>High school	346 (77.9)	299 (76.5)	47 (88.7)		2.41	1.00–5.82
Household income						
<\$25,000	32 (7.2)	27 (6.9)	5 (9.4)	0.33	1.23	0.43–3.53
\$25,000–\$49,999	80 (18.0)	76 (19.4)	4 (7.6)		0.35	0.12–1.05
\$50,000–\$89,999	158 (35.5)	137 (35.0)	21 (39.6)		1.02	0.53–1.94
\$90,000	160 (36.0)	139 (35.5)	21 (39.6)		1.00	–
Refused/unknown	15 (3.4)	13 (3.3)	2 (3.8)		–	–
Employment status						
Employed	183 (41.1)	162 (41.3)	21 (39.6)	0.81	1.07	0.60–1.93

	Total N = 445 N (%)	Completed (n = 392, 88.1 %) N (%)	Discontinued (n = 53, 11.9 %) N (%)	p value	OR for discontinuation of chemotherapy	95 % CI
Not employed	262 (58.9)	230 (58.7)	32 (60.4)		1.00	–
Marital status				0.96		
Married	237 (53.3)	208 (53.1)	29 (54.7)		0.96	0.51–1.82
Not married	144 (32.4)	127 (32.4)	17 (32.1)		1.00	–
Unknown	64 (14.4)	57 (14.5)	7 (13.2)			
Clinical factors						
AJCC stage ^c				0.87		
I	128 (28.8)	113 (28.8)	15 (28.3)		1.00	
II	252 (56.6)	223 (56.9)	29 (54.7)		0.98	0.51–1.90
III	65 (14.6)	56 (14.3)	9 (17.0)		1.21	0.50–2.94
Grade				0.75		
Well differentiated	55 (12.4)	47 (12.0)	8 (15.1)		1.00	–
Moderately differentiated	198 (44.6)	177 (45.3)	21 (39.6)		0.71	0.30–1.71
Poorly differentiated	167 (37.6)	145 (37.1)	22 (41.5)		0.91	0.38–2.18
Unknown	24 (5.4)	22 (5.6)	2 (3.8)		0.55	0.11–2.78
ER/PR status ^d				0.04		
Negative	129 (29.0)	107 (27.6)	22 (41.5)		1.00	–
Positive	312 (70.1)	281 (72.4)	31 (58.5)		0.54	0.30–0.97
Unknown	4 (0.9)					
HER2-neu status				0.87		
Negative	355 (80.3)	312 (80.2)	43 (81.1)		1.00	
Positive	87 (19.7)	77 (19.8)	10 (18.9)		0.94	0.45–1.96
Charlson comorbidity score				0.14		
0	348 (89.2)	309 (90.1)	39 (83.0)		1.00	–
1	42 (10.8)	34 (9.9)	8 (17.0)		1.86	0.81–4.31

Statistically significant associations are bolded

^aGroup 1 = 4 weeks regimens, AC and TC; Group 2 = 6–8 and 12 weeks regimens, TCarbo, TAC, AC TAX DD, ACT DD, AC TAX W, and ACT W

^bOther race = Hispanic, Asian, and other

^cAJCC American joint commission on cancer

d ER/PR status estrogen/progesterone receptor status

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Univariate analysis of the associations between chemother-women with non-metastatic breast cancer ($n = 445$) enrolled in the apy discontinuation and treatment decision-making, patient-physician BQUAL study who initiated chemotherapy treatment communication, treatment-related, and psychosocial factors among

Table 3

	Total (<i>n</i> = 445)		Completed <i>n</i> = 392, 88.1 % N/mean (%/SD)	Discontinued (<i>n</i> = 53, 11.9 %) N/mean (%/SD)	<i>p</i> value	OR ^a	95 % CI
	N/mean (%/SD)	Potential range					
Chemotherapy decision-making							
Level of chemotherapy decision difficulty					0.67		
Difficult	122 (27.6)	–	104 (26.7)	18 (34.0)		1.40	0.74–2.63
Neither difficult nor easy	60 (13.6)	–	54 (13.9)	6 (11.3)		0.90	0.36–2.27
Easy	260 (58.8)	–	231 (59.4)	29 (54.7)		1.00	–
Decision-making considerations							
Physical	0.56 (0.77)	0–1	0.54 (0.77)	0.70 (0.77)	0.17	1.28	0.90–1.83
Negative balance	0.87 (1.12)	0–5	0.88 (1.12)	0.83 (1.13)	0.76	0.96	0.74–1.25
Positive balance	2.87 (0.36)	0–3	2.88 (0.35)	2.85 (0.41)	0.64	0.82	0.39–1.73
Concrete	0.93 (1.10)	0–4	0.93 (1.08)	0.94 (1.10)	0.92	1.01	0.78–1.32
Friends and family	0.42 (0.49)	0–1	0.42 (0.49)	0.36 (0.48)	0.36	0.76	0.42–1.38
Chemotherapy-related patient-physician communication							
Quality of patient-physician communication	31.29 (5.09)	12–42	31.39 (4.92)	30.55 (6.18)	0.26	0.97	0.92–1.02
Treatment-related factors							
Treatment satisfaction							
Global satisfaction	113.84 (32.21)	0–300	119.1 (30.18)	114.30 (41.18)	0.33	1.00	0.99–1.01
Experience with treatment effectiveness	70.31 (22.37)	0–100	71.20 (21.75)	64.38 (28.50)	0.05	0.99	0.98–1.00
Experience with treatment side effects	46.00 (23.36)	0–100	45.73 (22.84)	46.53 (26.68)	0.84	1.00	0.99–1.01
Satisfaction with treatment convenience	79.70 (21.61)	0–100	80.80 (20.86)	79.92 (24.13)	0.81	1.00	0.98–1.01
Symptom assessment							
Physical symptoms	0.94 (0.55)	0–4	0.94 (0.54)	0.97 (0.62)	0.76	1.10	0.65–1.85
Psychological symptoms	0.77 (0.68)	0–4	0.75 (0.67)	0.87 (0.76)	0.30	1.27	0.85–1.90
Psychosocial factors							
Social support index	4.40 (0.61)	1–5	4.40 (0.60)	4.38 (0.69)	0.85	0.95	0.60–1.51
Emotional support	4.30 (0.60)	1–5	4.29 (0.60)	4.38 (0.65)	0.34	1.31	0.77–2.17

	Total (n = 445)		Completed n = 392, 88.1 % N/mean (%/SD)		Discontinued (n = 53, 11.9 %) N/mean (%/SD)		p value	OR ^a	95 % CI
	N/mean (%/SD)	Potential range	N/mean (%/SD)		N/mean (%/SD)				
Tangible support	4.43 (0.74)	1–5	4.46 (0.72)		4.28 (0.85)		0.17	0.76	0.53–1.07
Affectionate support	4.63 (0.68)	1–5	4.64 (0.66)		4.54 (0.81)		0.38	0.82	0.56–1.20
Positive social interaction	4.34 (0.74)	1–5	4.35 (0.74)		4.34 (0.76)		0.95	0.99	0.67–1.45
Chemotherapy attitudes	3.11 (0.48)	1–4	3.12 (0.48)		3.06 (0.50)		0.44	0.78	0.44–1.41
Optimism	24.39 (4.80)	0–32	24.46 (4.67)		23.91 (5.64)		0.50	0.98	0.92–1.04
Benefit finding and spirituality									
Total benefits	64.27 (21.02)	4–105	65.14 (20.94)		57.65 (20.72)		0.02	0.98	0.97–1.00
Relating to others	23.92 (6.89)	0–35	24.08 (6.82)		22.76 (7.41)		0.24	0.97	0.94–1.02
Seeing new possibilities	11.69 (6.41)	0–25	11.95 (6.48)		9.73 (5.52)		0.01	0.95	0.90–0.99
Gaining personal strength	12.98 (4.61)	0–20	13.19 (4.54)		11.37 (4.84)		0.02	0.93	0.87–0.98
Experiencing spiritual change	5.28 (3.42)	0–10	5.33 (3.42)		4.88 (3.46)		0.39	0.96	0.88–1.05
Having new appreciation of life	10.40 (3.17)	0–15	10.59 (3.03)		8.92 (3.77)		0.01	0.86	0.79–0.94
Breast cancer-related distress									
Overall	17.18 (15.23)	0–78	17.22 (15.47)		16.83 (13.50)		0.85	1.00	0.98–1.02
Avoidance	8.62 (8.51)	0–40	8.74 (8.64)		7.72 (7.57)		0.37	0.99	0.95–1.02
Intrusion	8.55 (8.39)	0–38	8.48 (8.40)		9.11 (8.41)		0.61	1.01	0.98–1.04
Quality of life									
Overall	82.29 (15.82)	0–108	82.22 (15.55)		82.83 (17.77)		0.81	1.00	0.98–1.02
Physical well-being	18.97 (6.43)	0–28	18.88 (6.36)		19.63 (6.95)		0.46	1.02	0.97–1.07
Social well-being	24.60 (3.68)	0–28	24.65 (3.59)		24.19 (4.32)		0.39	0.97	0.90–1.04
Emotional well-being	20.04 (3.62)	0–24	20.12 (3.56)		19.42 (4.02)		0.23	0.95	0.88–1.02
Functional well-being	18.71 (5.76)	0–28	18.59 (5.68)		19.60 (6.26)		0.27	1.03	0.98–1.09
Breast cancer related	24.03 (5.76)	0–40	24.01 (5.68)		24.18 (6.39)		0.85	1.01	0.96–1.06

Statistically significant associations are bolded

^aThe odds ratio for continuous variables represents the odds ratio for the unit change in each row

Table 4

Multivariable regression analysis examining the associations between early chemotherapy discontinuation and covariates

	Odds ratio	95 % CI	p value
Chemotherapy regimen group ^a			
Group 1	REF	–	
Group 2/3	2.59	1.32–5.08	0.006
Age, years			
50 years	REF	–	
>50 years	1.57	0.74–3.35	0.24
Race			
White	REF	–	
Black	0.84	0.32–2.22	0.73
Hispanic/Asian/other	0.36	0.10–1.29	0.12
Education			
High school	REF	–	
>High school	1.48	0.58–3.80	0.42
ER/PR status			
Negative	REF	–	
Positive	0.69	0.37–1.27	0.23
Psychosocial variables			
Benefit finding and spirituality			
New possibilities	1.00	0.92–1.09	0.95
Personal strength	1.00	0.90–1.11	0.98
Appreciation of life	0.88	0.76–1.02	0.09
Treatment satisfaction			
Treatment effectiveness	0.99	0.97–1.01	0.34
Side effects	0.98	0.96–1.00	0.11
Convenience	1.00	0.98–1.02	0.80
Memorial symptom assessment			
Physical symptoms	1.19	0.48–2.91	0.71
Psychological symptoms	1.92	1.00–3.68	0.05

Statistically significant associations are bolded

^aGroup 1 = 4 weeks regimens, AC and TC; Group 2 = 6–8 and 12 weeks regimens, TCarbo, TAC, AC TAX DD, ACT DD, AC TAX W, and ACT W

Stage and HER2 neu status are not included as they were not found to be significant in the stepwise regression analysis