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ORIGINAL PAPER

Symptoms after breast cancer treatment: are they influenced by patient characteristics?

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Abstract
Purpose This study examines the burden of symptoms by treatment type and patient characteristics in a population-based sample of newly diagnosed breast cancer patients.
Methods Using the Los Angeles County SEER Registry Rapid Case Ascertainment, we identified a cohort of breast cancer patients in 2000 and conducted telephone surveys in English and Spanish among participants.
Results We completed interviews of 1,219 breast cancer patients and found almost half (46%) had at least one severe symptom (any of the following: nausea/vomiting, arm problems, hot flashes, vaginal dryness, difficulty sleeping) that interfered with her daily functioning or mood. Multi-variate analysis controlling for patient characteristics and treatment showed that older (OR = 0.90; $P < 0.000$), black (OR = 0.50; $P < 0.000$), Hispanic Spanish-speaking (OR = 0.37; $P < 0.000$), widowed or never married (OR = 0.68; $P = 0.049$), and working (OR = 0.72; $P = 0.024$) women were less likely to report severe symptoms than other women. Number of comorbid conditions (OR = 1.21; $P < 0.000$) and receipt of chemotherapy (OR = 1.48; $P = 0.040$) were positively associated with reporting symptoms.
Conclusion These findings estimate the prevalence of several mutable symptoms in breast cancer patients that can be addressed by appropriate treatments. Comorbidity is a significant predictor of symptoms, especially amongst those receiving chemotherapy. Variation in symptom reporting occurred by race/ethnicity and other sociodemographic characteristics, raising questions of different thresholds for reporting symptoms or truly fewer symptoms for some sociodemographic groups. Population-based estimates of the probability of symptoms in women with incident breast cancer can be used to provide patient education about potential outcomes following the treatment of breast cancer.

Keywords Breast cancer · Quality of life · Symptoms

Introduction

Mortality from breast cancer has steadily decreased since 1990 due to advances in treatment and early detection with 5-year survival rates now 98% for local-stage disease and

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81% for regional-stage disease [1]. Given this progress in survival rates, optimizing the quality of life of cancer survivors is paramount. Quality of life or overall well-being is often measured by physical or mental functioning, subjective measures, or presence of symptoms [2]. A number of studies have evaluated the quality of life of selected breast cancer survivors and have generally found that women's global quality of life is very good after breast cancer treatment, regardless of the type of surgery [3, 4]. While these studies provide reassurance that women who survive a breast cancer diagnosis may have good quality of life, it is not well understood how quality of life for breast cancer patients varies for diverse populations as research with population-based datasets has been limited. A recent population-based study examined quality of life variation among women receiving treatment for breast cancer in Los Angeles and Detroit using various domains of functioning, although the study did not look at specific physical symptoms other than fatigue [5].

Global measures of quality of life may not be sensitive to the particular issues that affect breast cancer survivors. A number of studies have found that breast cancer survivors report a number of symptoms and these vary according to the treatment received. Tamoxifen and chemotherapy have been associated with hot flashes in several randomized and observational studies [6, 7]. Chemotherapy has also been previously linked to several other symptoms such as fatigue, nausea, and vaginal dryness as well as a greater number of symptoms [8–11]. Other studies have shown the association between mastectomy and arm problems such as edema and other arm morbidity [12–15]. Finally, research has shown that prevalent symptoms associated with radiation therapy included arm edema, fatigue, skin changes, sleep difficulties, sensory changes, and breast edema [16].

It is not well understood what other factors may influence patients' symptoms following their breast cancer treatment. A number of patient characteristics have been identified that may mediate patients' experience of symptoms following breast cancer treatment including low education [17], marital status [18], age [19, 20], and comorbidiy [21].

The evidence regarding a relationship between symptoms and quality of life and race/ethnicity has been mixed. One study found that white women had greater symptom severity than other women [22]. Another found post-surgical arm edema was increased for black women after controlling for treatment and other demographic characteristics [23], while a study of long-term breast cancer survivors in California found that ethnicity was not associated with overall quality of life [24].

Understanding the relationships between patient demographics and symptoms can help to identify patients who may require special attention following breast cancer treatment, identify patient characteristics linked to susceptibility to various symptoms, or represent a marker for the quality of medical care patients receive.

We studied a diverse, population-based sample of women with incident breast cancer from Los Angeles County to better understand what factors identify patients at greatest risk for symptoms that can impact quality of life following their initial cancer therapy. We focus on several prevalent symptoms that are common following treatment for breast cancer—nausea/vomiting, difficulty sleeping, arm problems, vaginal dryness, and hot flashes—and examine the medical and demographic correlates of these symptoms. We focus on these symptoms as measures of quality of life because providers are able to diagnose and treat these symptoms during routine medical care. As all of these symptoms have potentially effective treatments, our results can have important implications for the health care of women with breast cancer [25–30].

Methods

The Los Angeles Women's Study (LAW) is a population-based, longitudinal, observational study of women with breast cancer 50 years and older in Los Angeles County. The sample was drawn from a census of incident breast cancer cases diagnosed from March through November of 2000 excluding Asian women 55–70 years who were already allocated to a separate study. Using the Los Angeles County SEER Rapid Case Ascertainment (RCA) program from 103 hospitals or settings in Los Angeles County, we identified 2,745 patients who appeared to meet study criteria. Of these, 215 were unable to be contacted, 224 did not meet study inclusion criteria, 333 were ineligible for patient survey, and 704 refused to participate in a 90-min, baseline computer-assisted telephone interview (CATI) for a participation rate for eligible and contacted patients of 64% (see Fig. 1). About 1,219 patients completed the baseline survey a mean of 223 days after diagnosis (median 185 days, interquartile range 159–255). Both the RAND and UCLA IRB committees approved the study protocol. Participants provided verbal informed consent as part of the telephone interview.

The survey systematically queried each woman about her experiences from diagnosis to the date of the CATI. The survey underwent cognitive testing with 50 women during the early phases of development, later underwent

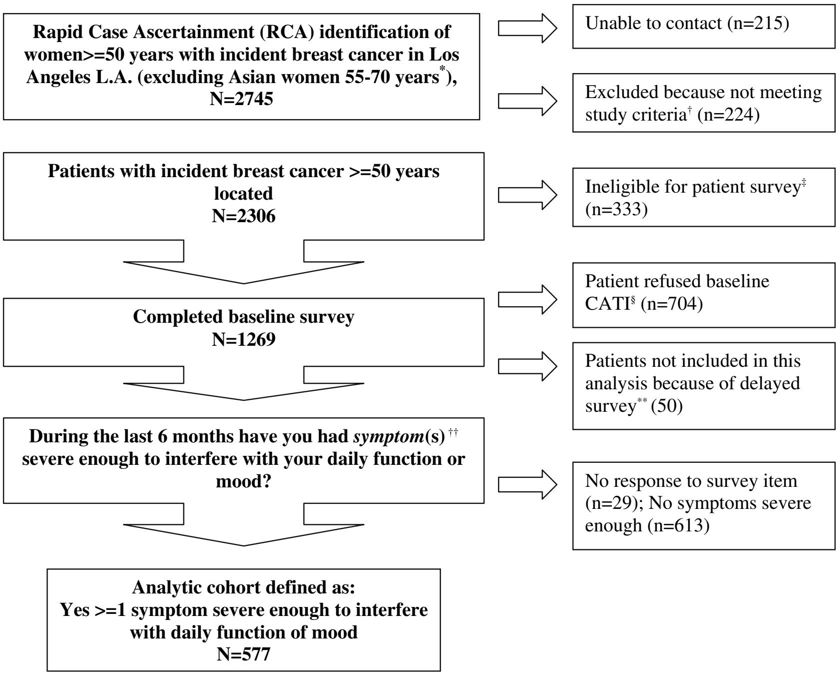

Fig. 1 Flow chart of analytic sample. *Asian women 55–70 years were not available for this study as they had already been assigned to a different study protocol. †224 patients identified by Rapid Case Ascertainment were excluded for the following reasons: male gender (5), false positive pathology (1), breast cancer diagnosis later than study window (17), no breast cancer diagnosis (62), breast cancer not incident (139). ‡333 patients identified by Rapid Case Ascertainment were not eligible for patient survey for the following reasons: physician indicated survey contact with patient could adversely effect patient (usually for mental health reasons, 16), patient did not live in or receive care in Los Angeles County (other than diagnosis-19), patient was deceased and could not be surveyed (81), patient had clinical problem precluding self-report survey (severe dementia-52, hearing impairment unable to be surveyed by phone despite several attempts using technology for hearing impaired calls-29, too ill with medical problems-39), patient spoke neither English not Spanish-the two languages in which the survey was fielded (97). §704 patients refused survey participation (of 1,590 eligible) including 420 who refused at baseline survey and the remaining 284 who could not be located at baseline but finally refused at follow-up survey 2 years after diagnosis. **50 patients completed the baseline survey at 24 months post-diagnosis, rather than at the time of the baseline survey fielding. Their symptom data will be described in a subsequent manuscript in association with the follow-survey data 24 months after diagnosis. ††Symptoms were asked about individually including: hot flashes, difficulty sleeping, arm problems, vaginal dryness, nausea, and vomiting

several rounds of pilot testing and review with audiotapes of these interviews by physician investigators prior to fielding the final survey, and finally underwent forward and backward translation into Spanish.

Women were queried about the presence of morbid symptoms and treatment for these symptoms using questions adapted from a previous study of another chronic condition [31]. Specifically, each patient was asked if during the last 6 months she had any of the following symptoms *severe enough that it interfered with her daily mood or function*: arm problems (defined as weakness, numbness, arm swelling, arm pain, loss of arm movement, or other arm problem on the side of surgery), nausea and vomiting, hot flashes, vaginal dryness, and problems with sleep. If she responded yes, then she was categorized as having a severe symptom. We restricted this analysis to patient complaint of severe symptoms as severity is known to predict health status. Additionally, each woman was asked about treatments received and whether she completed the treatment or was still receiving treatment. The most extensive surgery was considered the primary surgical treatment for the cancer. Women who received a lumpectomy were further categorized as either having an axillary lymph node dissection (ALND) or not having ALND (the no ALND group included women who had sentinel lymph node biopsy only). The survey also queried respondents about age, race/ethnicity, education, total household income from work and non-work sources, marital status, employment status, insurance coverage, and comorbid conditions (see Table 1). Language was determined based upon the woman's choice to complete the survey in English or Spanish. Approximately 50% of responding Hispanic patients completed the survey in Spanish and the remainder completed the survey in English. Stage at diagnosis was obtained from the SEER registry.

Table 1 Sample patient characteristics (n = 1,219)

	All patients n (%)
Age	
50–59	416 (30)
60–64	198 (15)
65–74	349 (29)
75–99	256 (26)
Race	
Black	112 (12)
Hispanic English speaker	103 (8)
Hispanic Spanish speaker	104 (9)
Other	66 (6)
White	834 (65)
Education	
Less than college	461 (40)
Some college	376 (31)
College graduate	180 (14)
Post-graduate	202 (15)
Income	
<$20K	288 (27)
$20K–39K	244 (22)
$40K+	687 (51)
Working	
Not working	818 (70)
Working	401 (30)
Marital status	
Married	625 (48)
Divorced	210 (17)
Never married	88 (7)
Separated	34 (3)
Widowed	262 (25)
Insurance	
Private/VA	638 (47)
Medicare	484 (44)
Medi Cal/other government	14 (1)
Other	33 (3)
None	50 (4)
0	223 (17)
1 or more	967 (83)
Stage at diagnosis	
Unknown	122 (11)
In situ	173 (13)
I	487 (38)
II	368 (30)
III	50 (5)
IV	19 (2)

Analytical methods

We conducted bivariate and multi-variable analyses to study the relationship between patient characteristics and symptom prevalence. Multi-variate analyses were conducted using a two-part model. First, we used logistic regression to predict women experiencing any symptoms severe enough to influence function or mood during the last 6 months. Next, we used linear regression to predict the number of symptoms experienced. We also conducted separate logistic regressions predicting each of the five individual symptoms. Model covariates were the same as the model predicting experience of any of the aggregate five symptoms.

We applied the regression to 1,161 women who participated in the CATI interview and had no missing variables, as well as to six subcohorts defined according to treatment received for the incident breast cancer. These cohorts were specified as women treated with and without chemotherapy (36% vs. 64%, respectively), with and without radiation therapy (54% vs. 46%), and with and without mastectomy (32% vs. 68%). Model covariates included all covariates from the full cohort models as well as interactions between treatments. We also tested for interaction of age with all other predictors and did not find any significant interactions. Covariates predicted dependent variables similarly across the cohorts as presented in Appendix.

Inclusion of hospital characteristics (associated with the site where the patient had her first surgery) had little impact on our multi-variate regression results, so we present only the models without hospital variables.

All regressions were adjusted for clustering within hospital cancer registry that reported the diagnosis to the Los Angeles County SEER Registry [32]. Bivariate and multi-variate results are weighted with non-response weights developed using logistic regression of patient with incident breast cancer noted in RCA file as a function of age, race, stage at diagnosis, and hospital indicators. Comparison of respondents and non-respondents showed that women who were non-white ($P < 0.0001$), were older ($P < 0.0001$), and had a stage III or IV diagnosis ($P < 0.0001$), were less likely to respond to the survey. There were no differences in response by hospital indicators.

Results

The study sample was racially diverse with 35% of the sample non-white (Table 1). A majority of this sample of women age 50 and older were not working, and many were covered by Medicare. Most of the women had at least one comorbid condition, and breast cancer diagnosis in later stages was infrequent.

Almost half of 1,219 breast cancer patients studied (46%) had at least one severe symptom that interfered with her daily functioning or mood during the first 6 months

Table 2 Type of severe symptom by treatment received (n = 1,219)

Treatment	n	At least one symptom (n = 577)	Hot flashes (n = 248)	Difficulty sleeping (n = 353)	Arm problems (n = 138)	Vaginal dryness n = 148)	Nausea, vomiting (n = 158)
% Patients with each symptom							
Mastectomy[a]							
Radiation[b]	44	61	25	35	37	13	24
No radiation[c]	329	51	18	27	17	12	13
Chi-square *P*-value		0.1034	0.1337	0.3076	0.0003	0.5213	0.0223
Lumpectomy[d]							
Radiation[e]	596	41	18	26	8	9	10
No radiation[f]	315	56	24	34	13	16	16
Chi-square *P*-value		<0.0001	0.0306	0.0060	0.0185	0.0019	0.0100
Axillary lymph node dissection[g]	610	53	21	31	16	12	17
No ALND[h]	580	38	17.5	24.8	5.7	10.7	6.5
Chi-square *P*-value		<0.0001	0.0696	0.002	<0.0001	0.4073	<0.0001
Both chemo and rad received[i]							
Chemo and rad completed	85	55	25	33	22	15	24
Only chemo completed	48	69	17	35	13	12	36
Only rad completed	30	62	26	35	9	22	32
Neither completed	20	58	36	38	20	15	35
Rad only (in Progress/completed)[j]	477	34	16	23	6	7	3
Chemo only (in Progress/completed)[k]	259	64	26	39	14	17	27
Neither[l]	300	41	15	23	12	11	4
Chi-square *P*-value[m]		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tamoxifen[n]	658	41	19	26	11	9	7
No tamoxifen[o]	642	52	19	30	11	14	18
Chi-square *P*-value		<0.0001	0.8785	0.0184	0.7646	0.0018	<0.0001
All patients	1,219	46	19	28	11	12	12

[a] Mastectomy regardless of prior lumpectomy

[b] 92% of patients had ALND, 57% had TAM and 85% had chemotherapy

[c] 73% of patients had ALND, 56% had TAM and 42% had chemotherapy

[d] Lumpectomy with no subsequent mastectomy

[e] 40% of patients had ALND, 61% had TAM and 21% had chemotherapy

[f] 57% of patients had ALND, 36% had TAM and 45% had chemotherapy

[g] 53% had TAM and 38% had chemotherapy

[h] 58% had TAM and 10% had chemotherapy

[i] 87% had ALND

[j] 58% had ALND

[k] 88% had ALND

[l] 60% had ALND

[m] Chi-square tests differences between all combinations of chemotherapy and radiation treatment

[n] 23% of patients had chemotherapy

[o] 48% of patients had chemotherapy

following diagnosis. Most of these patients (78%) had fewer than three symptoms. The most prevalent symptoms reported were difficulty sleeping (28%) and hot flashes (19%) (see Table 2). Arm problems were more prevalent among women who had both a mastectomy and radiation compared to mastectomy without radiation or lumpectomy. Women who completed or were undergoing treatment with both radiation and chemotherapy experienced all five symptoms more often than those who had neither treatment (all $P < 0.0001$). The prevalence of these symptoms also varied according to whether treatment was ongoing or completed. For patients undergoing both chemotherapy and radiation therapy, patients were more likely to experience hot flashes, difficulty sleeping, and nausea or vomiting compared to symptom prevalence following these treatments (all $P = <0.0001$).

Bivariate analyses showed variation in the prevalence of any severe symptom by patient characteristics other than treatment. Younger women reported a much greater prevalence of symptoms than older women with 71% of women in the youngest group (50–59 years) reporting severe symptoms compared to 22% of women in the oldest group (75 years and older) ($P < 0.001$). Fewer black women reported any symptoms compared to the other racial/ethnic groups in the study ($P = 0.06$). Women in the highest income group ($P = 0.0002$) and women who were working ($P = <0.0001$) reported higher rates of symptoms. Women who were widowed had fewer number of reported symptoms compared to married women ($P < 0.0001$). There was also a greater reported prevalence of symptoms among women receiving private insurance ($P < 0.0001$). Having a comorbid condition was associated with symptom report ($P = 0.014$) (Table 5).

Multi-variate analysis controlling for patient characteristics and treatment showed that age, race/ethnicity, marital status, number of comorbid conditions, and receipt of chemotherapy were independently related to patient report of any symptoms (Table 3). As in the bivariate analysis, younger women had greater odds of describing severe symptoms ($P < 0.001$) even when controlling for treatment received. Non-white women were less likely than white women to report severe symptoms. Black women were half as likely ($P < 0.001$) and Hispanic Spanish-speaking women were more than 60% less likely ($P < 0.001$) to report symptoms compared to white women. Women who were widowed or never married were significantly less likely than married women to report symptoms ($P = 0.05$). After controlling for covariates, women who were working were less likely to report symptoms than women who did not work ($P = 0.024$). The number of comorbid conditions was also positively related to having any symptoms: an increase in one comorbid condition was associated with a 21% increase in the odds of reporting a symptom ($P < 0.001$).

Table 3 Multi-variate analysis of predictors for having any severe symptoms (n = 1,161)

	Odds ratio [95% confidence interval]
Age	0.90 [0.87, 0.92]*
Race	
Black	0.44 [0.30, 0.64]*
Hispanic English speaker	0.66 [0.34, 1.25]
Hispanic Spanish speaker	0.34 [0.20, 0.57]*
Other	0.44 [0.22, 0.89]**
White	1.00
Education	
Less than college	0.92 [0.62, 1.34]
Some college	0.90 [0.63, 1.29]
College graduate	0.80 [0.50, 1.26]
Post-graduate	1.00
Income	
<$20K	1.59 [0.99, 2.55]
$20K–39K	1.29 [0.85, 1.96]
$40K+	1.00
Working	
Not working	1.00
Working	0.74 [0.56, 0.97]**
Marital status	
Married	1.00
Divorced/separated	1.04 [0.72, 1.50]
Never married	0.56 [0.33, 0.96]
Widowed	0.63 [0.44, 0.91]**
Insurance	
Insured	1.12 [0.52, 2.43]
Uninsured	1.00
Number of comorbidities	1.21 [1.10, 1.33]*
Surgery	
Lumpectomy with ALND	1.26 [0.62, 2.56]
Lumpectomy without ALND	0.63 [0.31, 1.28]
Mastectomy	1.00
Chemotherapy	
Yes	1.33 [0.82, 2.17]**
No	1.00
Radiation	
Yes	0.61, 2.88]
No	1.00
Tamoxifen	
Yes	0.93 [0.63, 1.37]
No	1.00
Stage at diagnosis	
I	0.75 [0.48, 1.18]
II	0.79 [0.45, 1.38]

Table 3 continued

	Odds ratio [95% confidence interval]
III	0.91 [0.42, 1.97]
IV	0.16 [0.04, 0.60]**
Unknown	0 [52, 2.88]
In situ	1.00

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

Separate multi-variate regressions for the presence of the five symptoms showed that demographic characteristics predicting any symptom were generally consistent across the five symptoms. Women who had a mastectomy were almost five times as likely to report having arm problems as women with only a lumpectomy. Women who received chemotherapy were more than five times as likely to experience nausea/vomiting than those who did not while tamoxifen use was associated with lower odds of reporting this symptom. No treatments were significantly associated with vaginal dryness.

Discussion

With diagnosis occurring at earlier stages, increased survival rates, and more patients receiving indicated treatments, the focus of patient and clinician alike often turn to how the cancer or treatment is likely to influence health-related quality of life. We used a diverse, multi-ethnic, multi-lingual population-based cohort of women with incident breast cancer in Los Angeles County to learn population-based rates of five prevalent symptoms mutable with appropriate medical care.

Almost half of all patients had at least one key symptom severe enough to interfere with mood or function, but symptom prevalence varied with treatment(s). After adjustment for stage at diagnosis and treatment, several patient-reported demographics predicted patients reporting symptoms severe enough to affect daily function or mood. Our results confirm that there is a negative relationship between age and symptoms for older women. Working also appears to play a role in reporting fewer symptoms. Severe symptoms may interfere with a woman's ability to perform her job so that women with more severe symptoms leave their jobs. An alternative explanation is that women who are working may be less likely to think that their symptoms are severe enough to interfere with their functioning or mood.

Symptom reporting did not vary by patient income, education, and insurance status, which contradict other research findings [33]. These characteristics are often to related race/ethnicity, which accounted for large differences in symptom reporting in our results. Compared with white and English-speaking Hispanic women, black, Hispanic Spanish-speaking, and women of other races reported lower odds of symptoms. This result is striking given that black women experience poorer quality and timeliness of breast cancer treatment, and poorer outcomes compared to white women [34–37].

As we accounted for stage and type of treatment, the lower rates of severe symptoms reported by non-white or Spanish-speaking women do not appear related to variations in the initial cancer diagnosis and management. These results raise questions about whether women from different demographic groups vary in their threshold for reporting symptoms or whether they truly have fewer symptoms.

When survey respondents were asked if they had any of the five symptoms, 20% of Spanish-speaking Hispanic respondents answered that they did not know or refused to answer the question for at least one of the five symptoms compared to only 5% of white respondents and 6% of black respondents. Thus, language may have an effect on our measurement of symptoms.

Alternatively, differences in physiology may affect the incidence of severe symptoms by women of different races/ethnicities [38, 39]. Black women were much less likely to report difficulty sleeping, vaginal dryness, and nausea/vomiting than white women but were not less likely to report hot flashes or arm problems. Race/ethnicity may be a surrogate for physiologic characteristics that affect the occurrence of some symptoms, for example, body mass index. Alternatively, women with more competing concerns (such as income, housing) may be less likely to report certain severe symptoms (Table 4).

Previous methodological studies of survey questions have found evidence that whites and Hispanics may not respond similarly. Johnson [40] found qualitative differences in whites' and Hispanics' interpretation of health status questions across multiple health surveys. Hayes and Baker [41] found the reliability and validity of a Spanish language patient satisfaction with communication scale differed significantly from that of the English version. Aday [42] noted Hispanics were more likely to respond ''yes'' to patient satisfaction questions than non-Hispanics, regardless of whether the question indicated greater satisfaction or dissatisfaction [41].

Further research is needed to determine interventions to improve identification and treatment of symptoms from breast cancer treatment for these vulnerable groups. Furthermore, as performance measurement and pay for performance become more of a reality, it is important to consider the theory that language and cultural barriers make it difficult for some individuals to admit to symptoms, even when questioned directly as we did in this

Table 4 Predictors for having severe symptom

	Hot flashes ($n = 248$)	Difficulty sleeping ($n = 353$)	Arm problems ($n = 138$)	Vaginal dryness ($n = 148$)	Nausea vomiting ($n = 158$)
Age	0.89*	0.91*	0.92*	0.90*	0.92*
Race					
Black	1.08	0.49**	0.98	0.31**	0.29**
Hispanic English speaker	0.52*	0.68	1.28	1.12	0.98
Hispanic Spanish speaker	0.69	0.52*	1.09	0.88	0.49
Other	0.69	0.66	1.47	0.91	1.40
White	1.00	1.00	1.00	1.00	1.00
Education					
Less than college	1.39	0.98	1.66	0.99	0.86
Some college	1.13	0.68*	1.67	0.97	0.95
College graduate	0.93	0.94	1.82	0.72	1.06
Post-graduate	1.00	1.00	1.00	1.00	1.00
Income					
<$20K	1.34	1.34	1.12	0.84	1.17
$20K–40K	0.98	1.25	0.95	0.94	0.98
$40K+	1.00	1.00	1.00	1.00	1.00
Working status					
Working	0.91	0.76	0.49**	0.79	0.47***
Not working	1.00	1.00	1.00	1.00	1.00
Marital status					
Divorced/separated	1.09	1.21	1.46	0.45*	1.68*
Never married	0.92	0.59	0.55	0.41	0.22**
Widowed	0.68	0.74	0.83	0.51	0.67
Married	1.00	1.00	1.00	1.00	1.00
Insurance					
Insured	0.92	0.59	1.09	1.08	1.70
Uninsured	1.00	1.00	1.00	1.00	1.00
Number of comorbidities	1.15*	1.24*	1.18**	1.06	1.18*
Surgery					
Lumpectomy with ALND	1.39	1.73	0.47*	0.98	0.95
Lumpectomy without ALND	1.27	1.40	0.09**	1.71	0.91
Mastectomy	1.00	1.00	1.00	1.00	1.00
Chemotherapy					
Yes	1.11	1.01	0.48**	1.16	3.64**
No	1.00	1.00	1.00	1.00	1.00
Radiation					
Yes	1.36	1.35	1.43	1.22	1.02
No	1.00	1.00	1.00	1.00	1.00
Tamoxifen					
Yes	1.57*	1.30	0.68	0.83	0.46*
No	1.00	1.00	1.00	1.00	1.00
Stage at diagnosis					
I	0.90	1.12	3.24*	0.99	2.26
II	0.92	1.13	2.82*	0.83	1.96

Table 4 continued

	Hot flashes (n = 248)	Difficulty sleeping (n = 353)	Arm problems (n = 138)	Vaginal dryness (n = 148)	Nausea vomiting (n = 158)
III	0.71	1.91	1.66	0.34	1.74
IV	0.37	0.29	0.64	0.25	1.47
Unknown	0.81	1.93	4.31	0.46	2.39
In situ	1.00	1.00	1.00	1.00	1.00

*$P < 0.05$

**$P < 0.01$

***$P < 0.001$

study. If this is the case, then before pay for performance is implemented, it would be useful to educate clinicians about culturally appropriate ways to query patients about their concerns.

Limitations

Our study did not include women < 50 years of age, so our results are not generalizable to younger women with breast cancer. Our sample did not include Asian women between 55 and 70 years of age, so we did not have enough power to make separate estimates for Asian women. There was some response bias in our sample with regards to age, race, and stage at diagnosis; however, all of our results are weighted for non-response, so we do not expect non-response to limit the generalizability of our results. In addition, while our survey was fielded in English and Spanish, we were unable to capture the experiences of patients who did not speak either of these languages. Even among patients who indicated that they could complete the survey in English and Spanish, language barriers may still play a role in measurement bias. We attempted to minimize this by using a telephone survey with experienced, trained interviewers.

While we were unable to take into account the duration of the symptom, we believe that treating severe symptoms can have an impact on quality of life including symptoms for a short duration.

Conclusions

The optimal methodology for assessing patient symptoms associated with a cancer treatment regimen would include serial patient assessments so that the patient's changing experiences could be captured as her treatments and symptoms change, and we report here using only baseline survey data. However, we think these data provide useful insights as the RCA methodology allowed us to interview patients soon after diagnosis in an effort to minimize recall bias. While this study looks at symptoms experienced only in the short-term within 6 months of their diagnosis, a follow-up study surveyed women 2 years after their diagnosis, and further analysis will determine what symptoms continue to affect patients long-term.

Understanding the relationship between patient characteristics and symptom prevalence can help inform breast cancer providers and patients about treatment benefits and possible negative effects of treatment. Such understanding may motivate a more systematic screening by providers of severe symptoms among patients at-risk for symptoms, thus opening the door to facilitate the use of effective treatments.

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Appendix

Table 5 Severe symptom prevalence by patient characteristics (n = 1,219)

	N	At least one severe symptom (%)	Chi-square P-value
Age			<0.001
50–59	416	71	
60–64	198	54	
65–74	349	37	
75–99	256	22	
Race			0.0626
Black	112	43	
Hispanic English speaker	103	49	

Table 5 continued

	N	At least one severe symptom (%)	Chi-square *P*-value
Hispanic Spanish speaker	104	44	
Other	66	35	
White	834	47	
Education			0.1608
Less than college	461	43	
Some college	376	46	
College graduate	180	47	
Post-graduate	202	50	
Income			0.0002
<$20K	288	41	
$20K–40K	244	41	
$40K+	687	50	
Working			<0.0001
Not working	818	43	
Working	401	53	
Marital status			<0.0001
Married	625	53	
Divorced	210	55	
Never married	88	40	
Separated	34	59	
Widowed	262	26	
Insurance			<0.0001
Private/VA	638	57	
Medicare	484	32	
Medi-Cal/other government	14	50	
Other	33	50	
None	50	52	
Comorbid conditions			0.0135
0	223	51	
1 or more	967	49	
Stage at diagnosis			<0.0001
Unknown	122	47	
In situ	173	48	
I	487	39	
II	368	49	
III	50	80	
IV	19	21	

Table 6 Predictors for number of severe symptoms if any ($n = 577$)

	Estimate [SE]
Age	–0.04 [0.48]*
Race	
Black	–0.09 [0.14]
Hispanic English speaker	0.05 [0.14]
Hispanic Spanish speaker	0.22 [0.18]
Other	0.58 [0.24]**
White	0
Education	
Less than college	0.11 [0.12]
Some college	–0.04 [0.10]
College graduate	0.13 [0.10]
Post-graduate	0
Income	
<$20K	–0.13 [0.13]
$20K–40K	–0.18 [0.12]
$40K+	0
Working	
Not working	0
Working	–0.25 [0.07]*
Marital status	
Married	0
Divorced/separated	0.11 [0.12]
Never married	–0.19 [0.12]
Widowed	0.04 [0.12]
Insurance	
Insured	–0.17 [0.23]
Uninsured	0
Number of comorbidities	0.07 [.02]**
Mastectomy	
Yes	0.02 [0.11]
No	0
Chemotherapy	
Yes	0.04 [0.13]
No	0
Radiation	
Yes	0.01 [0.09]
No	0
Tamoxifen	
Yes	0.03 [0.08]
No	0
Stage at diagnosis	
I	0.28 [0.11]**
II	0.17 [0.15]
III	0.11 [0.23]
IV	0.34 [0.59]
Unknown	0.37 [0.17]**
In situ	0

*$P < 0.05$

**$P < 0.0001$

Table 7 Predictors for having any severe symptoms for treatment-specific cohorts

	OR [*P*-value]					
	Yes chemotherapy	No chemo-therapy	Yes radiation	No radiation	Yes mastectomy	No mastectomy
Age	0.87 [<0.000]	0.91 [0.000]	0.90 [0.000]	0.90 [0.000]	0.89 [0.000]	0.89 [0.000]
Race						
Black	0.45 [0.015]	0.49 [0.001]	0.37 [0.000]	0.59 [0.042]	0.53 [0.145]	0.42 [0.000]
Hispanic English speaker	1.03 [0.948]	0.42 [0.033]	0.42 [0.023]	0.78 [0.529]	0.58 [0.320]	0.61 [0.149]
Hispanic Spanish speaker	0.31 [0.016]	0.43 [0.009]	0.37 [0.004]	0.33 [0.025]	0.27 [0.011]	0.42 [0.011]
Other	0.52 [0.257]	0.37 [0.035]	0.39 [0.131]	0.39 [0.030]	0.29 [0.030]	0.57 [0.214]
White						
Education						
Less than college	0.75 [0.394]	1.24 [0.393]	1.10 [0.756]	1.04 [0.859]	0.78 [0.413]	1.30 [0.337]
Some college	0.91 [0.788]	0.98 [0.927]	0.81 [0.380]	1.14 [0.581]	0.15 [0.684]	0.90 [0.627]
College graduate	0.84 [0.598]	0.72 [0.250]	0.72 [0.386]	0.87 [0.662]	0.54 [0.151]	0.96 [0.914]
Post-graduate						
Income						
<$20K	1.39 [0.400]	1.64 [0.089]	1.35 [0.394]	1.79 [0.055]	0.45 [0.215]	1.64 [0.110]
$20K–40K	1.43 [0.290]	1.20 [0.446]	1.07 [0.806]	1.68 [0.131]	1.71 [0.136]	1.12 [0.635]
$40K+						
Working						
Not working						
Working	0.62 [0.090]	0.86 [0.487]	0.75 [0.166]	0.73 [0.215]	0.69 [0.216]	0.77 [0.199]
Marital status						
Married						
Divorced/separated	1.03 [0.907]	0.95 [0.831]	1.06 [0.790]	0.87 [0.637]	0.83 [0.616]	1.04 [0.866]
Never married	0.41 [0.041]	0.64 [0.174]	0.78 [0.527]	0.29 [0.000]	0.32 [0.007]	0.73 [0.361]
Widowed	0.77 [0.576]	0.55 [0.016]	0.50 [0.028]	0.78 [0.427]	0.95 [0.893]	0.52 [0.022]
Insurance						
Insured	1.11 [0.801]	0.91 [0.841]	0.78 [0.682]	1.53 [0.142]	1.91 [0.165]	0.82 [0.738]
Uninsured						
Number of comorbidities	1.12 [0.231]	1.24 [0.000]	1.23 [0.002]	1.19 [0.017]	1.15 [0.128]	1.23 [0.001]
Mastectomy						
Yes	0.82 [0.623]	1.27 [0.555]	0.27 [0.282]	0.88 [0.741]	–	–
No					–	–
Chemotherapy						
Yes	–	–	2.44 [0.001]	1.42 [0.402]	1.98 [0.186]	1.48 [0.252]
No	–	–				
Radiation						
Yes	0.84 [0.660]	0.70 [0.216]	–	–	0.62 [0.704]	0.66 [0.197]
No			–	–		
Tamoxifen						
Yes	0.53 [0.181]	1.38 [0.501]	1.10 [0.689]	0.89 [0.821]	1.03 [0.947]	1.58 [0.246]
No						
Stage at diagnosis						
I	1.71×10^{-8} [0.000]	0.80 [0.346]	0.61 [0.079]	1.21 [0.574]	0.78 [0.571]	0.86 [0.582]
II	2.03×10^{-8} [0.000]	0.93 [0.806]	0.83 [0.648]	1.05 [0.917]	0.52 [0.200]	1.29 [0.455]
III	2.29×10^{-8} [0.000]	–	0.54 [0.353]	1.85 [0.311]	0.69 [0.592]	1.38 [0.583]
IV	2.23×10^{-9} [0.000]	0.33 [0.157]	–	0.25 [0.143]	0.12 [0.044]	0.09 [0.004]
Unknown	1.52×10^{-8} [0.000]	0.80 [0.515]	0.69 [0.363]	0.80 [0.587]	0.50 [0.278]	0.91 [0.799]

Table 8 Predictors for number of severe symptoms if any symptoms for treatment-specific cohorts

	Estimate [*P*-value]					
	Yes chemo-therapy	No chemo-therapy	Yes radiation	No radiation	Yes mastectomy	No mastectomy
Age	–0.06 [0.000]	–0.04 [0.000]	–0.04 [0.000]	–0.05 [0.000]	–0.05 [0.000]	–0.04 [0.000]
Race						
Black	–0.51 [0.005]	0.00 [0.986]	–0.09 [0.678]	–0.28 [0.107]	–0.46 [0.010]	–0.03 [0.881]
Hispanic English speaker	–0.18 [0.312]	0.19 [0.430]	0.07 [0.711]	–0.04 [0.862]	–0.10 [0.692]	0.07 [0.734]
Hispanic Spanish speaker	0.01 [0.978]	0.16 [0.479]	0.17 [0.488]	0.07 [0.747]	–0.36 [0.144]	0.52 [0.045]
Other	0.54 [0.079]	0.30 [0.392]	0.14 [0.596]	0.89 [0.013]	0.76 [0.067]	0.33 [0.230]
White	Omit	Omit	Omit	Omit	Omit	Omit
Education						
Less than college	–0.04 [0.859]	0.18 [0.212]	–0.06 [0.700]	0.32 [0.025]	0.20 [0.347]	0.07 [0.582]
Some college	–0.37 [0.044]	0.23 [0.144]	–0.04 [0.825]	0.02 [0.859]	–0.15 [0.469]	0.07 [0.581]
College graduate	–0.05 [0.806]	0.17 [0.356]	–0.09 [0.605]	0.31 [0.029]	0.26 [0.229]	–0.04 [0.746]
Post-graduate	Omit	Omit	Omit	Omit	Omit	Omit
Income						
<$20K	–0.13 [0.510]	0.00 [0.999]	0.06 [0.740]	–0.24 [0.183]	–0.03 [0.859]	–0.08 [0.630]
$20K–40K	–0.14 [0.471]	–0.08 [0.512]	–0.08 [0.545]	–0.09 [0.501]	–0.12 [0.447]	–0.03 [0.853]
$40K+	Omit	Omit	Omit	Omit	Omit	Omit
Working						
Not working	Omit	Omit	Omit	Omit	Omit	Omit
Working	–0.26 [0.020]	–0.17 [0.209]	–0.19 [0.210]	–0.26 [0.027]	–0.18 [0.246]	–0.22 [0.057]
Marital status						
Married	Omit	Omit	Omit	Omit	Omit	Omit
Divorced/separated	0.04 [0.784]	0.09 [0.637]	0.15 [0.431]	–0.02 [0.902]	0.17 [0.328]	0.06 [0.697]
Never married	–0.48 [0.055]	–0.19 [0.290]	–0.10 [0.600]	–0.6 [0.004]	–0.32 [0.176]	–0.29 [0.089]
Widowed	–0.35 [0.045]	0.11 [0.540]	–0.23 [0.153]	0.24 [0.199]	0.05 [0.829]	–0.08 [0.618]
Insurance						
Insured	–0.19 [0.527]	–0.15 [0.490]	0.13 [0.542]	–0.47 [0.105]	–0.23 [0.504]	0.06 [0.735]
Uninsured	Omit	Omit	Omit	Omit	Omit	Omit
Number of comorbidities	0.12 [0.007]	0.06 [0.065]	0.10 [0.004]	0.06 [0.103]	0.09 [0.071]	0.07 [0.029]
Mastectomy						
Yes	–0.26 [0.174]	–0.00 [0.984]	–0.62 [0.213]	0.05 [0.762]	–	–
No	Omit	Omit	Omit	Omit	–	–
Chemotherapy						
Yes	–	–	0.23 [0.277]	–0.05 [0.836]	–0.48 [0.063]	0.36 [0.162]
No	–	–				
Radiation						
Yes	–0.10 [0.567]	0.06 [0.723]	–	–	–1.15 [0.042]	0.067 [0.689]
No			–	–		
Tamoxifen						
Yes	–0.01 [0.979]	0.16 [0.471]	0.05 [0.714]	–0.06 [0.777]	–0.12 [0.478]	0.14 [0.577]
No	–	–	–	–	–	–
Stage at diagnosis						
I	0.61 [0.270]	0.22 [0.057]	0.15 [0.335]	0.31 [0.071]	0.32 [0.183]	0.23 [0.100]
II	0.34 [0.494]	0.24 [0.198]	–0.11 [0.599]	0.34 [0.137]	0.46 [0.144]	0.01 [0.958]
III	0.31 [0.548]		–0.31 [0.454]	0.12 [0.683]	0.43 [0.187]	–0.60 [0.151]
IV	1.00 [0.173]	–1.06 [0.003]		0.47 [0.388]	0.38 [0.444]	0.29 [0.774]
Unknown	0.38 [0.463]	0.40 [0.068]	0.28 [0.212]	0.24 [0.329]	0.30 [0.326]	0.36 [0.060]

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