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Symptom Burden in Cancer Survivors One Year after Diagnosis: A Report from the American Cancer Society's Studies of Cancer Survivors

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Abstract

Background—Few studies have examined risk for severe symptoms during early cancer survivorship. Using baseline data from the American Cancer Society's Study of Cancer Survivors-I, we examined cancer survivors with high symptom burden, identified risk factors associated with high symptom burden, and evaluated the impact of high symptom burden on health-related quality of life (HRQoL) 1 year post-diagnosis.

Methods—Participants were enrolled from 11 state cancer registries approximately 1 year after diagnosis and surveyed by telephone or mail. Outcomes measures were the Modified Rotterdam

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Symptom Checklist and Profile of Mood States-37 (to assess symptom burden) and the Satisfaction with Life Domains Scale-Cancer (to assess HRQoL).

Results—Of 4903 survivors, 4512 (92%) reported symptoms related to their cancer and/or its treatment. Two-step clustering yielded 2 sub-groups, one with low symptom burden (n=3113) and one with high symptom burden (n=1399). Variables associated with high symptom burden included metastatic cancer (odds ratio [OR], 2.05), number of comorbid conditions (OR, 1.76), remaining on active chemotherapy (OR, 1.93), younger age (OR, 2.31), lacking insurance/being underinsured (OR, 1.57), having lower income (OR, 1.61), being unemployed (OR, 1.27), or being less educated (OR, 1.29). Depression, fatigue, and pain had the greatest impact on HRQoL in survivors with high symptom burden, who also had lower HRQoL ($P < .0001$).

Conclusions—More than 1 in 4 cancer survivors had high symptom burden 1 year post-diagnosis, even after treatment termination. These results indicate a need for continued symptom monitoring and management in early posttreatment survivorship, especially for the underserved.

Keywords

cancer survivorship; symptom burden; late effects; risk factors; quality of life; cluster analysis

INTRODUCTION

A cancer survivor is any person who has received a diagnosis of cancer; survivorship begins at diagnosis and continues through the balance of the patient's life.[1] Owing to advances in cancer detection and treatment, the number of individuals living years after their cancer diagnosis has increased steadily. The 5-year survival rate for all U.S. cancer patients diagnosed between 1996 and 2004 has increased to 66%, and there are more than 11 million cancer survivors in the United States.[2]

The benefit of a longer life is offset for many survivors, however, by multiple persistent symptoms, including fatigue, distress, pain, and cognitive impairment. Some survivors remain on anticancer treatment and thus continue to experience treatment-related symptoms. Others who have completed treatment will experience residual symptoms of both the disease and the treatment, compounded by lack of the close medical monitoring that accompanies active therapy. In either case, symptoms cause a significant burden that diminishes survivors' quality of life.[3–6]

The 12 months after diagnosis may be especially stressful for patients,[7] and risk for symptom burden induced by cancer and its treatment remains high during this period. As patients move into the posttreatment period, individual variations in the presence and severity of physical and psychological morbidities are common.[8] The severity of symptoms is critical, as higher levels of symptom burden disproportionately impair function and quality of life.[9,10]

Therefore, it is important to identify specific groups of cancer survivors who are at greater risk for severe symptoms. Historically, however, in most symptom research the determination of variables associated with high symptom burden has been limited by a number of factors, including lack of statistical power due to small sample size[11]; lack of the assessment of symptom severity, an understanding of which would allow identification of the most symptomatic survivors[12]; confounding because of variability in the length of time as a survivor[13]; and a tendency to consider symptoms individually, regardless of the co-occurrence of multiple symptoms.[14]

To address these limitations, we conducted an analysis of population-based data from the American Cancer Society's Study of Cancer Survivors-I (SCS-I). All subjects had received their cancer diagnosis approximately 1 year prior to enrollment. We aimed to identify a subgroup with higher symptom burden in the early stages of cancer survivorship and to document possible factors that could contribute to having more-severe symptoms in early survivorship. We also investigated the pattern of multiple symptoms in this high-symptom group and identified symptoms that had the greatest impact on survivors' ratings of health-related quality of life (HRQoL).

METHODS

Study population

The SCS-I study was designed to identify longitudinal patterns of change in cancer survivors' HRQoL over an 11-year period. Cancer survivors representing diverse diagnoses, geographic regions, and demographic groups were randomly recruited from the cancer registries of 11 states. All survivors were at least 18 years old, diagnosed with one of the 10 most highly incident cancers (non-Hodgkin lymphoma, skin melanoma, or prostate, female breast, lung, colorectal, urinary bladder, kidney, ovarian, or uterine cancer), and approximately 1 year postdiagnosis at the time of recruitment and initial assessment. Sampling and investigation details for the SCS-I study have been described.[15] Overall approval for the SCS-I was obtained from the Institutional Review Board (IRB) of Emory University. Additional IRB and/or regulatory approvals were obtained for each state registry.[15]

To ensure the reliability of our analyses, we selected only those survivors whose missing-response rate on the study's baseline symptom assessment was less than 20%.

Measurement

Medical, demographic, and socioeconomic data in the SCS-I database was obtained from the state cancer registries or via a self-report survey. Patient-reported HRQoL and symptom severity were collected via mailed questionnaires. The Modified Rotterdam Checklist (RSCL-M) was used to assess physical symptoms: patients indicated the extent to which they have been bothered by each of 30 symptoms during the past week (not at all, a little, quite a bit, or very much).[16] The short-form Profile of Mood States (POMS-37) was used to assess psychological symptoms: patients indicated for 37 adjectives from 6 subscales (tension, depression, confusion, fatigue, anger, and vigor) the extent to which they had been feeling that way during the past 2 weeks (not at all, a little, moderately, quite a bit, or extremely).[17] The Satisfaction with Life Domains Scale-Cancer (SLDS-C) was used to assess HRQoL: patients indicated their current satisfaction with 17 life domains relevant to HRQoL by choosing 1 of 7 faces, ranging from a "terrible" face with a deep, downturned frown to a "delighted" face with a large smile.[18]

Statistical analysis

Because the current study focused on symptomatic cancer survivors, respondents who reported "not at all" for all RSCL-M and all POMS-37 items were removed from analysis. For missed symptom items, mean imputation was used for both scales according to the instrument's manual. Symptom scores were linearly transformed to a 0–100 metric to facilitate interpretation, with higher scores indicating more severe symptoms. Because of their inverse scoring, 6 symptoms belonging to the POMS-37 vigor subscale were reverse scored for a consistent interpretation with other symptoms.

To identify survivors with high symptom burden, we applied a 2-step cluster analysis to divide cancer survivors into groups with distinct levels of symptom severity (high versus low). With the 67 symptoms from RSCL-M and POMS-37 as variables, the clustering solution was obtained using log-likelihood estimation, and the optimal number of groups was defined as that with the lowest Bayesian Information Criterion (BIC). To confirm that 2-step clustering effectively differentiated survivors according to symptom burden, we used Student's *t* test and Cohen's *d* effect size to compare the severity of individual symptoms between the high-symptom and low-symptom groups. The magnitude of effect size was based on the value of *d*: 0.2 as small, 0.5 as medium, and 0.8 as large.[19] We expected the 2-step clustering to generate subgroups of survivors with distinct levels of symptoms with at least a medium effect size. We used the total score of the SLDS-C to represent HRQoL, with a lower score indicating poorer HRQoL; *t* tests were used to compare SLDS-C scores among groups with different symptom levels.

To estimate the associations between demographic and clinical variables and symptoms, we conducted logistic modeling with group membership as the dependent variable. Independent variables were all demographic, socioeconomic, and disease characteristics, including age, gender, race, education level, annual household income, marital status, current health insurance status, current employment status, cancer stage, number of comorbid conditions, cancer type, and type of therapy (surgery, chemotherapy, and/or radiotherapy). Odds ratios (OR) and 95% confidence intervals (CI) were calculated to estimate the effect of each risk factor. Only survivors with complete data for all variables were used for this analysis.

To explore the pattern of physical symptoms in the high-symptom group, we conducted exploratory factor analysis of the RSCL-M items using principal axis factoring as the extraction method. A factor loading of 0.30 or greater was deemed as significant.[20] Factor-based component scores were computed by averaging items loading principally on a particular factor. We used regression analyses to compare RSCL-M factor scores and POMS-37 subscale scores between survivors actively undergoing chemotherapy or radiotherapy and survivors who had already completed therapy.

To evaluate the impact of cancer-related symptoms on HRQoL in the high-symptom group, we employed a linear regression model of the factor-based composite scores of the RSCL-M and 4 subscale scores of the POMS-37 (depression, tension, anger, and confusion). POMS-37 fatigue and vigor subscales were excluded to avoid redundancy with the RSCL-M variables (which also measured fatigue). The most distressing symptoms were selected on the basis of the standardized regression coefficient, a parameter used to identify the independent variable that has a greater unique effect upon the criterion (SLDS-C total score). The larger the standardized coefficient value, the greater the effect.[21]

We used SPSS version 16.0 statistical software (Chicago, IL) to perform the 2-step cluster analysis and SAS version 9.2 statistical software (Cary, NC) to perform all other analyses. All statistical tests were 2-sided; *P* values <.05 were considered statistically significant.

RESULTS

Patient characteristics

The SCS-I database contained 5277 cancer survivors whose self-reported cancer site was consistent with information in the cancer registry. From these, we identified 4903 (93%) whose missing-response rate on the study's baseline symptom assessment was less than 20%. Demographic and clinical characteristics are shown in Table 1. Of the 4903 survivors with adequate symptom data, 391 (8%) were nonsymptomatic (ie, reported "not at all" for

all RSCL-M and POMS-37 items) and were removed from further analysis, resulting in a sample of 4512 survivors with some level of symptom burden.

Survivors with High Symptom Burden

Two-step clustering generated 2 groups: a low-symptom group (n=3113, 69%) and a high-symptom group with significantly higher mean symptom severity (n=1399, 31%). Except for weight gain and problems controlling urine, effect sizes (Cohen's *d*) of differences between the high-symptom and low-symptom groups for all symptoms equaled or exceeded 0.5, indicating medium-to-large magnitude of effect (Appendix 1; appendices online only). We compared HRQoL in the high-symptom and low-symptom groups, using the SLDS-C total score as an index of overall HRQoL. The high-symptom group reported significantly lower mean SLDS-C scores than did the low-symptom group (73.72 (95%CI, 72.74–74.70) *vs*. 98.24 (95%CI 97.79–98.69); $P < .0001$).

Variables Associated with Symptom Burden

Multivariate logistic regression modeling revealed that survivors who were younger than 55 years (OR, 2.31; 95% CI, 1.91–2.80), had an annual household income below $40,000 (OR, 1.61; 95% CI, 1.34–1.94), were currently unemployed (OR, 1.27; 95% CI, 1.05–1.53), had no more than a high school education (OR, 1.29; 95% CI, 1.09–1.53), or were uninsured/underinsured (ie, on Medicaid or medical assistance) (OR, 1.57; 95% CI, 1.10–2.24) were more likely to experience severe symptoms (Table 2). Clinical characteristics for severe symptoms included having lung cancer (OR, 2.27; 95% CI, 1.76–2.94), having distant metastases (OR, 2.05; 95% CI, 1.60–2.62), or undergoing active chemotherapy (OR, 1.93; 95% CI, 1.47–2.54). Further, the likelihood of severe symptoms increased as the number of comorbidities increased (OR, 1.76; 95% CI, 1.59–1.95). Because survivors with lung cancer were more likely to report severe symptoms, we repeated the logistic regression analyses separately in survivors with lung cancer and those with other cancers. Survivors with other cancers were similar to the entire sample in the associations between symptom burden and multiple variables. In lung cancer survivors, younger age, low income, unemployment, minimal health insurance, more comorbidities, and metastasis remained significantly associated with high symptom burden (data not shown).

Symptom profiles in the high-symptom group

Exploratory factor analysis of the RSCL-M in the high-symptom group revealed 7 factors (Table 3): pain, treatment-related symptoms, fatigue, nausea, bowel/bladder control problems, weight change, and lung symptoms, which accounted for 7%, 6%, 5%, 4%, 4%, and 3%, respectively, of the total variance among the RSCL-M items. The *pain factor* comprised 5 items that loaded principally upon it: pain (other than low back), sore muscles, low back pain, difficulty sleeping, and headaches. The *treatment-related symptoms factor* included dry mouth, burning/sore eyes, loss of hair, sore mouth/pain when swallowing, tingling hands/feet, skin irritation, swelling of arms/legs, and dizziness. The *fatigue factor* was composed of tiredness and lack of energy. The *nausea factor* included nausea and vomiting. The *control-problems factor* included problems controlling bowels, diarrhea, and abdominal aches. The *weight-change factor* was composed of weight loss, lack of appetite, and weight gain, which exhibited a negative loading. The *lung-symptoms factor* included coughing and shortness of breath. Five items did not belong to any factor because their factor loadings were lower than 0.30: decreased sexual interest, shivering, constipation, heartburn/belching, and problems controlling urine.

To derive a component score for each RSCL-M factor or POMS-37 subscale in the high-symptom group, we averaged the ratings for all items loading on a particular factor or subscale. The 3 highest RSCL-M symptom factor scores were for fatigue, pain, and lung

symptoms, whereas the top-scoring POMS-37 subscales were vigor, fatigue, and tension (Appendix 2; appendices online only).

Given that currently receiving chemotherapy contributed to membership in the high-symptom group, we examined whether completion of chemotherapy or radiotherapy affected symptom severity in the high-symptom group, of whom 523 (37%) had completed chemotherapy and 212 (15%) were still undergoing chemotherapy, and 460 (33%) had completed radiotherapy and 137 (10%) were still undergoing radiotherapy. No significant differences in symptom severity between survivors undergoing active chemotherapy and survivors who had completed chemotherapy were found for any symptom other than nausea (higher in the active treatment group; $P = .005$). No significant differences in any symptoms were found between survivors who had completed radiation and those still receiving treatment (Appendix 2).

Impact of symptoms on HRQoL

We estimated effects of symptoms on HRQoL in the high-symptom group using a linear regression model, with the total score of SLDS-C as the dependent variable. The POMS-37 depression subscale, RSCL-M fatigue factor, and RSCL-M pain factor had the strongest standardized coefficients (−0.41, −0.22, and −0.09, respectively), suggesting that among all 67 symptom items, depression, fatigue, and pain affected a survivor's HRQoL most (Table 4).

DISCUSSION

In this analysis of 1-year cancer survivors drawn from nationwide, population-based survey data, more than 1 in 4 survivors were categorized into a high-symptom group via 2-step cluster analysis. Survivors in this high-symptom group had significantly higher mean symptom severity on 2 assessment measures (RSCL-M and POMS-37) and lower HRQoL ratings than did survivors in the low-symptom group. Characteristics associated with high-symptom group membership included being younger than 55 years, having low socioeconomic status (no better than a high-school education, annual household income below $40,000, no health insurance [or Medicaid/medical assistance], and being unemployed), having lung and/or metastatic cancer, having comorbid conditions, and current chemotherapy. To control the effect of cancer site, we stratified the entire sample by lung cancer *vs*. other cancers and found similar results, suggesting that risk factors for high symptom burden are common in all cancer survivors. In survivors with high symptom burden, exploratory factor analysis of RSCL-M symptom items revealed 7 factors, of which fatigue and pain contained the items with the highest severity scores. For the high-symptom group, symptom severity was similar whether or not therapy had been completed. Fatigue, pain, and depression most negatively affected survivors' ratings of HRQoL.

Previous studies of symptom burden in cancer survivors have compared the mean symptom burden of the entire cancer survivor population with the healthy population. In the current study we identified a subgroup of survivors with high symptom burden, which should enable us to identify survivors who may require additional symptom monitoring and management after termination of therapy. The transition from active cancer therapy to follow-up has been identified as a period of disrupted adjustment during survivorship.[7] Residual symptoms from cancer and cancer treatment are often not monitored as closely during follow-up as during active cancer therapy, which may contribute significantly to this disrupted adjustment. Cancer survivors in our study were approximately 1 year postdiagnosis, and more than 80% had completed anticancer treatment. Similar levels of major symptoms (eg, fatigue, pain, and depression) were reported in survivors who completed their therapy and those who were

still in active therapy, implying that symptom burden in the early period of survivorship may persist whether or not cancer treatment has been completed.

Several of the socioeconomic variables we identified as associated with membership in the high-symptom group are often used to define “medically underserved” persons, including 4 characteristics representing low socioeconomic status: low annual income, low education level, unemployment, and minimal health insurance. It is generally accepted that socioeconomic status may affect the adequacy of symptom control and therefore the level of symptom burden, with results from numerous studies indicating that symptom control may be comparatively poorer for medically underserved populations. For example, patients with low socioeconomic status have been found to be unable to access appropriate health care services for their disease[22] or to communicate with clinicians who could aid in managing symptoms after treatment has ended.[23] Socioeconomic disparity in cancer survivors has been associated with poor survival rates, more-rapid disease progression,[24] poor HRQoL,[25] and serious psychological distress.[26] However, whether or not low income or unemployment caused high symptom burden could not be determined from the available data, because these variables were collected only once, 1 year after diagnosis. High symptom burden could contribute to change in a survivor’s income or employment status—or vice versa. Studies tracking longitudinal changes in survivor income and employment over time would help to characterize the association between symptom burden and socioeconomic status. Finally, our sample tended to be well-educated and well-insured. Better representation from medically underserved populations might have resulted in a higher percentage of survivors with greater symptom burden. Nonetheless, even in our well-educated and well-insured sample we found a subset of cancer survivors with higher symptom burden.

The finding of greater risk for higher symptom burden in younger survivors is consistent with a report from the 2002 National Health Interview Survey,[12] which evaluated the contribution of age to the presence of multiple symptoms in 1904 cancer survivors, and with a 2005 report from Baker et al., who found that younger survivors were more likely than older survivors to reportpsychosocial problems as a result of their disease and treatment.[27] Younger cancer survivors may have higher symptom burden because they are more likelyto receive aggressive cancer therapies.[28] In addition, younger patients may have higher expectations for resuming full vocational and family obligations, which may exacerbate symptoms.[29]

Fatigue, pain, and depression were identified in the NIH State-of-the-Science Statement on symptom management in cancer[30] as the most common symptoms of which clinicians and researchers need to be aware. Not surprisingly, our analyses revealed that fatigue, pain, and depression had the greatest negative impact on HRQoL. These symptoms are highly correlated with poor HRQoL in patients with cancer,[31,32] affecting their daily activities and ability to work and socialize; pain has been shown to predict disease recurrence and survival.[33,34] In addition, depressive symptoms usually occur with fatigue, pain, and sleep disturbance.[35] The NIH report suggests that these symptoms are frequently undertreated in patients with cancer, even though guidelines for their management have been published by the National Comprehensive Cancer Network[36] and other groups. Our findings suggest that these critical symptoms should be monitored well beyond the end of curative treatment into the early stage of survivorship, when survivors often attempt to return to normal roles.

The current study had several potential limitations. For example, the physical and psychological aspects of symptom burden were measured by different instruments with different response formats. In addition, our study attempted to providean overview of symptom burden among U.S. cancer survivors by collapsingheterogeneous cancer types into 1 broad category. Certain types of cancers, such as lung cancer, are associated withhigher

symptom burden, and symptom patterns may vary by diagnosis or anticancer treatment. Future studies need to describe how such variables as disease site and treatment contribute to survivor symptom burden. As with most studies of symptoms in cancer survivors, the cross-sectional nature of the data limited our abilityto describe developmental trajectories of symptom burden. However, the SCS-I's longitudinal design provides cancer survivors the opportunity to contribute information about the persistence of symptoms throughout their survival.

Because they are derived from a population-based nationwide survey, our findings have implications for the clinical care of cancer survivors. The fact that one fourth of the cancer survivors in the current study experienced high symptom burden highlights the need for routineposttreatmentsymptom assessment and management, especially in the first year after diagnosis. Symptom assessment and routine medical monitoring are likely to be infrequent after active therapy has ended, yet some severe symptoms reported by our sample could possibly have been addressed, leading to better functioning and less distress.[7] In addition, the significantly higher burden experienced by uninsured and underinsured cancer survivors suggests another area of disparity in health care delivery that needs to be addressed at a policy level.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Cancer Survivor Characteristics (N=4903)

Characteristic	No. of Survivors (%)		*P*
	Symptomatic Survivors (n=4512)	Asymptomatic Survivors (n=391)	
Gender			
Women	2633 (58.4)	188 (48.1)	<.0001
Men	1879 (41.6)	203 (51.9)	
Age			
<55 y	2200 (48.8)	192 (49.1)	.896
≥55 y	2312 (51.2)	199 (50.9)	
Race			
Non-Hispanic White	3957 (87.7)	349 (89.3)	
Black	310 (6.9)	17 (4.3)	
Hispanic	153 (3.4)	13 (3.3)	
Other	92 (2.0)	12 (3.1)	
Married			
Yes	3302 (73.6)	305 (78.0)	.064
No	1183 (26.4)	86 (22.0)	
Education			
College or higher	2676 (60.2)	263 (68.1)	.007
Other	1766 (39.8)	128 (32.9)	
Annual household income			
< $5,000	56 (1.3)	1 (0.3)	.149
$5,000 – $9,999	170 (3.9)	5 (1.3)	
$10,000 – $19,999	437 (9.9)	17 (1.3)	
$20,000 – $39,999	1001 (22.9)	79 (20.2)	
$40,000 – $74,999	1251 (28.6)	118 (30.2)	
≥$75,000	1005 (23.0)	120 (30.7)	
Currently employed			
Yes	2342 (51.9)	233 (59.6)	.004
No	2170 (48.1)	158 (40.4)	
Health insurance			
Employer paid	2427 (54.7)	244 (66.8)	.004
A plan that you or someone else buys on your own	250 (5.6)	22 (5.6)	
Military, Champus, TriCare, Veterans Administration	51 (1.2)	1 (0.3)	
Medicare	1117 (25.2)	92 (23.5)	
Medicaid or medical assistance	122 (2.8)	4 (1.0)	
Other source	80 (1.8)	2 (0.5)	
None	97 (2.2)	2 (0.5)	

Characteristic	No. of Survivors (%)		
	Symptomatic Survivors (n=4512)	Asymptomatic Survivors (n=391)	*P*
Cancer type			
Breast	1098 (24.3)	81 (20.7)	<.0001
Prostate	822 (18.2)	81 (20.7)	
Colorectal	676 (15.0)	63 (16.1)	
Bladder	179 (4.0)	16 (4.1)	
Uterine	222 (4.9)	20 (5.1)	
Melanoma	210 (4.6)	61 (15.6)	
Non-Hodgkin lymphoma	287 (6.4)	21 (5.4)	
Kidney	269 (6.0)	27 (6.9)	
Lung	463 (10.3)	7 (1.8)	
Ovarian	286 (6.3)	14 (3.6)	
Cancer stage			
In situ	100 (2.2)	10 (2.6)	<.0001
Localized	2616 (58.0)	275 (70.3)	
Regional	1245 (27.6)	81 (20.7)	
Distant	551 (12.2)	25 (6.4)	
Comorbid conditions			
None	1977 (43.8)	226 (57.8)	<.0001
One	1251 (27.7)	116 (29.7)	
Two or more	1284 (28.5)	49 (12.5)	
Anticancer treatments			
Previous surgery	3684 (83.9)	333 (85.2)	.083
Chemotherapy-completed	1594 (36.8)	107 (27.4)	.231
Chemotherapy-active	512 (11.8)	43 (11.0)	
Radiotherapy-completed	1520 (35.3)	104 (26.6)	.253
Radiotherapy-active	393 (9.1)	34 (8.7)	

Table 2

Variables Associated with Symptom Burden

	High-Symptom Group (n=1054) [a]	Low-Symptom Group (n=2338)[a]		
	No. Patients (%)	No. Patients (%)	OR (95% CI)	*P*
Age				
≥55 y	433 (27.7)	1132 (72.3)	1.00	
<55 y	621 (34.0)	1206 (66.0)	2.31 (1.91 – 2.80)	<.0001
Sex				
Male	410 (29.3)	989 (70.7)	1.00	
Female	644 (32.3)	1349 (67.7)	1.05 (0.88 – 1.25)	.592
Race				
Non-Hispanic white	904 (30.0)	2106 (70.0)	1.00	
Other	150 (39.3)	232 (60.7)	1.07 (0.84 – 1.36)	.597
Married				
Yes	730 (28.9)	1794 (71.1)	1.00	
No	324 (37.3)	544 (62.7)	1.18 (0.98 – 1.42)	.090
Education level				
College or higher	595 (27.4)	1576 (72.6)	1.00	
High school or lower	459 (37.6)	762 (62.4)	1.29 (1.09 – 1.53)	.003
Annual household income				
≥$40,000	525 (25.3)	1548 (74.7)	1.00	
< $40,000	529 (40.1)	790 (59.9)	1.61 (1.34 – 1.94)	<.0001
Currently employed				
Yes	542 (27.6)	1419 (72.4)	1.00	
No	512 (35.8)	919 (64.2)	1.27 (1.05 – 1.53)	.012
Health insurance				
Yes	954 (29.7)	2263 (70.3)	1.00	
None/Medicaid	100 (57.1)	75 (54.3)	1.57 (1.10 – 2.24)	.012
Metastasis				
No	865 (29.0)	2113 (71.0)	1.00	
Yes	189 (45.7)	225 (54.3)	2.05 (1.60 – 2.62)	<.0001
Comorbidities			1.76 (1.59 – 1.95)	<.0001
None	369 (24.0)	1168 (76.0)	1.00	
One	283 (29.1)	688 (70.9)	1.52 (1.26 – 1.83)	<.0001
Two or more	402 (45.5)	482 (54.5)	3.22 (2.65 – 3.91)	<.0001
Lung cancer				
No	900 (29.3)	2175 (70.7)	1.00	
Yes	154 (48.6)	163 (51.4)	2.27 (1.76 – 2.94)	<.0001
Surgery				

	High-Symptom Group (n=1054) [a]	Low-Symptom Group (n=2338)[a]		
	No. Patients (%)	**No. Patients (%)**	**OR (95% CI)**	***P***
No	183 (35.7)	330 (64.3)	1.00	
Yes	871 (30.3)	2008 (69.7)	0.96 (0.76 – 1.21)	.748
Chemotherapy				
No therapy	471 (27.1)	1268 (72.9)	1.00	
Therapy completed	417 (33.2)	840 (66.8)	1.23 (1.02 – 1.49)	.031
Active therapy	166 (41.9)	230 (58.1)	1.93 (1.47 – 2.54)	<.0001
Active therapy vs. therapy completed			1.45 (1.11 – 1.90)	<.0001
Radiotherapy				
No therapy	593 (31.0)	1318 (69.0)	1.00	
Therapy completed	367 (30.5)	837 (69.5)	1.02 (0.85 – 1.21)	.863
Active therapy	94 (33.9)	183 (66.1)	0.82 (0.85 – 1.21)	.211
Active therapy vs. therapy completed			0.83 (0.60 – 1.15)	.627

OR indicates odds ratio; CI, confidence interval.

[a]Only survivors with complete data in all variables (n=3392) were included in the logistic regression model.

Table 3

Factor Structure for RSCL-M in Cancer Survivors with High Symptom Burden (n=1399)

	Factor Loading						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Pain-related							
Pain (other than low back pain)	0.691						
Sore muscles	0.674						
Low back pain	0.591						
Difficulty sleeping	0.339						
Headaches	0.328						
Decreased sexual interest	0.158						
Treatment-related							
Dry mouth		0.495					
Burning/sore eyes		0.408					
Loss of hair		0.393					
Sore mouth/pain when swallowing		0.392					
Tingling hands or feet		0.372					
Skin irritation		0.370					
Swelling of arms or legs		0.365					
Dizziness		0.300					
Shivering		0.293					
Constipation		0.286					
Heartburn/belching		0.239					
Fatigue							
Tiredness			0.871				
Lack of energy			0.818				
Nausea							
Nausea				0.807			
Vomiting				0.675			
Controlling problem							

	Factor Loading						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Problems controlling your bowels					0.799		
Diarrhea					0.634		
Abdominal aches					0.360		
Problems controlling your urine					0.291		
Weight change							
Weight loss						0.645	
Lack of appetite						0.606	
Weight gain						−0.505	
Lung symptoms							
Coughing							0.664
Shortness of breath							0.453

RSCL-M indicates Modified Rotterdam Checklist.

Table 4

Regression Model Analyses for the Impact of Symptoms on Health-Related Quality of Life

Variable	Estimate	Standard Error	*t*	*P*	Standardized Estimate
RSCL-M factors					
Fatigue	−0.146	0.011	−13.83	<.0001	−0.222
Pain	−0.084	0.015	−5.75	<.0001	−0.092
Weight change	−0.085	0.019	−4.37	<.0001	−0.060
Lung symptoms	−0.044	0.013	−3.39	.0007	−0.049
Nausea	−0.037	0.018	−1.98	.048	−0.026
Bowel/bladder control problems	−0.025	0.015	−1.67	.095	−0.021
Treatment-related symptoms	−0.032	0.024	−1.30	.192	−0.020
POMS-37 sub-scales					
Depression	−0.409	0.022	−18.19	<.0001	−0.409
Tension	0.072	0.020	3.65	.0003	0.075
Confusion	−0.044	0.021	−2.06	.040	−0.040
Anger	−0.012	0.020	−0.60	.545	−0.011

RSCL-M indicates Modified Rotterdam Checklist; POMS-37, short form of the Profile of Mood States.