Original Article

Cancer-Related Chronic Pain

Examining Quality of Life in Diverse Cancer Survivors

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BACKGROUND: Disparities in cancer survival and pain rates negatively impact quality of life (QOL). This study examines cancer-related chronic pain (CP) and its impact on QOL in diverse cancer survivors. **METHODS:** This survey study focused on current and past pain, health, and QOL in black and white cancer survivors. Participants with breast, colorectal, lung, and prostate cancer and multiple myeloma were recruited through the Michigan State Cancer Registry. Analysis of variance was used to examine outcome differences by pain status, race, and sex. Hierarchical regressions explored predictors for experiencing pain. **RESULTS:** The subjects (N = 199) were 31% black, 49% female, and 57 to 79 years old; 19.5% experienced current pain, and 42.6% reported pain since diagnosis. Women experience more pain ($P < .001$) and greater pain severity ($P = .04$) than men. Blacks experienced more pain interference and disability ($P < .05$). Experiencing pain is related to greater depressive symptoms, poorer functioning, and more symptoms. In hierarchical regressions, female sex predicted pain since diagnosis; pain severity for pain since diagnosis was predicted by black race and female sex. **CONCLUSIONS:** The authors extend the literature by showing that 20% of diverse cancer survivors had cancer-related CP, and 43% had experienced pain since diagnosis, revealing racial and sex disparities in cancer-related CP's incidence and impact on QOL. Having pain was related to poorer QOL in several domains and was more frequently experienced by women. Although black race was not related to pain prevalence, it was related to greater severity. This study reveals an unaddressed cancer survivorship research, clinical, and policy issue. *Cancer* 2010;000:000–000. © 2010 American Cancer Society.

KEYWORDS: cancer, pain, quality of life, health, survivorship, sex, race and ethnicity, disparities, cancer-related chronic pain.

Chronic pain, the third largest global public health problem, remains a neglected topic in medicine.[1-5] Pain complaints and cancer are increasing as more people survive cancer and chronic diseases.[5,6] In the US, pain is the most frequent cause of disability and second leading cause for physician visits, and is associated with depression, anxiety, and sleep disturbance.[7,8] The National Cancer Institute (NCI) estimates most (>60%) people diagnosed with cancer will be alive in 5 years.[9] According to the Lance Armstrong Foundation and NCI, survivorship begins at diagnosis; however, pain threatens health and quality of life (QOL).[10] Most (60%-85%) people with advanced cancer and nearly 40% of 5-year survivors report pain.[1,11-13] Many unscheduled hospital admissions (14%-26%) are because of uncontrolled pain, costing >$10 million in expenditures.[14] However, cancer-related chronic pain (CP) remains a poorly explored survivorship issue, especially among diverse cancer survivors.[6,15-18] As America ages and diversifies the increasing prevalence of cancer, pain, and cancer-related CP will have significant individual and societal ramifications.[19]

Increased longevity and QOL have not been uniformly translated.[20] Minorities are more likely to report diminished health, less likely to have a physician, have less access to specialists, and experience increased disease burden, even when their health insurance and socioeconomic status are similar to whites.[1,21-25] Cancer remains the second leading cause of death in the United States, and significant disparities exist.[18,24,26] Despite increased awareness, a knowledge gap exists regarding cancer-related CP in diverse cancer survivors.

The literature documents the benefits of optimizing pain management, but disturbing variability and disparities based on sociodemographic characteristics remain.[1-4,12,18] Bernabei revealed black nursing home residents with cancer pain were 63% more likely than whites to receive no pain medications.[27] Sex-based differences in pain care are known, with women referred to pain specialists less frequently than men.[2-4] Also, structural barriers prevent minorities from being able to fill their

prescriptions in their local pharmacies.[28,29] Critically important data to ensure appropriate pain and healthcare planning are lacking, yielding a significant literature gap.[18]

Despite the importance of cancer, pain, and health disparities, it is unknown whether the increased health perturbations seen with CP are more pronounced in cancer survivors. This study in black and white survivors hypothesizes that the prevalence, etiology, characteristics, and sequelae (eg, QOL) of cancer-related CP vary by race and sex. This study was designed to 1) identify and compare the relative prevalence, etiology, and characteristics of cancer-related CP; 2) investigate and compare the relationship between cancer-related CP and mental health, disability, and QOL; and 3) evaluate and compare sociodemographics, attitudes, and pain care factors influencing cancer-related CP potentially mediating the relations described above.

MATERIALS AND METHODS

Participants
The University of Michigan Health System Institutional Review Board and the Michigan State Cancer Registry Institutional Review Board granted study approval. Each participant provided written informed consent upon enrollment. Adult survivors (18-90 years old) who experienced breast, prostate, colorectal, or lung cancer or multiple myeloma with initial diagnosis at least 2 years prior provided study data. *Survivor* was defined in accordance with the Lance Armstrong Foundation and NCI, which define survival from the moment of diagnosis. Because of geographic reporting inconsistencies, we used diagnosis plus 2 years to ensure consistency.[10]

The Michigan State Cancer Registry stratified their database by race and randomly identified black and non-Hispanic white potential subjects, cross-checked death records, verified addresses, and contacted physicians to ensure there were not contraindications to participation. Up to 3 letters were mailed, the last certified, with an interest form and return envelope. Information from participants returning signed interest forms was forwarded from Michigan State Cancer Registry to the study team. The research office then mailed participants' information and the survey using Dillman's Total Design Method.[30] A modest $20 incentive was sent on receipt of the survey.

Measures
Sociodemographics included age, self-identified race, sex, marital status, education, employment, and household income.

Cancer and treatment information was self-reported and confirmed through registry report. Cancer information included diagnosis, date, stage, and current status (cancer-free, remission, active and receiving treatment, active and not receiving treatment). A treatment checklist was included: chemotherapy, radiation therapy, hormone therapy, and surgery. Participants could check all that applied and marked when they had last received each treatment (never, 0-3 months ago, 3-12 months ago, 1-2 years ago, >2 years ago, do not recall).

Current pain was used to establish skip patterns in the survey, with the question, "Do you currently experience pain regularly?" Participants were asked to classify pain: consistent pain, consistent pain that sometimes had much stronger pain flares, pain flares only, or pain only related to certain activities or motions. The same screening questions were again asked related to pain since cancer.

The Brief Pain Inventory (BPI) assessed pain severity and interference with normal functioning.[31] Items determined pain severity (at worst, least, average, and right now), pain-related interference (eg, mood, work, relationships, sleep), pain characteristics (eg, timing, duration, quality), pain location (via 2 drawings of the body), pain duration and description (ie, consistent, flares, or both), pain-related medications and percentage of pain relieved by medication, and an open-ended item regarding what actions relieved pain. A subset of questions was repeated for past pain, in addition to documenting the timing of cancer pain when the participant was no longer experiencing pain.

The Center for Epidemiological Studies Depression Scale assessed depressed affect. We dropped the 4 positively worded items from the original 20-item survey, because factor analysis showed the items do not accurately predict negative affect when reversed, as confirmed in the literature for cancer patients.[32] Responses for the remaining 16 items were summed and weighted to calculate an overall score comparable to the published scale range (0-60; scores >15 indicated severe psychological distress and depression). Internal consistency was consistent with published values ($\alpha = .91$).[32]

The John Henryism Active Coping Scale evaluated a high output active coping strategy characterized by protracted struggles against seemingly insurmountable obstacles. Originally reported in older blacks, it is correlated with high blood pressure and bodily pain. The sum score of 12 Likert-type items was calculated (60 = maximum active coping score). Internal consistency ($\alpha = .87$) was higher than published values.[33]

The Barriers Questionnaire assessed attitudes toward pain management and has 4 separate subscales: physiological effects, fatalism, communication, and harmful effects.[34] Mean scores were calculated for each set subscale; fatalism items were reverse scored before analysis. The internal consistency for subscales ranged from $\alpha =$ .60 to $\alpha =$ .91. Only the fatalism subscale had a reliability value below published values of $\alpha =$ .79.[34] Reliability was $\alpha =$ .60. It is possible that our small sample size, the few questions on the subscale, and potential differences in the meaning to survivors may account for this difference.

The Pain Disability Index (PDI) evaluated the impact of CP on the individual via summation of seven 11-point subscales representing 7 life domains (family, occupation, recreation, social, sexual, life-support, and self-care) and the amount of impairment (0 = no disability, 10 = total disability, 70 = maximum disability).[35] PDI was weighted, allowing for up to 2 missing items.

The European Organisation for the Research and Treatment of Cancer survey assessed health-related quality of life.[36] Five QOL functioning domains (eg, cognitive, emotional, physical) and 8 symptom-control domains (eg, anorexia, dyspnea, fatigue) were evaluated for their contribution to QOL. Additional measures assessed financial concerns, global health, and overall QOL. Scores were linearly transformed to a 0 to 100 scale. Internal consistency of the subscales ($\alpha =$ .71-.91) was high.[36]

Statistical Analysis

Descriptive statistics were calculated using PSAW 18.0. Analysis of variance and chi-square analysis were used for group comparisons; because of multiple comparisons; a conservative $P =$ .01 was used to determine significance. Hierarchical logistic regression examined predictors of current pain and pain at any time since cancer diagnosis. Age and dummies for black race and female sex were entered at Block 1, income and education at Block 2. Prostate cancer, related to lower pain rates than other cancers, was used for cancer type; chemotherapy was related to current and any pain; radiation and hormone treatments were predictive of having had pain since diagnosis; likewise, cancer surgery was listed as the most common pain cause, so dummy variables were used for each treatment. All were added in the final block, followed by multivariate regression among those who had experienced pain (using the same prediction variables, to test for predictors of pain severity). Because of the smaller sample size and lack of relationship with pain severity, radiation,

hormone therapy, and surgery were not included in the severity regressions.

RESULTS

Participants

Nine hundred fifty participants were identified in the 2 waves (450 whites, 500 blacks). Blacks were more likely to be deceased (n = 70 vs n = 33), have physicians expressing contraindication (n = 45 vs n = 32), and have bad addresses (n = 71 vs n = 28); leaving 670 people (49% female, 47% black) eligible to contact. Blacks were less likely to actively refuse participation (n = 44 vs n = 86; 19.4% overall), but were also less likely to actively agree in addition to the greater mortality and mobility, so were less likely to be forwarded to the research office (n = 105 black [33.5%]; 158 white [44.3%]; 39.3% overall) and represented a smaller percentage to complete surveys (n = 61 black [19.5%]; 137 white [38.4%]). Respondents (N = 199) were 31% black, 49% female, and from 42 to 87 years old. One person reported their race as Arabic/East Asian and was not included in racial comparisons. Most participants were currently cancer free or in remission (95.2% women, 95.7% men, 94.3% blacks, 98.2% whites). Cancer type differed by sex ($P <$ .001) but not by race. Blacks tended to have lower incomes ($P =$ .04), lower cancer stages, and lower surgery rates. Women had higher rates of chemotherapy, radiation, and hormone therapy and were more likely to lack insurance ($P =$ .02). Table 1 provides information about the sample's characteristics. Most (>90%) of "most recent" treatments were received >1 year prior. Other than hormone treatment, >85% of the other treatments had occurred >2 years earlier.

Group Differences

Nearly 20% (19.5%) experienced current pain. Women experienced more pain since diagnosis than men (56% vs 30%; $P <$ .001). Tables 2 and 3 provide data on cancer and pain characteristics by group. Pain flares were the most common pain form and were more common in women than men ($P =$ .03). Twice as many women reported more pain with activities than men (50% vs 24%; $P =$ .05). The most significant source of pain was cancer surgery (53.8%) for whites and cancer treatment (46.2%) for blacks. Blacks with pain reported higher pain severity for pain since diagnosis ($P =$ .001). Women experienced more pain since diagnosis ($P <$ .001). Although not all results are significant, many findings trended the same direction, with blacks and women faring worse. Blacks experienced more interference from pain (mood and walking ability) and greater

Table 1. Sociodemographic Characteristics by Group

Characteristic	Overall, N = 199	Black, n = 61	White, n = 137	Statistic (P)	Men, n = 101	Women, n = 98	Statistic (P)
Age, y	68.1 ± 10.5	67.2 ± 10.6	68.1 ± 10.6	F = 0.21	71.6 ± 7.8	64.0 ± 11.6	F = 29.8 (<.001)[a]
% black	31%	—	—		31.6%	29.6%	$\chi2$ = 1.11 (.57)
% women	49%	47.5%	49.6%	χ^2 = 1.11 (.57)	—	—	
Education				χ^2 = 11.0 (.53)			χ^2 = 7.68 (.26)
≤6th grade	6.4%	7.0%	6.1%		8.2%	4.4%	
7th-<12th	3.2%	5.3%	2.3%		5.2%	1.1%	
High school	26.2%	19.3%	29.0%		27.8%	24.4%	
Some college	31.0%	40.4%	26.7%		29.9%	32.2%	
College graduate	23.0%	22.8%	22.9%		17.5%	28.9%	
Graduate school	10.2%	5.3%	13.0%		11.3%	8.9%	
Income, $				χ^2 = 24.6 (.04)			χ^2 = 5.54 (.60)
≤9,999	1.7%	3.8%	0.8%		2.2%	1.1%	
10,000-20,000	15.0%	28.3%	9.4%		12.1%	18.2%	
20,001-40,000	26.1%	15.1%	31.5%		26.4%	26.1%	
40,001-60,000	19.4%	24.5%	16.5%		23.1%	9.6%	
60,001-100,000	23.3%	18.9%	26.0%		23.1%	23.9%	
≥100,001	13.9%	9.4%	15.7%		13.2%	14.8%	
No insurance	3.2%	3.1%	3.5%	χ^2 = 0.50 (.97)	0%	6.7%	χ^2 = 7.75 (.02)
Cancer type				χ^2 = 4.56 (.92)			χ^2 = 162.9 (<.001)[a]
Breast	40.4%	35.1%	43.2%		2.1%	81.3%	
Colorectal	9.6%	10.5%	9.1%		6.2%	13.2%	
Lung	4.8%	5.3%	4.5%		5.2%	4.4%	
Multiple myeloma	1.6%	3.5%	0.8%		3.1%	0.0%	
Prostate	41.0%	43.9%	39.4%		79.4%	0.0%	
Other	2.7%	1.8%	3.0%		4.1%	1.1%	
Cancer stage (at worst)				χ^2 = 28.4 (.01)[a]			χ^2 = 8.55 (.29)
I	21.9%	30.8%	19.5%		18.6%	25.6%	
II	14.4%	13.5%	17.2%		10.3%	18.9%	
III	7.0%	5.8%	7.8%		8.2%	5.6%	
IV	5.3%	1.9%	6.3%		5.2%	5.6%	
Unknown	51.3%	48.1%	48.1%		57.7%	55.6%	
Treatments received							
Chemotherapy	36.2%	42.6%	33.9%	χ^2 = 2.95 (.23)	17.2%	57.1%	χ^2 = 30.5 (<.001)[a]
Radiation	50.9%	50.0%	51.2%	χ^2 = 0.02 (.88)	40.7%	61.9%	χ^2 = 7.89 (.005)[a]
Hormone therapy	11.4%	7.0%	14.0%	χ^2 = 1.97 (.37)	5.2%	18.0%	χ^2 = 7.48 (.006)[a]
Surgery	73.5%	58.9%	79.2%	χ^2 = 8.60 (.01)[a]	68.8%	78.8%	χ^2 = 2.33 (.13)

[a] Statistically significant.

Table 2. Pain Prevalence and Severity by Cancer Type and Stage

	Percentage With Current Pain, n = 40	Current Pain Severity, n = 40	Percentage With Pain Since Cancer, n = 88	Pain Severity, n = 88
Cancer type				
Breast, n = 84	25.0%	2.47 ± 1.71	58.3%	3.49 ± 1.93
Colorectal, n = 17	23.5%	2.06 ± 1.46	41.2%	4.00 ± 2.10
Lung, n = 9	22.2%	4.00 ± 1.77	55.6%	2.92 ± 2.04
Multiple myeloma, n = 3	33.3%	0.00[a]	100.0%	7.44 ± 2.14[b]
Prostate, n = 81	14.8%	1.34 ± 1.07	28.4%	4.57 ± 1.95
Cancer stage at worst				
I, n = 49	24.5%	2.38 ± 2.15	53.1%	4.24 ± 2.14
II, n = 35	20.0%	2.39 ± 1.17	57.1%	2.94 ± 1.24
III, n = 14	25.6%	2.35 ± 1.96	50.0%	4.92 ± 3.77
IV, n = 5	20.0%	1.25[a]	60.0%	5.67 ± 0.94
Unknown, n = 79	16.5%	1.74 ± 1.35	32.9%	4.08 ± 2.48

[a] n = 1 in cell, there is no standard deviation.
[b] Multiple myeloma has a significantly higher past pain level than all others.

Table 3. Group Outcomes

Outcome	Overall, N = 199	Black, n = 61	White, n = 137	Statistic (P)	Men, n = 101	Women, n = 98	Statistic (P)
Currently experience pain	20.1%	21.3%	19.7%	$\chi^2 = 0.32$ (.845)	16.8%	23.5%	$\chi^2 = 1.37$ (.24)
Experienced pain since cancer	44.2%	39.3%	46.7%	$\chi^2 = 1.73$ (.42)	31.7%	57.1%	$\chi^2 = 13.07$ (<.001)[a]
Kind of pain (those experiencing current pain)[b]	n=40	n=13	n=27		n=17	n=23	
Chronic consistent	11.3%	15.8%	9.6%	$\chi^2 = 0.53$ (.47)	21.7%	6.4%	$\chi^2 = 0.27$ (.60)
Acute consistent	14.1%	10.5%	15.4%	$\chi^2 = 0.27$ (.60)	17.4%	12.8%	$\chi^2 = 0.09$ (.77)
Consistent + flares	11.3%	15.8%	9.6%	$\chi^2 = 0.53$ (.47)	13.0%	10.6%	$\chi^2 = 0.94$ (.33)
Flares only	43.8%	42.1%	44.4%	$\chi^2 = 0.03$ (.86)	34.8%	46.9%	$\chi^2 = 4.59$ (.03)
Pain with activities	41.9%	31.5%	45.5%	$\chi^2 = 1.12$ (.29)	24.0%	50.0%	$\chi^2 = 5.82$ (.05)
Number of pain locations	1.63 ± 2.21	0.60 ± 1.26	2.78 ± 2.54	F = 5.79 (.03)	0.75 ± 1.75	2.27 ± 2.37	F = 2.25 (.14)
Pain cause (multiple responses permitted)[c]							
Cancer	14.6%	30.8%	7.1%	$\chi^2 = 3.97$ (.05)	12.5%	16.0%	$\chi^2 = 0.10$ (.76)
Cancer treatment	32.5%	33.3%	32.1%	$\chi^2 = 0.01$ (.94)	25.0%	37.5%	$\chi^2 = 0.68$ (.41)
Cancer surgery	35.0%	25.0%	39.3%	$\chi^2 = 0.75$ (.39)	31.3%	37.5%	$\chi^2 = 0.17$ (.69)
Accident/injury	21.4%	15.4%	24.1%	$\chi^2 = 0.41$ (.52)	33.3%	12.5%	$\chi^2 = 2.65$ (.10)
Illness/disorder	39.0%	30.8%	42.9%	$\chi^2 = 0.83$ (.36)	58.8%	25.0%	$\chi^2 = 4.78$ (.03)
Percentage of pain relieved with medication (100=full relief)[c]	61.19%	71.1%	55.4%	F = 1.64 (.21)	62.6%	60.1%	F = 0.40 (.84)
BPI pain severity, current pain[c]	2.07 ± 1.61	2.21 ± 2.06	2.00 ± 1.33	F = 0.17 (.69)	1.51 ± 1.39	2.54 ± 1.65	F = 4.68 (.04)
BPI pain interference[c]							
General activity	2.76 ± 2.74	2.86 ± 3.25	2.71 ± 2.51	F = 0.25 (.88)	2.33 ± 2.68	3.08 ± 2.80	F = 0.77 (.39)
Mood	2.79 ± 2.89	4.00 ± 3.09	2.04 ± 2.54	F = 4.63 (.04)	2.33 ± 2.89	3.19 ± 2.91	F = 0.85 (.36)
Walking ability	3.48 ± 3.41	4.93 ± 3.65	2.67 ± 3.04	F = 4.64 (.04)	4.21 ± 3.58	2.87 ± 3.21	F = 1.64 (.21)
Work	3.76 ± 3.24	5.00 ± 3.82	3.04 ± 2.68	F = 3.73 (.06)	3.83 ± 3.52	3.70 ± 3.08	F = 0.02 (.90)
Relationships	2.32 ± 3.13	2.73 ± 3.37	2.08 ± 3.03	F = 0.41 (.53)	2.67 ± 3.41	2.04 ± 2.95	F = 0.39 (.53)
Sleep	3.44 ± 3.13	4.40 ± 3.11	2.93 ± 3.07	F = 2.23 (.14)	3.63 ± 3.42	3.29 ± 2.94	F = 0.12 (.73)
Enjoyment of life	3.09 ± 3.29	4.07 ± 3.77	2.57 ± 2.94	F = 2.06 (.16)	2.84 ± 3.39	3.29 ± 3.28	F = 0.19 (.66)
BPI severity, pain since cancer	3.94 ± 2.12	5.35 ± 1.87	3.35 ± 1.96	F = 13.18 (.001)[a]	5.03 ± 2.06	3.44 ± 1.97	F = 8.13 (.006)[a]
Attitudes about pain treatment							
Fatalism	2.30 ± 0.92	2.58 ± 0.97	2.18 ± 0.87	F = 7.32 (.008)[a]	2.28 ± 0.91	2.33 ± 0.93	F = 0.11 (.74)
Physical barriers	2.76 ± 0.82	2.80 ± 0.92	2.75 ± 0.78	F = 0.15 (.70)	2.88 ± 0.80	2.67 ± 0.84	F = 2.90 (.09)
Communication barriers	1.96 ± 0.84	1.89 ± 0.82	1.99 ± 0.85	F = 0.48 (.49)	1.97 ± 0.78	1.97 ± 0.90	F = 0.00 (.97)
Harmful effects	2.94 ± 1.03	3.18 ± 1.17	2.83 ± 0.94	F = 4.19 (.04)	3.11 ± 0.99	2.82 ± 1.05	F = 3.44 (.07)
Pain Disability Index							
Family	3.65 ± 3.42	5.50 ± 3.70	2.76 ± 2.95	F = 6.91 (.01)[a]	3.56 ± 3.38	3.72 ± 3.52	F = 0.02 (.88)
Recreation	4.23 ± 3.35	5.80 ± 3.59	3.41 ± 2.96	F = 5.56 (.02)	4.79 ± 3.29	3.80 ± 3.39	F = 0.94 (.34)
Social activity	3.02 ± 3.41	4.00 ± 3.91	2.52 ± 3.08	F = 1.91 (.18)	3.74 ± 3.54	2.48 ± 3.28	F = 1.48 (.23)
Occupation	3.49 ± 3.87	5.21 ± 4.40	2.66 ± 3.35	F = 4.47 (.04)	3.26 ± 3.89	3.67 ± 3.93	F = 0.11 (.74)
Sexual behavior	4.77 ± 4.40	5.93 ± 4.28	4.14 ± 4.41	F = 1.64 (.21)	5.79 ± 4.44	3.96 ± 4.29	F = 1.87 (.18)
Self-care	1.82 ± 3.28	4.33 ± 4.45	0.52 ± 1.21	F = 19.0 (<.001)[a]	1.63 ± 3.34	1.96 ± 3.30	F = 0.11 (.75)
Life support	1.73 ± 2.80	3.47 ± 3.56	0.83 ± 1.79	F = 10.8 (.002)[a]	2.05 ± 3.17	1.48 ± 2.52	F = 0.45 (.51)
Depression	10.5 ± 9.2	11.5 ± 10.6	9.8 ± 8.4	F = 1.47 (.23)	8.6 ± 7.2	12.4 ± 10.6	F = 7.78 (.006)[a]
Functioning							
General health	78.3 ± 17.4	73.8 ± 19.8	80.2 ± 16.0	F = 5.25 (.02)	79.6 ± 16.2	76.7 ± 18.8	F = 1.26 (.26)
Physical	82.9 ± 20.9	75.8 ± 25.7	86.0 ± 17.6	F = 9.70 (.002)[a]	85.0 ± 20.6	80.2 ± 21.0	F = 2.50 (.12)
Role	86.5 ± 24.9	83.3 ± 31.8	87.9 ± 21.2	F = 1.33 (.25)	89.2 ± 21.9	83.2 ± 27.6	F = 2.76 (.10)
Emotional	79.5 ± 20.9	78.1 ± 23.1	80.0 ± 19.9	F = 0.33 (.57)	81.8 ± 18.9	76.6 ± 22.5	F = 3.01 (.08)
Cognitive	82.8 ± 24.5	80.7 ± 25.7	83.7 ± 24.0	F = 0.60 (.44)	86.1 ± 18.7	78.8 ± 29.1	F = 4.28 (.04)
Social	87.3 ± 23.3	81.3 ± 31.5	89.8 ± 18.3	F = 5.43 (.02)	87.0 ± 22.7	87.0 ± 24.2	F = 0.00 (1.0)
Symptoms							
Fatigue	24.2 ± 24.8	27.4 ± 30.2	22.8 ± 22.1	F = 1.28 (.26)	21.1 ± 24.1	28.2 ± 25.2	F = 3.83 (.05)
Nausea/vomiting	5.2 ± 17.0	8.4 ± 18.9	3.8 ± 15.9	F = 3.11 (.08)	4.1 ± 12.7	6.8 ± 20.8	F = 1.16 (.28)
Pain	19.5 ± 25.5	20.3 ± 29.0	19.2 ± 24.1	F = 0.07 (.79)	16.8 ± 23.4	23.0 ± 27.4	F = 2.68 (.10)
Trouble sleeping	26.0 ± 31.3	27.9 ± 36.7	25.3 ± 28.9	F = 0.27 (.60)	24.7 ± 30.5	28.1 ± 32.5	F = 0.52 (.47)
Appetite	8.3 ± 19.91	13.5 ± 24.3	6.1 ± 17.4	F = 5.60 (.02)	6.2 ± 15.5	11.0 ± 23.9	F = 2.72 (.10)
Shortness of breath	16.2 ± 26.1	19.3 ± 28.1	14.9 ± 25.2	F = 1.13 (.29)	14.1 ± 23.0	19.0 ± 29.0	F = 1.69 (.19)
Constipation	14.7 ± 27.4	24.6 ± 32.4	10.4 ± 23.8	F = 11.1 (.001)[a]	14.1 ± 25.4	15.9 ± 29.7	F = 0.21 (.65)
Diarrhea	8.2 ± 20.2	11.7 ± 24.8	6.6 ± 17.7	F = 2.53 (.11)	6.5 ± 15.7	15.0 ± 27.5	F = 1.67 (.20)
Financial difficulty	13.8 ± 28.2	21.4 ± 35.1	10.6 ± 24.1	F = 5.95 (.02)	9.7 ± 21.6	18.7 ± 33.4	F = 4.79 (.03)

BPI indicates Brief Pain Inventory.

[a] Statistically significant.

[b] Chronic, >3 months; acute, <3 months; consistent means steady pain; flares are pain that varies greatly in strength, coming and going.

[c] Question were asked only of those with current cancer-related pain.

Table 4. Outcomes by Pain Status

Outcome	Current Pain, n = 40	No Current Pain, n = 159	Statistic (P)	Pain Since Diagnosis, n = 88	No Pain Since Diagnosis, n = 111	Statistic (P)
Pain treatment attitudes						
Fatalism	2.51 ± 0.97	2.26 ± 0.89	F = 2.21 (.14)	2.28 ± 0.96	2.33 ± 0.88	F = 0.11 (.74)
Physical barriers	2.87 ± 0.78	2.74 ± 0.83	F = 0.73 (.40)	2.71 ± 0.80	2.81 ± 0.84	F = 0.66 (.42)
Communication barriers	2.05 ± 0.85	1.94 ± 0.84	F = 0.50 (.48)	1.92 ± 0.84	1.99 ± 0.85	F = 0.22 (.64)
Harmful effects	3.06 ± 1.03	2.93 ± 1.03	F = 0.47 (.49)	2.74 ± 0.98	3.12 ± 1.04	F = 6.11 (.01)[a]
Depression	13.8 ± 11.1	9.6 ± 8.5	F = 6.12 (.02)	12.4 ± 11.0	8.9 ± 7.3	F = 6.63 (.01)[a]
Functioning						
General health	69.7 ± 18.8	80.3 ± 16.4	F = 11.6 (.001)[a]	74.4 ± 18.7	80.9 ± 15.9	F = 6.50 (.01)[a]
Physical	68.5 ± 26.5	86.4 ± 17.4	F = 25.1 (<.001)[a]	77.0 ± 25.1	87.4 ± 15.4	F = 12.02 (.001)[a]
Role	68.0 ± 35.0	90.9 ± 19.3	F = 29.1 (<.001)[a]	77.6 ± 31.3	93.0 ± 15.9	F = 19.9 (<.001)[a]
Emotional	74.1 ± 23.6	80.8 ± 20.0	F = 3.05 (.08)	74.2 ± 23.1	83.4 ± 18.1	F = 9.51 (.002)[a]
Cognitive	77.0 ± 26.2	84.1 ± 23.8	F = 2.52 (.11)	76.5 ± 29.3	87.3 ± 18.8	F = 9.46 (.002)[a]
Social	90.3 ± 20.1	90.3 ± 20.1	F = 15.3 (<.001)[a]	81.0 ± 26.4	91.7 ± 19.6	F = 10.26 (.002)[a]
Symptoms						
Fatigue	45.4 ± 29.7	19.1 ± 20.5	F = 38.5 (<.001)[a]	35.6 ± 27.2	15.7 ± 18.7	F = 34.5 (<.001)[a]
Nausea/vomiting	5.6 ± 13.0	5.2 ± 17.9	F = 0.02 (.90)	3.4 ± 9.7	6.7 ± 20.8	F = 1.79 (.18)
Pain	45.4 ± 31.3	13.6 ± 19.5	F = 59.6 (<.001)[a]	30.2 ± 28.9	11.9 ± 19.2	F = 27.2 (<.001)[a]
Trouble sleeping	41.7 ± 38.5	22.9 ± 28.5	F = 11.0 (.001)[a]	36.3 ± 33.2	19.3 ± 28.1	F = 14.5 (<.001)[a]
Appetite	16.2 ± 25.6	6.5 ± 17.9	F = 7.34 (.007)[a]	12.3 ± 22.6	5.5 ± 17.2	F = 5.71 (.02)
Shortness of breath	25.2 ± 32.8	14.1 ± 23.7	F = 5.62 (.02)	20.2 ± 29.2	13.3 ± 23.1	F = 3.26 (.07)
Constipation	25.2 ± 31.8	12.2 ± 25.6	F = 6.99 (.009)[a]	18.8 ± 29.0	11.8 ± 25.8	F = 3.02 (.08)
Diarrhea	11.7 ± 19.6	7.4 ± 20.3	F = 1.36 (.25)	7.9 ± 17.0	8.5 ± 22.3	F = 0.04 (.85)
Financial difficulty	24.1 ± 37.9	11.5 ± 24.8	F = 6.03 (.02)	20.8 ± 34.1	8.8 ± 21.5	F = 8.88 (.003)

[a] Statistically significant.

pain-related disability in several PDI domains, expressed more fatalism and concerns about harmful pain treatment effects, had poorer general health ($P = .02$) and physical ($P = .002$) and social ($P = .02$) functioning, had greater appetite symptoms ($P = .02$), and had more constipation ($P = .001$) than whites. Women reported poorer cognitive functioning than men ($P = .04$) and more depressive symptoms ($P = .006$). Both blacks and women reported more financial difficulties ($P < .05$). Additional comparisons are in Table 3.

Pain Versus No Pain

Participants with current pain reported poorer general health ($P = .001$) and physical ($P < .001$), role ($P < .001$), and social ($P < .001$) functioning. Pain since diagnosis predicts all European Organisation for the Research and Treatment of Cancer survey functioning scales ($P < .01$), 3 symptom scales ($P < .01$), and depression ($P = .01$). Participants with past pain also reported significantly greater financial difficulty ($P = .003$). Participants experiencing pain since diagnosis endorsed pain medications' harmful effects less than those who had not experienced pain ($P = .01$). Table 4 and Figures 1 and 2 provide additional details.

Predicting Pain

Logistic regression examined predictors for current pain and pain at any time since cancer diagnosis. Age, race, and female sex were entered at Block 1, income and education at Block 2. Prostate cancer, chemotherapy, radiation, hormone therapy, and cancer surgery were added in the final block. When logistic regression was run, there were no significant predictors for current pain. Female sex predicted having had pain since the time of cancer diagnosis at block of entry. There were no significant predictors in the final model. Table 5 shows odds ratios, intervals, and significance for variables in all regressions.

Among participants with pain in multiple regression, there were no significant predictors for current pain severity as measured by BPI, but pain since diagnosis was significantly related to female sex ($\beta = -.43$, $P = .02$) and black race ($\beta = .45$, $P < .001$).

DISCUSSION

There are few racial differences in the prevalence of cancer by race, but stark racial disparities in morbidity and mortality.[37] To our knowledge, this is the first study showing that nearly 20% of black and white cancer survivors (> 2
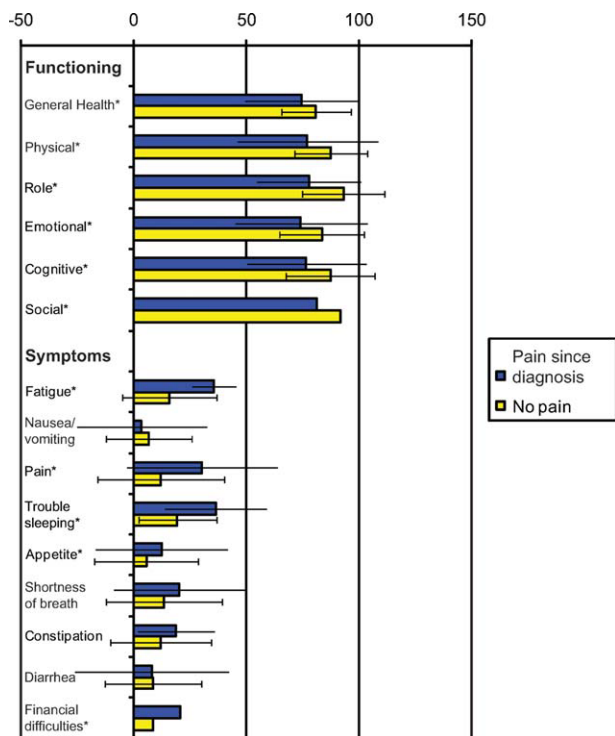
Figure 1. Current functioning and symptoms by experience of pain since diagnosis among cancer survivors are shown according to the European Organisation for the Research and Treatment of Cancer survey. All functioning and 4 symptom outcomes were significantly poorer for participants who had experienced pain.
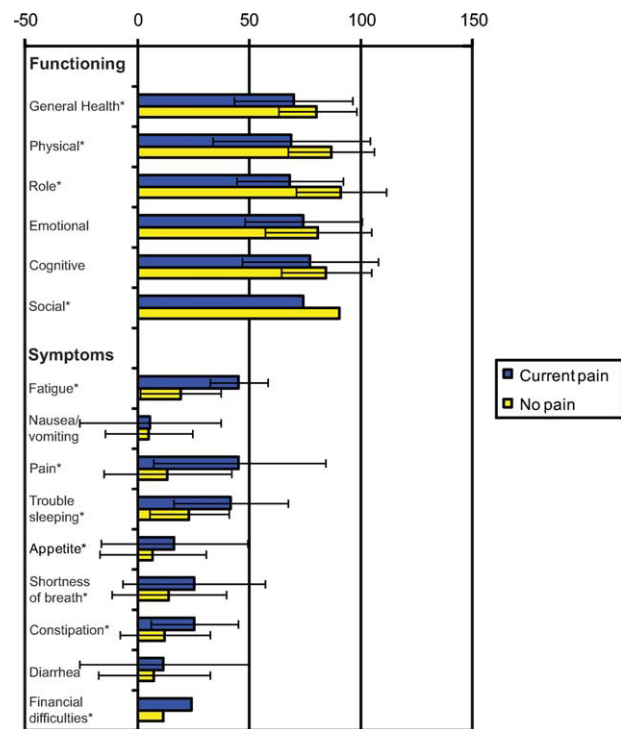

Figure 2. Current functioning and symptoms by experience of current pain among cancer survivors are shown according to the European Organisation for the Research and Treatment of Cancer survey. Current pain was related to a greater number of symptom scales, but only 4 of the 6 functioning scales.

years from diagnosis) report current chronic pain, and 44% have experienced pain since their diagnosis, comparable to previous studies.[38,39] We identified differences in pain type, number of pain locations, perceived etiology, pain severity, pain interference, disability, functioning, and symptoms, with blacks and women adversely impacted. Although blacks tended to have a lower cancer stage than whites, consistent with physician variability in decision making, we identified differences in cancer treatment with women more likely to have chemotherapy and blacks having lower surgery rates.[40] Although the cross-sectional design cannot determine causality, our results suggest that pain associated with cancer may cause increased morbidity and diminished QOL for blacks and women, consistent with an unequal burden of cancer, pain, and cancer-related CP.[24] As more people survive cancer and develop chronic pain (especially cancer-related CP), these cross-cutting findings address a significant knowledge gap and survivorship issue, while highlighting significant clinical and health policy issues.

The literature reveals a significant financial toll associated with cancer. We found blacks and women reported more financial difficulties than their counterparts, with women less likely to have insurance. Blacks and women with chronic pain report increased difficulty paying for healthcare and are more likely to believe sex, race, ethnicity, and culture influence access to health and pain care.[25,29] Thus, sex and race are important considerations in ensuring access to quality health and pain care.[28,41] Although we did not show a difference in the prevalence of pain or depression, other investigators revealed increased pain severity and impairment for blacks.[15,16,42,43] However, when blacks experienced cancer-related CP, they had increased pain severity, depression, and disability compared with whites ($P < .05$).[18,25] Women had increased pain, more pain flares, more disability because of pain, and were more depressed than men ($P < .05$). Because depression is often poorly assessed and frequently goes without treatment, they may suffer substantially more impairment in their health and QOL.

Despite significant medical advances, multimodal pain therapies, and improved longevity, most cancer survivors reporting pain reported that their pain was only relieved by 61%. There are opportunities to improve the

Table 5. Main Effect of Each Independent Variable at Block Entered and in Final Model

Variable	Current Pain, Odds Ratio (CI)	R^{2a}/P	Pain Since Diagnosis, Odds Ratio (CI)	R^{2a}/P	Current Pain, BPI β (P)	Current Pain, BPI R^2 Δ	Pain Since Diagnosis, β (P)	Pain Since Diagnosis, BPI R^2 Δ
Block 1: demographics		0.025/.41		0.148/<.001		.123 (.19)		.327 (<.001)
Age	0.99 (0.95-1.02)	0.46	0.98 (0.95-1.01)	0.98	−.05 (.82)		.10 (.39)	
Female	1.54 (0.74-2.34)	0.29	3.08 (2.42-3.74)	0.001	.31 (.13)		−.34 (.005)	
Black	1.15 (0.36-1.93)	0.73	0.68 (0.00-1.36)	0.27	.09 (.58)		.44 (<.001)	
Block 2: socioeconomic		0.030/.71		0.151/.53		.037 (.48)		.020 (.44)
Income	1.00 (0.98-1.01)	0.63	1.01 (0.99-1.02)	0.43	−.141 (.44)		−.06 (.71)	
Schooling	1.03 (0.91-1.15)	0.62	0.97 (0.87-1.07)	0.52	.18 (.31)		.19 (.28)	
Final model								
Demographics								
Age	0.99 (0.95-1.03)	0.61	0.99 (0.96-1.02)	0.56	−.02 (.94)		.10 (.41)	
Female	0.93 (0.00-2.24)	0.92	2.05 (0.94-3.16)	0.21	.25 (.38)		−.44 (.02)	
Black	1.08 (0.25-1.91)	0.86	0.80 (0.08-1.51)	0.53	.14 (.45)		.45 (<.001)	
Socioeconomic								
Income	1.00 (0.98-1.01)	0.60	1.01 (0.99-1.02)	0.44	−.13 (.49)		−.03 (.85)	
Schooling	1.04 (0.84-1.24)	0.69	0.96 (0.87-1.06)	0.44	.20 (.30)		.17 (.34)	
Cancer and treatment		0.062/.58		0.195/.22		.013 (.78)		.013 (.58)
Prostate cancer	0.73 (0.00-2.14)	0.66	0.89 (0.00-2.06)	0.85	−.11 (69)		−.18 (.32)	
Chemotherapy	1.77 (0.85-2.69)	0.23	1.64 (0.80-2.44)	0.22	.07 (.73)		−.09 (.47)	
Radiation therapy	1.53 (0.72-2.34)	0.30	1.55 (0.86-2.23)	0.22				
Hormone therapy	0.72 (0.00-1.17)	0.58	1.63 (0.57-2.69)	0.37				
Surgery	1.03 (0.10-1.97)	0.94	1.82 (0.80-4.43)	0.15				

CI indicates confidence interval; BPI, Brief Pain Inventory.
[a]Nagelkerke R^2 is included, along with significance for added block. Because logistic regression does not require normal distribution, the Nagelkerke is only an estimate.

quality of clinical care for survivors. When necessary and appropriate, both pharmacologic and nonpharmacologic therapies such as counseling should be incorporated to optimize pain care and improve QOL. However, patient and physician knowledge and attitudes about pain management (eg, opioids and nonpharmacological modalities) may contribute to suboptimal care. For instance, concerns about side effects (eg, addiction) may affect communication and coping and lead both to minimize pain complaints.[3,4,44] Differences in communication styles may compromise a patient's willingness to disclose concerns and the physician's willingness to address concerns.[45] For blacks and women, differences in communication styles may hamper physician decision making, but are critical for quality pain care. Future studies should design interventions to optimize physician patient communication, address attitudes regarding pain management, and decrease physician variability in decision making to improve the quality of pain care.

Having current or past pain significantly impaired health. Participants with pain reported more symptoms (including depression), decreased QOL, and increased financial difficulties. Having cancer-related CP decreased all QOL domains, with an increased health and financial burden for blacks and women. Surprisingly, there were no predictors for current pain in our final model. Pain since diagnosis was significantly related to black race and female sex. Although our findings suggest disparities based upon social determinants, future cancer-related CP studies should attempt to disentangle their role using larger diverse samples.

Despite our important findings, we acknowledge limitations. First, although the surveys had no identifiers, were collected in a confidential manner, and were chosen to determine global differences, there is potential for a self-report bias. Second, a representation bias could be present, with people in better health more willing and able to participate, and it is possible that these estimates may understate the percentage of survivors experiencing

pain. Blacks were also more likely to be contacted to participate than whites because we needed adequate numbers for statistical analysis, thus each black had a higher probability of selection. Despite oversampling, noncoercive monetary incentives to compensate subjects, and using Dillman's Total Design Method, blacks were less likely to participate and more likely to have a bad address. This has been observed in past studies, but may also be confounded with poorer health, as blacks have earlier mortality and lower survivorship rates for cancer.[46,47] Future studies should address whether these limitations are because of recruitment challenges, geographic mobility, or a survival effect. Regardless, we revealed important new findings regarding differences and disparities in cancer-related CP, while providing a sound platform for future studies focusing on cancer survivorship in diverse samples.

In summary, we established the high prevalence (nearly 20%) of cancer-related CP and its tremendous impact on black and white cancer survivors. More than 40% of survivors experienced pain since their cancer diagnosis, with blacks and women more impacted than whites and men. Considering the increasing prevalence of pain and cancer and persistent health disparities in an increasingly aging and diverse society, these results are particularly salient. We provide new knowledge about cancer-related CP and its impact on overall health and QOL. We also identify important barriers, while presenting new opportunities for research focusing on interventions (eg, patient, clinician, health system, and health policy) designed to improve health and pain care quality. We provide a sound platform for research focusing on survivorship and cancer-related CP as well as for optimizing pain care in diverse cancer survivors. All in all, the high prevalence of cancer and pain and now cancer-related CP among diverse survivors (especially blacks and women) reveals new opportunities for clinical care, research, and policy.[24]

CONFLICT OF INTEREST DISCLOSURES

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