HHS Public Access

Author manuscript

J Psychosom Res. Author manuscript; available in PMC 2021 September 01.

Published in final edited form as:

J Psychosom Res. 2020 September ; 136: 110169. doi:10.1016/j.jpsychores.2020.110169.

Predictors of Depression Outcomes in Adults with Cancer: A 12-Month Longitudinal Study

Andrea A. Cohee[1], **Kurt Kroenke**[2,3], **Eric Vachon**[1], **Jingwei Wu**[4], **Wanzhu Tu**[5], **Shelley A. Johns**[2,3,6,7]

[1]Indiana University School of Nursing, Indianapolis, IN, USA

[2]Indiana University School of Medicine, Indianapolis, IN, USA

[3]Center for Health Services Research, Regenstrief Institute, Inc., Indianapolis, IN USA

[4]Temple University College of Public Health, Philadelphia, PA, USA

[5]Indiana University Fairbanks School of Public Health, Indianapolis, IN USA

[6]Charles Warren Fairbanks Center for Medical Ethics, Indiana University Health, Indianapolis, IN USA

[7]Research in Palliative and End of Life Communication and Training Center, Indiana University Purdue University Indianapolis, Indianapolis, IN USA

Abstract

Objectives: The prevalence of depression in patients with cancer ranges from 8% to 24% within the first year of receiving a cancer diagnosis. Identifying predictors of depression outcomes may facilitate tailored or more intensive treatment in patient subgroups with a poorer prognosis for depression improvement. The objective of this study was to determine predictors of depression severity and improvement over 12 months among adults with cancer.

Methods: Longitudinal analysis of data from the Indiana Cancer Pain and Depression trial was performed in 309 patients (n = 309) with cancer-related depression. Depression outcomes were assessed at baseline, 1, 3, 6, and 12 months and included depression severity (Hopkins Symptom Checklist-20) and global improvement (Depression Global Rating of Improvement (DGRI)). Multivariable repeated measures analyses, adjusting for treatment group, baseline depression, and

Corresponding author: Andrea A. Cohee, PhD, Indiana University School of Nursing, 600 Barnhill Drive, NU433W, Indianapolis, IN 46202, aamaners@iu.edu.

Contributors

KK conceived the idea for the study. KK and WT designed the study. JW and WT performed the statistical analyses. AC, KK, EV and SJ wrote the first draft of the manuscript. All revised the manuscript critically. All have given their final approval of the version to be published.

Trial Registration clinicaltrials.gov Identifier: NCT00313573

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

time point, were conducted to determine symptom (pain), demographic, and clinical predictors of depression outcomes over 12 months.

Results: Pain was particularly important, with a clinically meaningful reduction in pain predicting a 12–24% greater odds of depression global improvement. Other factors that independently predicted better depression outcomes over 12 months included female sex, newly-diagnosed or maintainence/disease-free cancer, fewer comorbid medical conditions, and higher socioeconomic status. As expected, the three covariates adjusted for in the model (treatment group, passage of time, and baseline depression severity) also predicted depression outcomes.

Conclusion: Pain as well as several demographic and clinical factors predict depression outcomes over 12 months. These findings may help identify patient subgroups requiring closer monitoring and more intensive or tailored depression treatment.

Keywords

Cancer; depression; pain; randomized controlled trial; prognosis

1. Introduction

The prevalence of depression in cancer ranges from 8% to 24% [1]. People with cancer are five times more likely to be affected by depression than the general population [2] and suffer disproportionately from depression compared to those living with other chronic illnesses [3]. Yet, up to 73% of people with cancer with major depression do not receive treatment [4].

Multiple factors may influence depression incidence and prognosis in persons with cancer. Pain is one of the most prevalent cancer-related symptoms [5] and co-occurs with depression 37% of the time [6]. Moreover, pain and depression have reciprocal adverse effects on one another [6–8]. Severity of depression may change over the cancer continuum [9]. One study found that depression rose markedly after diagnosis, peaking in the first 6 months, then declining over time [10]. Others found continued increases in depression for the first 12 months after diagnosis [11], while others found no discernable pattern [4]. Demographic (e.g., age, gender, race, marital status, socioeconomic status) [4, 12–14] and clinical (e.g., comorbid conditions, baseline depression, cancer type, cancer stage) [4, 15] factors may also contribute to depression.

The purpose of the current study was to determine prognostic factors for depression severity and improvement in adults with cancer over 12 months. Analyses used data from the Indiana Cancer Pain and Depression (INCPAD) trial, a randomized control effectiveness trial of telecare management for the treatment of pain and depression in adults with cancer [16].

2. Methods

2.1. Study Design and Participants

Patients with cancer were recruited from 16 urban and rural outpatient clinics. Eligible patients included those reporting cancer-related depression (PHQ-9 score ≥ 10) and/or pain (Brief Pain Inventory worst pain severity score ≥ 6) as these symptoms often co-occur [17]. After eligibility determination, patients provided written informed consent and were

randomized to the intervention or usual-care group. The intervention, consisting of centralized telecare management coupled with automated symptom monitoring, was designed to optimize medications for the treatment of pain and/or depression in patients with various cancer types at different phases. Participants in usual care continued to receive medical care from their oncologists. Research assistants, blinded to group assignment, collected data at baseline (T0), 1 month (T1), 3 months (T3), 6 months (T6), and 12 months (T12) through phone interviews. The study was approved by the institutional review boards at Indiana University and Community Health Network.

In the parent study, 405 patients enrolled and, of these, 131 had depression only, 96 had pain only, and 178 had both. Thus, the 309 patients with depression constituted the study sample for this paper.

2.2 Measures

2.2.1 Depression and pain—INCPAD measures have been previously described [17]. The depression and pain co-primary outcome measures were not explicitly mentioned by name in the trial registration but were specifically stated in the protocol paper [17] The Hopkins Symptom Checklist 20-item depression scale (HSCL-20) was the primary measure used to assess depression severity. Participants rate the amount of distress related to symptoms of depression during the previous 4 weeks, with item responses scored from 0 (not at all) to 4 (extremely). Mean HSCL-20 scores range from 0 to 4 with higher scores reflecting more severe depression. Depression global improvement was measured with the Depression Global Rating of Improvement (DGRI) item. Participants rated their impression of overall improvement in depression since study enrollment on a 7-point scale ranging from worse to completely better. Scores were dichotomized to produce binary “clinically meaningful improvement” (values ≥ 3) and “non-clinically meaningful improvement” (values < 3) categories for each of the 4 follow-up time points (T1, T3, T6, and T12).

The Brief Pain Inventory (BPI) 4-item severity scale was the primary measure for assessing pain. Participants rated their pain currently and within the last week at its worst, least, and average level. The scale ranges from 0 (no pain) to 10 (as bad as you can imagine). The mean of the 4 items was calculated, with higher scores reflecting more severe pain.

2.2.2 Demographic and clinical factors—Demographics included age, gender, race, and marital status. The Socioeconomic Disadvantage (SED) Index assigns 1 point each for low education (less than high school), unemployment (unable to work due to health or disability), and low income (not enough to make ends meet), for a total SED Index score of 0 to 3. Cancer phase was categorized as newly diagnosed, maintenance/disease-free, or recurrent/progressive. Medical comorbidity was assessed with a checklist of eight diseases shown to predict health care utilization and mortality in medical populations.

2.3. Statistical analyses

Analyses were performed using PROC MIXED of SAS Version 9.1 (SAS Institute, Cary, North Carolina). Outcome variables included depression severity (HSCL-20) at baseline and 1, 3, 6, and 12 months (i.e., T0, T1, T3, T6, and T12) and global improvement (DGRI) at 1,

3, 6, and 12 months. A linear mixed-effects model was fitted for the continuous outcome variable (HSCL-20 depression severity score) and a binary mixed-effects logistic regression model was fitted for the binary outcome variable (i.e., the DGRI score dichotomized as "clinically meaningful improvement" versus "non-clinically meaningful improvement"). Predictor variables included age, gender, race, marital status, SED Index, medical comorbidity, cancer type, cancer phase, and change in pain severity over time. All models were adjusted for 3 covariates: treatment group (intervention versus usual care), baseline depression severity, and time point (passage of time since enrollment).

Repeated measures analysis was used to test the temporal effect of pain on depression severity and improvement [7]. For each time interval (T0–T1; T1–T3; T3–T6; and T6–T12), antecedent changes in pain, as measured by BPI severity scores, were modeled to predict the subsequent depression score, as measured by HSCL-20 or DGRI (see Figure).

3. Results

3.1. Patient Characteristics

Baseline characteristics of the study sample are summarized in Table 1. Patients had an average age of 58 years (range 26–80), with the majority being women (68%) and white (81%). HSCL-20 decreased from 1.64 at baseline to 1.19 by 12 months (effect size of .70). The dichotomized DGRI indicated clinically meaningful improvement in 43% of patients.

3.2 Predictors of Depression Outcomes

Table 2 summarizes results of the repeated measures multivariable models. With regards to depression severity, reductions in BPI pain severity and female gender predicted reductions in HSCL-20 depression severity scores over 12 months. As expected, the 3 covariates adjusted for in the model (intervention group, lower baseline depression, and passage of time) were also highly associated with depression severity over 12 months.

Regarding the dichotomized DGCI, a 1 to 2 point reduction in BPI pain severity was associated with a 12–24% greater odds of clinically meaningful depression global improvement. Improvement was also more likely in patients whose cancer was newly-diagnosed or in a disease-free or maintenance phase as well as those with fewer comorbid medical conditions and less socioeconomic vulnerability. As with depression severity, the 3 covariates were associated with global improvement.

4. Discussion

Our study has several important findings. First, the average depression improvement over 12 months was moderate although less than half reported clinically meaningful improvement. Second, reduction in pain was an important predictor of depression improvement. Third, newly diagnosed or stable cancer, female gender, less medical comorbidity and higher socioeconomic status predicted better depression outcomes. Study strengths included a reasonable sample size, broad range of cancer types and phases, and longitudinal analyses

Compared to our INCPAD trial, prior literature has shown either more favorable [18–22] or similar [13, 14, 23, 24] findings for depression improvement. Whereas previous studies have reported depression improvement in specific cancer types within the first year or two after cancer treatment, INCPAD represents a broader population with multiple cancer types and at different phases along the cancer continuum. Although depression rates may vary by type of cancer [14], cancer type was not predictive of either depression severity or global improvement. However, cancer phase did influence prognosis, as those whose cancer was newly diagnosed or in a disease-free or maintenance phase were more likely to improve.

Pain is a particularly prominent as well as treatable predictor of depression outcomes. A 1 to 2 point reduction in BPI pain severity is considered clinically meaningful [25] and was associated with a 12–24% greater odds of depression global improvement. Lower medical comorbidity also favorably affected prognosis. Depending on the cancer type, the prevalence of comorbid conditions may range from 0.4%−90%, with up to 15% of patients having 2 or more comorbid conditions [26].

Sex was the only demographic factor predicting depression outcomes. Although prior studies have found a higher incidence of depression in women with cancer [27–29], women had a more favorable prognosis in terms of depression severity outcomes in INCPAD compared to men. Lower socioeconomic status trended towards being an adverse prognostic factor which is consistent with studies suggesting a link between socioeconomic vulnerability and depression prevalence and outcomes in cancer [28].

Although the INCPAD trial was completed a decade ago, our findings regarding factors linked to depression improvement are informative for clinicians treating patients throughout the cancer continuum. Effectively managing both co-occurring pain and pre-existing chronic conditions may be important in optimizing depression outcomes [30]. Second, men and those with recurrent/progressive disease may require closer surveillance to monitor depression response. Third, additional social support services may be needed in depressed patients of lower socioeconomic status. The high prevalence of depression across the full spectrum of cancer types and phases warrants tailored treatment in subgroups with poorer long-term outcomes.

Disclosures

Research reported in this publication was supported by the National Cancer Institute of the National Institutes of Health under Award Numbers R01 CA-115369 (Kroenke), K05CA175048 (Cohee, Johns; PI: Champion), T32CA117865-11 (Vachon), and Walther Cancer Foundation 0175.01 (Johns). Its content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, including the National Cancer Institute. Dr. Cohee is supported by Indiana Clinical and Translational Sciences Institute (KL2 Program), UL1TR002529 (PI: Shekhar), 05/18/2018– 04/30/2023.

References

[1]. Krebber AM, Buffart LM, Kleijn G, Riepma IC, de Bree R, Leemans CR, Becker A, Brug J, van Straten A, Cuijpers P, Verdonck-de Leeuw IM, Prevalence of depression in cancer patients: a meta-analysis of diagnostic interviews and self-report instruments, Psychooncology 23(2) (2014) 121–30. [PubMed: 24105788]

[2]. Hartung TJ, Brahler E, Faller H, Harter M, Hinz A, Johansen C, Keller M, Koch U, Schulz H, Weis J, Mehnert A, The risk of being depressed is significantly higher in cancer patients than in

the general population: Prevalence and severity of depressive symptoms across major cancer types, Eur J Cancer 72 (2017) 46–53. [PubMed: 28024266]

[3]. CDC, Mental Health and Chronic Diseases, National Center for Chronic Disease Prevention and Health Promotion-Division of Population Health, 2012, pp. 1–6.

[4]. Walker J, Hansen CH, Martin P, Symeonides S, Ramessur R, Murray G, Sharpe M, Prevalence, associations, and adequacy of treatment of major depression in patients with cancer: a cross-sectional analysis of routinely collected clinical data, Lancet Psychiatry 1(5) (2014) 343–50. [PubMed: 26360998]

[5]. McCowat M, Fleming L, Vibholm J, Dixon D, The psychological predictors of acute and chronic pain in women following breast cancer surgery: a systematic review, Clin J Pain 35(3) (2019) 261–271. [PubMed: 30531400]

[6]. Laird BJ, Boyd AC, Colvin LA, Fallon MT, Are cancer pain and depression interdependent? A systematic review, Psychooncology 18(5) (2009) 459–464. [PubMed: 18942659]

[7]. Kroenke K, Wu J, Bair MJ, Krebs EE, Damush TM, Tu W, Reciprocal relationship between pain and depression: a 12-month longitudinal analysis in primary care, J. Pain 12 (2011) 964–973. [PubMed: 21680251]

[8]. Wilson Rogers LP, Rennoldson M, Are pain and fatigue in multiple myeloma related to psychosocial factors?: A systematic review, Cancer Nurs 43(3) (2020) E121–E131. [PubMed: 32108706]

[9]. Korsten LHA, Jansen F, de Haan BJF, Sent D, Cuijpers P, Leemans CR, Verdonck-de Leeuw IM, Factors associated with depression over time in head and neck cancer patients: A systematic review, Psychooncology 28(6) (2019) 1159–1183. [PubMed: 30865357]

[10]. Schag CA, Ganz PA, Polinsky ML, Fred C, Hirji K, Petersen L, Characteristics of women at risk for psychosocial distress in the year after breast cancer, J Clin Oncol 11(4) (1993) 783–93. [PubMed: 8478672]

[11]. Rasic DT, Belik SL, Bolton JM, Chochinov HM, Sareen J, Cancer, mental disorders, suicidal ideation and attempts in a large community sample, Psychooncology 17(7) (2008) 660–7. [PubMed: 18050260]

[12]. Shayan Z, Shahkolahi Z, Ahmadlo N, Vafaee L, Shayan L, Prognostic factors of depression in patients with cancer undergoing chemotherapy or radiotherapy, Health Scope 3(4) (2014) e18609.

[13]. Hopwood P, Sumo G, Mills J, Haviland J, Bliss JM, Group STM, The course of anxiety and depression over 5 years of follow-up and risk factors in women with early breast cancer: results from the UK Standardisation of Radiotherapy Trials (START), Breast 19(2) (2010) 84–91. [PubMed: 20042336]

[14]. Boyes AW, Girgis A, D'Este CA, Zucca AC, Lecathelinais C, Carey ML, Prevalence and predictors of the short-term trajectory of anxiety and depression in the first year after a cancer diagnosis: a population-based longitudinal study, J Clin Oncol 31(21) (2013) 2724–9. [PubMed: 23775970]

[15]. Zabora J, BrintzenhofeSzoc K, Curbow B, Hooker C, Piantadosi S, The prevalence of psychological distress by cancer site, Psychooncology 10(1) (2001) 19–28. [PubMed: 11180574]

[16]. Kroenke K, Theobald D, Wu J, Norton K, Morrison G, Carpenter J, Tu W, Effect of telecare management on pain and depression in patients with cancer: a randomized trial, JAMA 304(2) (2010) 163–171. [PubMed: 20628129]

[17]. Kroenke K, Theobald D, Norton K, Sanders R, Schlundt S, McCalley S, Harvey P, Iseminger K, Morrison G, Carpenter JS, Stubbs D, Jacks R, Carney-Doebbeling C, Wu J, Tu W, Indiana Cancer Pain and Depression (INCPAD) Trial: design of a telecare management intervention for cancer-related symptoms and baseline characteristics of enrolled participants, Gen. Hosp. Psychiatry 31(3) (2009) 240–253. [PubMed: 19410103]

[18]. Carlson LE, Waller A, Groff SL, Giese-Davis J, Bultz BD, What goes up does not always come down: patterns of distress, physical and psychosocial morbidity in people with cancer over a one year period, Psychooncology 22(1) (2013) 168–76. [PubMed: 21971977]

[19]. Liu H, Yang L, Dynamic change of depression and anxiety after chemotherapy among patients with ovarian cancer, Medicine (Baltimore) 98(31) (2019) e16620. [PubMed: 31374028]

[20]. Schwarz R, Krauss O, Hockel M, Meyer A, Zenger M, Hinz A, The Course of Anxiety and Depression in Patients with Breast Cancer and Gynaecological Cancer, Breast Care (Basel) 3(6) (2008) 417–422. [PubMed: 21048913]

[21]. Bergerot CD, Clark KL, Nonino A, Waliany S, Buso MM, Loscalzo M, Course of distress, anxiety, and depression in hematological cancer patients: Association between gender and grade of neoplasm, Palliat Support Care 13(2) (2015) 115–23. [PubMed: 24182842]

[22]. Stafford L, Judd F, Gibson P, Komiti A, Mann GB, Quinn M, Screening for depression and anxiety in women with breast and gynaecologic cancer: course and prevalence of morbidity over 12 months, Psychooncology 22(9) (2013) 2071–8. [PubMed: 23401315]

[23]. Geue K, Gobel P, Leuteritz K, Nowe E, Sender A, Stobel-Richter Y, Friedrich M, Anxiety and depression in young adult German cancer patients: Time course and associated factors, Psychooncology 28(10) (2019) 2083–2090. [PubMed: 31397041]

[24]. Oberoi D, White V, Seymour J, Prince HM, Harrison S, Jefford M, Winship I, Hill D, Bolton D, Kay A, Millar J, Doo NW, Giles G, The course of anxiety, depression and unmet needs in survivors of diffuse large B cell lymphoma and multiple myeloma in the early survivorship period, J Cancer Surviv 11(3) (2017) 329–338. [PubMed: 28144891]

[25]. Chen CX, Kroenke K, Stump T, Kean J, Carpenter JS, Krebs EE, Bair MJ, Damush TM, Monahan PO, Estimating minimally important differences for the PROMIS pain interference scales: results from three randomized clinical trials, Pain 159(4) (2018) 775–782. [PubMed: 29200181]

[26]. Edwards BK, Noone AM, Mariotto AB, Simard EP, Boscoe FP, Henley SJ, Jemal A, Cho H, Anderson RN, Kohler BA, Eheman CR, Ward EM, Annual Report to the Nation on the status of cancer, 1975–2010, featuring prevalence of comorbidity and impact on survival among persons with lung, colorectal, breast, or prostate cancer, Cancer 120(9) (2014) 1290–314. [PubMed: 24343171]

[27]. Ghanem I, Castelo B, Jimenez-Fonseca P, Carmona-Bayonas A, Higuera O, Beato C, Garcia T, Hernandez R, Calderon C, Coping strategies and depressive symptoms in cancer patients, Clin Transl Oncol 22(3) (2020) 330–336. [PubMed: 31077086]

[28]. Gotze H, Friedrich M, Taubenheim S, Dietz A, Lordick F, Mehnert A, Depression and anxiety in long-term survivors 5 and 10 years after cancer diagnosis, Support Care Cancer 28(1) (2020) 211–220. [PubMed: 31001695]

[29]. Jefford M, Ward AC, Lisy K, Lacey K, Emery JD, Glaser AW, Cross H, Krishnasamy M, McLachlan SA, Bishop J, Patient-reported outcomes in cancer survivors: a population-wide cross-sectional study, Support Care Cancer 25(10) (2017) 3171–3179. [PubMed: 28434095]

[30]. Riba MB, Donovan KA, Andersen B, Braun I, Breitbart WS, Brewer BW, Buchmann LO, Clark MM, Collins M, Corbett C, Fleishman S, Garcia S, Greenberg DB, Handzo RGF, Hoofring L, Huang CH, Lally R, Martin S, McGuffey L, Mitchell W, Morrison LJ, Pailler M, Palesh O, Parnes F, Pazar JP, Ralston L, Salman J, Shannon-Dudley MM, Valentine AD, McMillian NR, Darlow SD, Distress Management, Version 3.2019, NCCN Clinical Practice Guidelines in Oncology, J Natl Compr Canc Netw 17(10) (2019) 1229–1249. [PubMed: 31590149]

Highlights

- Depression improves during 12-month follow-up in 43% of depressed adults with cancer
- Pain reduction is an important predictor of depression improvement
- Cancer stage, gender, and medical comorbidity also predict depression improvement.

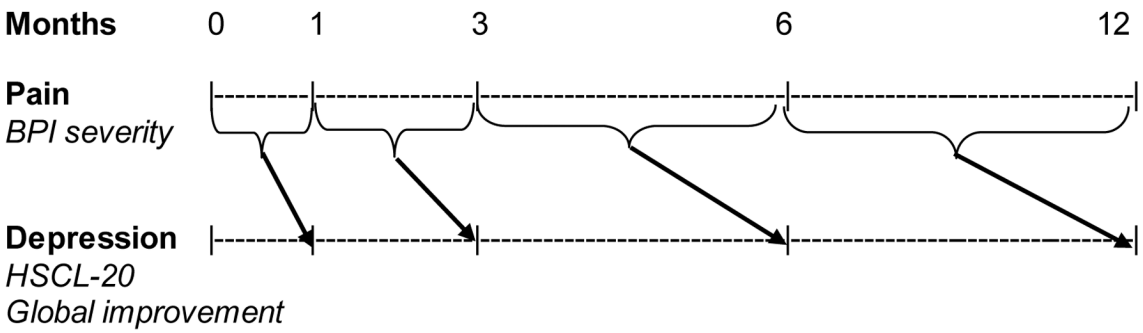

Figure.

Repeated measures for examining whether change in pain predicted depression over 12 months, both as a continuous outcome (HSCL-20) and a categorical outcome (Depression Global Rating of Improvement [DGRI])

Table 1.

Baseline Characteristics of Participants with Depression

Baseline Characteristics	***N*** **=309**
	Mean **(SD)**
Age	58.3 (11.0)
Socioeconomic Disadvantage Index *	1.42 (0.98)
Medical Comorbidity (no. of diseases)	2.15 (1.63)
HSCL-20 Depression (0 to 4 scale)	1.64 (0.64)
BPI Pain Severity (0–10 scale)	4.08 (2.43)
	N **(%)**
Group	
Intervention	154 (49.8)
Control	155 (50.2)
Symptom	
Depression only	131 (42.4)
Depression and pain	178 (57.6)
Gender	
Female	209 (67.6)
Male	100 (32.4)
Race	
White	250 (80.9)
Black	51 (16.5)
Other	8 (2.6)
Marital Status	
Married	144 (46.6)
Unmarried/Other	165 (53.4)
Education	
Less than high school *	64 (20.7)
High school	129 (41.7)
Some college or trade school	79 (25.6)
College graduate	37 (12.0)
Employment	
Employed	48 (11.6)
Unable to work due to health or disability *	149 (48.2)
Retired	87 (28.2)
Other	25 (8.1)
Income level	
Comfortable	69 (22.3)
Just enough to make ends meet	143 (46.3)

Not enough to make ends meet *	97 (31.4)
Type of Cancer	
Breast	94 (30.4)
Lung	63 (20.4)
Gastrointestinal	54 (17.5)
Lymphoma/Hematological	37 (12.0)
Genitourinary	29 (9.4)
Other	32 (10.4)
Phase of Cancer	
Newly-diagnosed	119 (38.5)
Maintenance or disease-free	132 (42.7)
Recurrent or progressive	58 (18.8)

BPI = Brief Pain Inventory; HSCL-20 = Hopkins Symptom Check List-20.

* The SED Index ranges from 0 to 3, scoring 1 point each for less than high school education, inability to work due to health or disability, and low income (“not enough to make ends meet”).

Table 2.

Multivariate Predictors of Depression Severity and Global Improvement Outcomes over 12 Months

Predictor	Df[d]	Outcome Variables[c]						
		HSCL-20 Depression Severity[d]			Depression Global Improvement			
		Beta[e] (SE)	*F*[f]	*P*	Odds Ratio	95% CI	*F*[f]	*P*
Covariates								
Treatment Arm (Intervention Group)	1	−.2586 (.0568)	20.8	< .0001	1.59	1.06 – 2.36	5.1	.024
Baseline Depression Severity	1	.5531 (.0458)	146.1	< .0001	0.73	0.53 – 1.01	3.7	.056
Visit (passage of time)	1	−.0140 (.0034)	16.6	< .0001	1.09	1.05 – 1.13	19.3	< 0001
Predictor Variables[a]								
Reduction in BPI Pain Severity[b]	1	−.0249 (.0063)	15.6	<.0001	1.12	1.04 – 1.19	10.2	.002
Female gender	1	−.1659 (.0711)	5.5	.020	1.47	0.89 – 2.44	2.3	.13
Socioeconomic Disadvantage (SED) Index	1	.0603 (.0328)	3.4	.07	0.79	0.63 – 1.00	3.8	.051
Medical Comorbidity (# of diseases)	1	.0296 (.0185)	2.5	.11	0.84	0.74 – 0.96	6.4	.012
Phase of Cancer Newly-diagnosed vs.	2	−.1536 (.0852)	1.6	.19	2.73	1.27 – 4.35	4.4	.013
Recurrent/progressive Maintenance/disease-free vs.		−.0949 (.0840)			1.45	0.79 – 2.64		
Recurrent/progressive								

Note: BPI = Brief Pain Inventory; HSCL-20 = Hopkins Symptom Check List-20; SE = standard error; CI = Confidence Interval.

[a] In addition to variables in the table, we also adjusted for age, marital status, race, and type of cancer. None of these variables were significant predictors in the models.

[b] BPI Pain Severity change scores between 0 month and 1 month (T0–T1), between 1 month and 3 months (T1–T3), between 3 months and 6 months (T3–T6), and between 6 months and 12 months (T6–T12).

[c] A negative beta indicates lower depression at 12 months whereas a positive beta indicates higher (worse) depression. An OR greater than 1 indicates a higher odds of depression improvement whereas an OR < 1 indicates lower odds

[d] Df = numerator degrees of freedom. Denominator df in models was 640 for HSCL-20 and 635 for Depression Improvement

[e] Beta is the unstandardized regression coefficient and indicates how much HSCL-20 changes over 12 months for every unit change in predictor. For example HSCL-20 decreases .0249 for every 1 point reduction in BPI pain severity score (or .0747 for every 3 point reduction), and it decreases .1659 in women compared to men. Effect size (ES) = this change divided by HSCL-20 baseline SD (which is 0.64). Thus, a 3-point reduction in BPI pain severity has an ES of 0.12 (i.e., .0747/.64) on 12-mo. depression severity, and female gender has an ES of 0.26

[f] The F value from the modeling is one metric for comparing the relative strength of predictors, along with the associated P-value.