

Socioeconomic Status Is Associated with Depressive Severity Among Patients with Advanced Non–Small-Cell Lung Cancer: Treatment Setting and Minority Status Do Not Make a Difference

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Introduction: Non–small-cell lung cancer (NSCLC) is the leading cause of cancer-related morbidity and mortality. Unfortunately, patients with NSCLC have relatively poor survival rates compared with patients diagnosed with most other types of cancer. Accordingly, managing physical and mental health symptoms are important treatment goals. In the current investigation, we sought to determine whether individual socioeconomic status (SES; as indexed by level of education), racial/ethnic minority status, and hospital type (public versus tertiary care center) were associated with NSCLC cancer patients' depressive severity. Importantly, we investigated whether NSCLC patients' individual SES was more or less prognostic of their depressive severity compared with minority status and the hospital context where they received treatment.

Methods: Patients scheduled for chemotherapy were assessed for depressed mood by the Beck Depression Inventory-II (BDI-II). Data were collected at baseline and at approximately 6, 12, and 18 weeks.

Results: NSCLC patients with less education had more depressive severity than those with more education. Treatment setting and minority status were not associated with depressive severity. The interaction between education level and treatment setting predicting depressive severity was not significant, suggesting that the association between education level and depressive severity did not differ by treatment setting.

Conclusion: Our study brings heightened awareness to the substantial, persistent SES differences that exist in depressive severity among late-stage NSCLC patients. Furthermore, these findings seem

to persist, regardless of minority status and whether the patient is treated at a public hospital or tertiary cancer center.

Key Words: Depression, Quality of life, Socioeconomic status, Non–small-cell lung cancer, Medically underserved.

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Health disparities increase with each step down the socioeconomic status (SES) ladder.¹ Whether indexed by education, income, or job status, being low SES is associated with poor health.¹ For most cancers, lower SES individuals are at greater risk for both incidence and mortality compared with those who are higher SES.^{2,3} Much less is known about how SES impacts cancer patients' mental and physical well-being.

Non–small-cell lung cancer (NSCLC) is the leading cause of cancer-related morbidity and mortality.⁴ Unfortunately, patients with NSCLC have relatively poor survival rates compared with patients diagnosed with most other types of cancer. Accordingly, managing physical and mental health symptoms are important treatment goals.⁵ To improve NSCLC patients' quality of life (QOL), it is imperative to identify factors associated with physical and mental well-being.

Recently, we demonstrated that lower SES individuals (as indexed by level of education) with advanced NSCLC had poorer physical well-being (i.e., pain, fatigue, disturbed sleep, shortness of breath, and drowsiness) during chemotherapy compared with those who were higher SES.⁵ Likewise, NSCLC patients who were treated at public hospitals with good performance status were more likely to experience these symptoms compared with those treated at a tertiary care centers.⁵ Importantly, these findings persisted over 15 weeks of therapy.⁵

In the current investigation, we sought to determine whether SES, racial and ethnic minority status, and hospital type (public versus tertiary care center) were associated with NSCLC cancer patients' depressive severity over 15 weeks of therapy. Depression severity is an important aspect of mental well-being and one of the strongest predictors of QOL for cancer patients.⁶ Cancer patients' depression is also a major contributor to their close family members' well-being.⁷ Importantly, we investigated whether NSCLC patients' individual SES was more or less prognostic of their depressive severity compared

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with the hospital context where they received treatment and their status as a racial or ethnic minority.

STUDY PARTICIPANTS

Advanced stage (IIIB–IV) NSCLC patients who were scheduled for chemotherapy were recruited for this study between January 2004 and December 2008. They were recruited from thoracic medical oncology clinics of a tertiary cancer center in Houston, Texas, and from the general oncology clinics of three public hospitals (two in Houston, one in Miami, Florida) providing care for medically underserved (noninsured/underinsured and/or low-income) patients.⁸ The study was approved by the institutional review boards of the participating institutions. All patients gave informed consent to participate. The study time period was limited to the first 18 weeks of treatment based on a standard chemotherapy protocol that included six, 3-week cycles of treatment.

Of 234 eligible patients approached to participate in the study, 189 consented to participate. Four withdrew before baseline assessment, such that 185 were included in the final analysis. Of these, 102 were recruited from the tertiary cancer center and 83 from the public hospitals. All 185 patients contributed data at baseline, 140 at 6 weeks, 107 at 12 weeks, and 79 at 18 weeks from the start of the study (Fig. 1).

MEASURES

The Beck Depression Inventory II (BDI-II)⁹ is a widely used instrument for measuring the intensity of depression. It contains 21 items that assess various aspects of depression. Each item is rated on a 4-point scale, resulting in a maximum attainable score of 63. A higher total score indicates more-severe depressive severity. The BDI-II has high clinical sensitivity with a reliability coefficient of 0.92 and predictive validity of 0.91.⁹ Assessments were obtained at baseline and at 6, 12, and 18 weeks from initiation of chemotherapy using the BDI-II's standard cut points.⁹ The BDI-II has been found to be a reliable measure of depression across race/ethnicity and gender.^{10,11}

Comorbidities

The Charlson index is the most widely used comorbidity index. Originally developed for predicting mortality in breast cancer patients, it has now been widely used with both cancer and noncancer populations.¹²

Demographic and Clinical Variables

Participants answered questions about their age, race, highest level of education, marital status, and gender. Following participants' authorization, electronic medical records were reviewed to obtain initial treatment date.

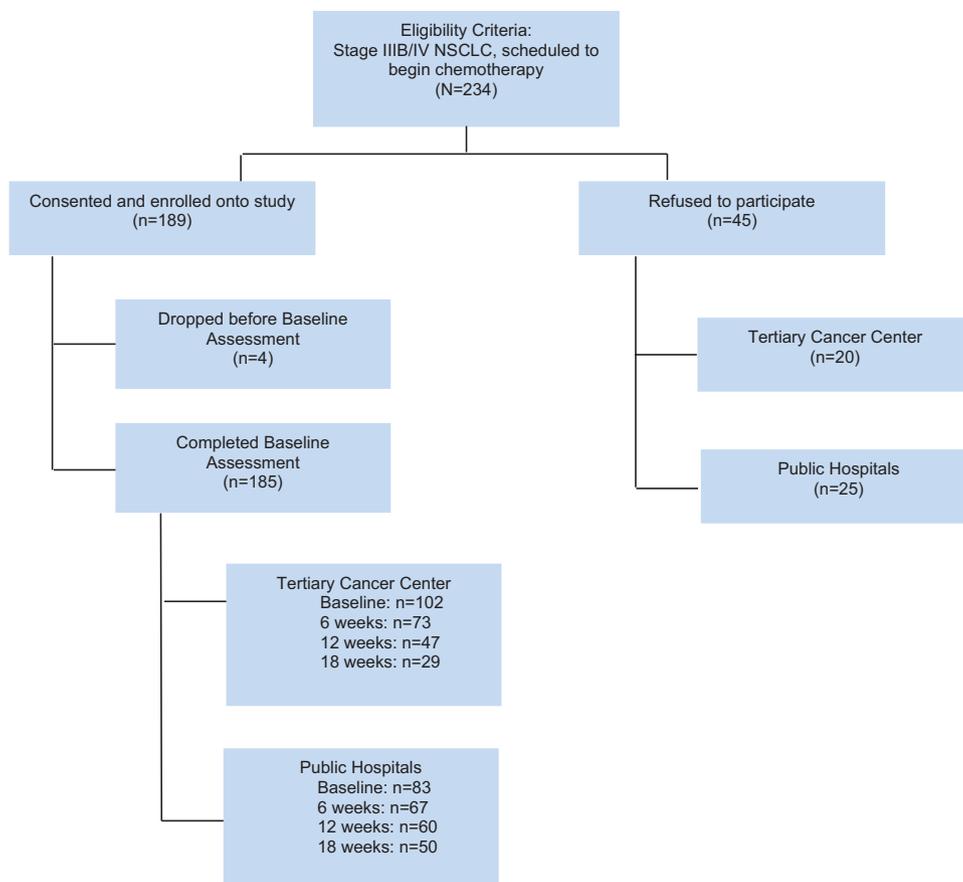


FIGURE 1. Flow of participants through the study. NSCLC, Non-small-cell lung cancer.

Educational level was used to assess the women in our sample as has been done in previous studies using cancer populations that included older adult women because it was difficult to know whether the women in our same sample worked outside the home.¹³ In addition, education is less vulnerable to fluctuations in current income and job status.^{14–16} Participants reported number of years of formal schooling they had received to indicate level of education.

ANALYTIC METHOD

Education was modeled as a continuous variable, based on prior work showing that the association between SES and health is monotonic (i.e., the association between SES and health shows a gradient increase).^{17,18} Descriptive statistics, including means, standard deviations (SDs), and percentages, were used to describe patient demographics and clinical characteristics. Using mixed models regression, we addressed the question of whether SES (as indexed by level of education), minority status, and hospital type were associated with depressive severity across visits. We used restricted information maximum likelihood estimation to fit all models. Restricted information maximum likelihood is superior to listwise deletion for handling attrition.¹⁹ It performs well when data are missing at random and improves nonrandom circumstances over ignoring cases entirely.²⁰ We used an unstructured within-subjects covariance matrix and examined the model residuals to confirm that they were distributed normally. We included education, visit, minority status, time since treatment, marital status, comorbidities, sex, age, and stage in the model. Age and depressive severity were time varying. All other variables were time invariant.

In ancillary analyses, we adjusted for cancer treatment rather than cancer stage (stage and treatment type are highly related and were not entered simultaneously to avoid multicollinearity); none of the results presented below changed. We also created a variable indicating if and when a patient dropped out at any time before the end of the study; we included this variable in ancillary analyses to ensure it did not bias the results.

RESULTS

Preliminary Analyses

T1 Patient demographic and clinical characteristics by treatment site (tertiary versus public) are presented in Table 1. A higher proportion of patients at the tertiary center had stage IV disease. Patients at the tertiary center were more likely to be married, have attended college, be employed, or be retired. Individuals who were lost to attrition did not significantly differ on any of the study variables compared with those who completed both visits. Those who were less educated were more likely to be treated at a public hospital compared with a tertiary cancer center ($r = -0.42$, $p = 0.001$). Across all visits and groups, 67.1% experienced minimal depressive severity, 18.8% experienced mild depressive severity, 9.0% experienced moderate depressive severity, and 5.2% experienced severe depressive severity.

Analyses

T2 As can be seen in Table 2, participants with more education had less depressive severity than those with less

TABLE 1. Sample Characteristics by Treatment Site

Characteristic	Tertiary (<i>n</i> = 102)	Public (<i>n</i> = 83)	<i>p</i>
	No. (%)	No. (%)	
Age			
Mean (yr)	61.3	58	0.012
Standard deviation	9.4	8.1	
Gender			
Men	67 (65.7)	49 (59.0)	0.352
Women	35 (34.3)	34 (41.0)	
Marital status			
Married	84 (82.4)	32 (38.6)	<0.001
Unmarried	18 (17.6)	51 (61.4)	
Education level			
Mean (yr)	13.6	10.7	<0.001
Standard deviation	3.1	3.3	
Job status			
Employed outside the home	24 (24.0)	13 (15.7)	<0.001
Homemaker	8 (8.0)	3 (3.6)	
Retired	43 (43.0)	13 (15.7)	
Medical leave or disability	23 (23.0)	32 (38.6)	
Unemployed/other	2 (2.0)	22 (26.5)	
Ethnicity			
Asian	0 (0.0)	1 (1.2)	<0.001
Black Non-Hispanic	7 (6.9)	38 (45.8)	
Hispanic	1 (1.0)	25 (30.1)	
White Non-Hispanic	94 (92.2)	19 (22.9)	
Cancer stage			
IIIB	7 (6.9)	29 (34.9)	<0.001
IV	95 (93.1)	54 (65.1)	
Previous treatment			
Chemotherapy	27 (26.5)	18 (21.7)	0.538
Surgery	19 (18.6)	3 (3.6)	0.002
Radiation	37 (36.3)	16 (19.3)	0.016
Treatment naive	59 (57.8)	29 (34.9)	0.008
Charlson comorbidity score			
0 to 1	69 (68.3)	64 (81.0)	0.054
2+	32 (31.7)	15 (19.0)	

education. The interaction between education and time was not significant ($b = -0.01$, $p = 0.61$), demonstrating that the association between education and depressive severity did not differ across visits. Treatment setting was not associated with depressive severity. Likewise, treatment setting did not interact with visit ($b = -0.01$, $p = 0.25$). Those who were members of a racial/ethnic minority group did not experience more depressive severity than those who were not. To estimate the magnitude that depressive severity differed by level of education between participants lower and higher in educational level, we used the covariate-adjusted means at 1 SD above and below the mean level of education. Participants with less education (-1 SD) had 42.5% more depressive severity than those with more education ($+1$ SD).

TABLE 2 Summary of Mixed Models Analysis Predicting Depression Severity

Variable	Depression Severity			
	B	SE	p	95% CI
Visit	-0.019	0.02	0.42	-0.06 to 0.03
Time since treatment	0.000	0.00	0.29	-0.00 to 0.00
Race (0 = nonwhite, 1 = white)	0.07	0.017	0.69	-0.27 to 0.41
Stage	-0.09	0.15	0.56	-0.40 to 0.21
Comorbidities	-0.02	0.05	0.65	-0.12 to 0.08
Married	0.08	0.14	0.58	-0.20 to 0.35
Age	-0.01	0.01	0.41	-0.02 to 0.01
Sex (male = 0, female = 1)	-0.01	0.12	0.94	-0.25 to 0.24
Education level	-0.07	0.03	0.04	-0.13 to -0.01
Treatment site (1 = tertiary, 2 = public)	0.18	0.18	0.30	-0.16 to 0.53

In ancillary analyses, we tested for the interaction between education level and treatment setting predicting depressive severity and it was not significant ($b = 0.01$, $p = 0.66$). Finally, we adjusted for dropout by including a covariate that modeled number of time points completed. Educational level was still associated with depressive severity ($b = -0.07$, $p = 0.04$), while treatment setting was not ($b = 0.22$, $p = 0.22$).

DISCUSSION

Higher SES (as indexed by education) NSCLC patients had less depressive severity than those who were lower SES. This association persisted irrespective of whether or not the patients were members of an ethnic or racial minority group. It also persisted regardless of whether the patients were treated at a public hospital or a tertiary cancer center. NSCLC patients treated at tertiary cancer centers were no less likely to experience elevated levels of depressive severity than those treated at public hospitals.

Previous studies have reported that medically underserved cancer patients are more likely to experience depression compared with others.^{21,22} However, this is the first study, to our knowledge, to compare the impact of patients' individual SES relative to their treatment context. This is particularly important, given our prior work that demonstrated that treatment context (i.e., public versus tertiary cancer center) was a major factor associated with NSCLC patients' physical well-being as indexed by a composite symptom burden index.⁵

There are several factors that may explain the association between SES and depressive severity among NSCLC patients. As previously reported, those who are low SES experience more physical symptoms compared with those who are higher SES.⁵ Physical symptoms can enhance depressive severity.²³ Furthermore, lower SES individuals do not benefit from same quality of social support as higher SES individuals because their support network has many competing demands.¹³ High-quality social support is one of the most effective ways to buffer against stress and depression during a stressful life event.^{24,25}

Depression is a risk factor for mortality among NSCLC patients such that those who were depressed had twice the risk of death compared with nondepressed patients.²⁶ Recent work demonstrated that interventions aimed at improving depressive severity and symptom control among those with NSCLC may also promote longer survival.²⁷ These interventions may be particularly beneficial for low SES individuals.

This study has several limitations. First, it included patients from a single tertiary center; thus, generalization of our results to other tertiary centers is not warranted. Second, it did not include patients from community care settings. It would be interesting for future studies to use income and job status in addition to education to evaluate SES. Finally, this study included patients with advanced NSCLC only; thus, results may not be generalizable to patients with other types of cancer or less advanced disease. Future studies to assess patients' depression should include longitudinal designs and incorporate patients from multiple public, community, and tertiary care centers.

Our study brings heightened awareness to the substantial, persistent SES differences that exist in depressive severity among late-stage NSCLC patients. Clinicians in all treatment facilities should screen for depression and institute early and appropriate management. These interventions may improve QOL and even impact survival time.²⁷⁻³¹

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