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Original Research Reports

Functional Impairment in COPD Patients

The Impact of Anxiety and Depression

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The authors examined the relationship between functional status and comorbid anxiety and depression and the relationship between utilization of health care resources and psychopathology in elderly patients with chronic obstructive pulmonary disease (COPD). Elderly male veterans (N=43) with COPD completed anxiety, depression, and functional status measures. The authors constructed regression models to explore the contribution of COPD severity, medical burden, depression, and anxiety to the dependent variables of functional impairment and health care utilization. Anxiety and depression contributed significantly to the overall variance in functional status of COPD patients, over and above medical burden and COPD severity, as measured by the 8 scales of the Medical Outcomes Study (MOS) 36-item Short Form Health Survey. Surprisingly, medical burden and COPD severity did not contribute significantly to overall variance in functional status. Few patients were receiving any treatment for anxiety or depression.

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Chronic obstructive pulmonary disease (COPD) afflicts an estimated 14 to 20 million people in the United States[1] and is the fourth leading cause of death for Americans. The economic costs of the disease are estimated at almost $40 billion annually in the United States. Social costs include significant disability, as reflected in poorer emotional functioning, decreased social-role functioning, impaired activities of daily living, and limited recreational pastimes.[2] Several studies indicate that the incidence of depression and anxiety disorders is increased in patients with COPD. About 40% of COPD patients in general medical practice are estimated to suffer from depressive disorders compared with 13% of total patients.[3]

Ormel et al.[4] report that depressive symptoms contribute more to functional disability, poor health perception, and poor well-being than many chronic medical conditions.

Patients with both chronic medical illness and depression

are more functionally disabled than those with either a chronic medical illness or depression alone. Furthermore, patients with both conditions use greater resources, more primary care services, and more emergency care than patients with chronic illness without depression.[5,6] Research on patients with coronary artery disease has shown that both anxiety and depression have a significant effect on change in physical functioning over 12 months.[7] However, little attention has been paid to patients with COPD and concomitant psychopathology, despite findings that less than 40% of the variance in exercise tolerance is explained by any physiological measure of pulmonary function.[8]

Previous studies of COPD patients indicate that there is no relationship between functional status and psychiatric comorbidity.[8,9] However, more recent studies report a significant relationship between functional status of COPD patients and the presence of anxiety or depression.[10,11] Furthermore, several studies indicate that pharmacotherapy of depression or anxiety in COPD patients improves functional capacity.[4,12,13]

Our study expands this previous research by using the Medical Outcomes Study (MOS) 36-Item Short Form Health Survey (SF-36), derived from the Medical Outcomes Study,[14] to assess the relationship between functional impairment and the presence of comorbid anxiety and depression in elderly COPD patients. We hypothesize that anxiety and depression would be moderating factors in the association between COPD and functional capabilities. Moreover, COPD patients with anxiety and/or depression should use greater medical resources than those without comorbid psychopathology. Finally, we examine the pharmacologic treatment practices of primary care providers for patients in our sample with depression and anxiety symptoms.

METHODS

Patient Sample

Subjects were selected from an alphabetical list of 564 patients seen in the Pulmonary Function Test (PFT) Laboratory from March through September 1997 at the Houston Veterans Affairs Medical Center (HVAMC). A board-certified pulmonologist (using chart review and PFT results) selected patients who had COPD as their most disabling condition. We excluded patients ($n = 229$, 40.6%) with the following concurrent, potentially confounding chronic conditions: life-threatening malignancy, myocardial infarction within the previous year, coronary artery

disease requiring surgical intervention, and dementia. Other reasons we excluded patients included records restricted by the VA hospital ($n = 3$, 0.5%) and younger than 60 years old ($n = 182$, 32.3%). Thirty-three patients (5.9%) were excluded because of normal PFT results, 22 patients (3.9%) were excluded because of incomplete PFTs, and 3 patients (0.5%) were deceased. Of the remaining 92 patients, 48 (52%) met inclusion criteria but were unable to participate in the study because of distance from the HVAMC ($n = 16$), uninterested in participating in research ($n = 14$), or researchers' inability to contact the patient ($n = 18$). One patient who met inclusion criteria withdrew during the interview because of adverse effects of questioning. Forty- three patients (47% of suitable candidates) gave written informed consent and completed the entire battery of tests.

Procedure

Subjects signed a consent form approved by the Baylor College of Medicine and the HVAMC Institutional Review Boards. Subjects met with the interviewer (HK, MK, or SL) who then administered the Mini-Mental State Exam (MMSE). The subjects were asked to complete the self-report scales described in the next section. The interviewer then completed the Modified Cumulative Illness Rating Scale (MCIRS) based on the clinical interview and chart review. Patients were offered a $5 cafeteria voucher on completion of the self-report questionnaires and interview.

Medication profiles were obtained from computerized patient records. We obtained subjects' inpatient and outpatient utilization of VA resources from the Department of Veterans Affairs patient treatment files of hospitalizations and the outpatient clinic files for 1997–98. These files contain information on all discharges from VA acute care facilities and all outpatient visits to VA staff.

Measures

We assessed COPD severity with the forced expiratory volume in one second (FEV1). Functional impairment was measured with the SF-36,[14] a 36-item self-report or orally administered questionnaire widely accepted as a measure of functional status in medical populations. The SF-36 contains scales to assess 8 major dimensions of functioning over the previous 4 weeks: Physical Functioning, Role Limitations Due to Physical Health, Role Limitations Due to Emotional Problems, Bodily Pain, General Health, Vitality, Social Functioning, and Mental Health. Symptoms

of depression were identified with the Geriatric Depression Scale (GDS),[15] a questionnaire with validity and reliability in detecting depression among psychiatrically ill, medically ill, and healthy elderly patients.[16] We identified anxiety symptoms with the Beck Anxiety Inventory (BAI).[17] Fourteen of the 21 items form a physiological/somatic symptom subscale, and 7 form a subjective symptom subscale. The somatic and subjective subscales demonstrate a high degree of internal reliability and moderate to strong intercorrelation.[18] We assessed medical burden with the Modified Cumulative Illness Rating Scale (MCIRS), an organ-based rating scale of medical burden with previously established high reliability and validity.[19,20] We measured cognitive functioning with the MMSE.[21]

Data Analysis

We calculated descriptive statistics for age, race, health care utilization, and scores on the psychometric instruments (MMSE, MCIRS, SF-36, GDS, and BAI). We then constructed hierarchical regression models to explore the contribution of COPD severity, medical burden, and psychopathology to functional impairment. A Bonferroni correction of $P < 0.006$ controlled for high study-wise error because of the large number of equations being tested. Differences in COPD severity and demographic variables between participants and nonparticipants were explored using chi-square analyses and independent-samples t-tests.

To evaluate the contribution of anxiety and depression to functional status over and above COPD severity and medical burden, we calculated hierarchical regression models using the functional status scores from the 8 scales of the SF-36. Predictor variables were FEV1 as an estimate of COPD severity, MCIRS score as an estimate of medical burden, and anxiety and depression scores as estimates of psychopathology. The MCIRS total score and the FEV1 were entered on the first step to control for the effects of medical burden and COPD severity, and anxiety and depression scores were entered together on the second step.

A second set of hierarchical regression models were constructed with the same steps as outlined above to assess the contribution of medical burden, COPD severity, anxiety, and depression to the following health care utilization variables: total number of inpatient hospitalizations during the 12 months before study participation, total number of inpatient days of care, total outpatient clinic visit days, total emergency room/urgent care visit days, total primary care visit days, and total mental health visit days. As this was

a pilot study, we did not use a Bonferroni correction for this second analysis.

RESULTS

Patient Characteristics

The 43 male veteran patients in the sample had a mean age of 69.2 years (SD 4.71, range 60–78); 86% were White and 14% were African American. Descriptive statistics for the measures utilized to assess cognitive functioning, anxiety, depression, COPD severity, functional status, and health care utilization are shown in Table 1. Most patients had adequate cognitive functioning; 84% scored 28 or higher on the MMSE, and only one scored less than 24. The MCIRS results indicated a mild level of medical burden; the mean FEV1 was consistent with a moderate level of COPD. With respect to functional status, the eight scales of the SF-36 for this sample varied considerably from national averages: the Physical Functioning, General Health,

TABLE 1. Mean ± SD of anxiety and depression measures, cognitive functioning, medical burden, COPD severity, functional status measures, and health care utilization in the 1 year before study participation

Measure	Mean ± SD	Range
BAI	12.74 ± 9.68	0–41
GDS	9.58 ± 7.26	0–27
MMSE	28.37 ± 2.04	23–30
MCIRS ($n = 41$)	24.10 ± 3.60	17–34
FEV1	1.31 ± 0.64	0.53–2.84
SF-36 (transformed scale)		
Physical Functioning	44.30 ± 25.34	10–100
General Health ($n = 41$)	47.80 ± 23.37	5–87
Role-Physical	37.79 ± 35.09	0–100
Role-Emotional ($n = 42$)	76.19 ± 38.46	0–100
Social Functioning	63.95 ± 32.64	0–100
Bodily Pain	64.51 ± 28.43	20–100
Mental Health	74.74 ± 20.85	12–100
Vitality	51.16 ± 23.91	10–93
Total Outpatient Visit Days	15.77 ± 14.38	1–77
Primary Care Visit Days	4.16 ± 6.25	0–38
Mental Health Visit Days	1.47 ± 8.69	0–57
Emergency Room Visit Days	2.09 ± 2.18	0–8
Total Inpatient		
Hospitalization Discharges	0.56 ± 0.96	0–4
Hospitalization Days	6.98 ± 17.42	0–99

Note: BAI = Beck Anxiety Inventory; GDS = Geriatric Depression Scale; MCIRS = Medical Cumulative Illness Rating Scale; MMSE = Mini–Mental State Exam; FEV1 = Forced Expiratory Volume in 1 second; SF–36 = Short Form 36; $n = 43$ unless otherwise noted.

and Role-Physical means were greater than one standard deviation below the mean scores (lower functioning) for the general U.S. population; means of Social Functioning, Bodily Pain, and Vitality scales were less than one standard deviation below the general adult means; and Role-Emotional and Mental Health means were similar to norms. We did not find any differences between participants and non-participants on age, COPD severity, gender, or race using chi-square analyses and independent-samples t-tests.

Medical burden and COPD severity together did not contribute significantly, at the level of the Bonferroni correction ($P<0.006$), to the overall variance in functional status in any of the areas of Physical Functioning, General Health, Role-Physical, Role-Emotional, Social Functioning, Bodily Pain, Mental Health, or Vitality. However, as expected, psychopathology did contribute significantly to all of the SF-36 functional status scales except Physical Functioning (r^2 change $=0.20$; $P=0.007$). After controlling for COPD severity and medical burden, anxiety and depression accounted for a significant proportion of the variance in 7 of 8 scales of the SF-36 (Table 2).

Given that somatic anxiety symptoms may be confounded with some COPD symptoms (e.g., shortness of

breath and sweating), the somatic items were removed from the total anxiety score. The BAI items were divided into a somatic subscale (14 items) and subjective subscale (7 items) as suggested by Kabacoff et al.[18] We tested the linear equations again using the subjective BAI subscale rather than BAI total score. Results were consistent with findings from previously tested models.

Fourteen of 43 patients (32.6%) had total BAI scores indicative of moderate to severe anxiety (BAI scores>15). Seventeen of 43 subjects (39.5%) scored higher than 10 on the GDS, indicating moderate to severe symptoms of depression. Ten patients (23.3%) had scores reflecting both moderate to severe anxiety and moderate to severe depression symptoms.

Forty subjects (93%) obtained prescription medications from the HVAMC pharmacy. The remaining 3 subjects had no prescriptions on file, indicating that they either received medication through Medicare or private insurance programs or received no medication at all. Of the 40 patients who did obtain medication from the VA pharmacy in the past year, 5 (12.5%) were on antidepressants (1 amitriptyline, 2 sertraline, 1 amitriptyline/sertraline, 1 trazodone) and 3 (7.5%) were receiving anxiolytics (1 buspi-

TABLE 2. Multiple hierarchical regression of medical burden, COPD severity, depression, and anxiety on functional status

	r^2 Change	F Change	Sig F Change	df	Physical Functioning
Dependent Variable					
Block 1	0.177	4.095	0.025	2,38	[FEV1, MCIRS]
Block 2	0.198	5.688	0.007	4,36	[FEV1, MCIRS, BAI, GDS]
General Health					
Block 1	0.034	0.635	0.536	2,36	[FEV1, MCIRS]
Block 2	0.430	13.654	0.000	4,34	[FEV1, MCIRS, BAI, GDS]
Role-Physical					
Block 1	0.121	2.624	0.086	2,38	[FEV1, MCIRS]
Block 2	0.354	12.139	0.000	4,36	[FEV1, MCIRS, BAI, GDS]
Role-Emotional					
Block 1	0.049	0.963	0.391	2,37	[FEV1, MCIRS]
Block 2	0.337	9.614	0.001	4,35	[FEV1, MCIRS, BAI, GDS]
Social Functioning					
Block 1	0.046	0.925	0.405	2,38	[FEV1, MCIRS]
Block 2	0.473	17.716	0.000	4,36	[FEV1, MCIRS, BAI, GDS]
Bodily Pain					
Block 1	0.076	1.571	0.221	2,38	[FEV1, MCIRS]
Block 2	0.291	8.300	0.001	4,36	[FEV1, MCIRS, BAI, GDS]
Mental Health					
Block 1	0.096	2.013	0.148	2,38	[FEV1, MCIRS]
Block 2	0.639	43.474	0.000	4,36	[FEV1, MCIRS, BAI, GDS]
Vitality					
Block 1	0.019	0.376	0.689	2,38	[FEV1, MCIRS]
Block 2	0.499	18.678	0.000	4,36	[FEV1, MCIRS, BAI, GDS]

Note: DF=degrees of freedom; FEV1 = Forced Expiratory Volume in 1 second; MCIRS=Medical Cumulative Illness Rating Scale; BAI = Beck Anxiety Inventory; GDS=Geriatric Depression Scale.

rone, 1 lorazepam, 1 clonazepam). Within the past year, 4 of these 8 patients receiving psychiatric medications had obtained psychiatric help in the form of psychiatrist visits, psychiatric inpatient hospitalization, or substance abuse group therapy.

With respect to utilization of HVAMC resources, medical burden and, COPD severity did contribute significantly to the overall variance in 3 of the 4 outpatient measures of health care utilization, including total outpatient visits, mental health visits, and emergency room visits. On the other hand, anxiety and depression did not contribute significantly to the overall variance of any of the 4 outpatient measures. For the inpatient health care utilization measures, medical burden, COPD severity, anxiety, and depression did not contribute significantly to inpatient hospitalizations or hospitalization days. These results are presented in Table 3.

DISCUSSION

First, our study provides strong evidence that anxiety and depression are significantly associated with the functional status of COPD patients. Second, utilization of most outpatient health care resources was significantly associated with COPD severity and medical burden but not with anxiety and depression, contrary to expectations generated

from the first finding. Finally, we found that there was great disparity between the prevalence of anxiety and depression symptoms and the recognition and treatment of these symptoms by primary care providers.

Study Limitations

Our study has several limitations. First, our sample was made up of elderly men, mostly White, who were ambulatory and living independently in the community, and almost all of the participants did not have a past psychiatric history. Our results may not be generalizable across age, gender, and ethnicity, or to severely ill, hospitalized patients. Another limitation is our choice of functional status measurement. Other studies of chronic illness and functional disability have relied on physical functioning measures such as a 12-minute exercise tolerance test or the St. George's Respiratory Questionnaire, a test specifically designed for patients with chronic lung disease. We chose to use the SF-36 because of its broad, multidimensional definition of functional status.

Clinical Implications

COPD is a common chronic illness with staggering economic and social costs. Medical care for COPD has

TABLE 3. Multiple hierarchical regression of medical burden, COPD severity, depression, and anxiety on health care utilization in the 1 year before study participation

	r^2 Change	F Change	Sig F Change	DF	Total Outpatient Visit Days
Dependent Variable					
Block 1	0.152	3.419	0.043	2,38	[FEV1, MCIRS]
Block 2	0.044	0.980	0.385	4,36	[FEV1, MCIRS, BAI, GDS]
Primary Care Visit Days					
Block 1	0.031	0.610	0.549	2,38	[FEV1, MCIRS]
Block 2	0.010	0.193	0.825	4,36	[FEV1, MCIRS, BAI, GDS]
Mental Health Visit Days					
Block 1	0.159	3.594	0.037	2,38	[FEV1, MCIRS]
Block 2	0.044	0.989	0.382	4,36	[FEV1, MCIRS, BAI, GDS]
Emergency Room Visit Days					
Block 1	0.166	3.771	0.032	2,38	[FEV1, MCIRS]
Block 2	0.035	0.789	0.462	4,36	[FEV1, MCIRS, BAI, GDS]
Total Inpatient Hospitalization Discharges					
Block 1	0.095	1.991	0.151	2,38	[FEV1, MCIRS]
Block 2	0.034	0.706	0.501	4,36	[FEV1, MCIRS, BAI, GDS]
Hospitalization Days					
Block 1	0.014	0.270	0.765	2,38	[FEV1, MCIRS]
Block 2	0.078	1.554	0.225	4,36	[FEV1, MCIRS, BAI, GDS]

Note: FEV1 = Forced Expiratory Volume in 1 second; MCIRS = Medical Cumulative Illness Rating Scale; BAI = Beck Anxiety Inventory; GDS = Geriatric Depression Scale.

focused mainly on the lung pathology itself. But in our study, anxiety and depression were more strongly related to functional status than COPD severity. However, no conclusions of a cause and effect relationship between anxiety or depression and functional status can be made. Most likely, depressive and anxiety symptoms, functional disability, and disease severity are mutually exacerbating, with each triggering the others.[4] Regardless of the direction of causality, treatment with anxiolytic and antidepressant medications may be followed by a significant improvement in the functional status of COPD patients.[5,12,13] It is imperative that clinicians treat not only the medical illness but also the concomitant psychological symptoms in order to optimize the patient's quality of life.

Even though anxiety and depression contribute significantly to the variance in functional status, they do not seem to play a role in the patterns of health care utilization for both inpatient and outpatient measures. Perhaps our small sample size may have limited our ability to detect small effects in health care utilization differences.

Our data suggest that anxiety and depression may be both underdiagnosed and undertreated within the COPD patient population. Because of their impact on quality of life, screening for anxiety and depression in chronically ill COPD patients should become routine for primary care providers. Furthermore, it is important that providers rec-

ognize the presence of subthreshold variants of depression and anxiety; that is, depression or anxiety symptoms that do not fully meet the established diagnostic criteria. Clinicians may be reluctant to use sedative medications that further aggravate CO_2 retention and respiratory acidosis in COPD patients, but nonsedating alternatives exist among anxiolytics (e.g., buspirone) and antidepressants (e.g., Selective Serotonin Reuptake Inhibitors). Nonpharmacological treatments such as stress management, relaxation training, guided imagery, biofeedback, and cognitive-behavioral approaches can also be used. The frequent co-occurrence of anxiety and depression with COPD, the relationship of such psychopathology to patients' functional impairment, and the availability of effective psychiatric treatments are reasons enough to encourage primary care clinicians to assess and treat anxiety and depression in their COPD patients.

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