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Screening for Depression in Chronic Obstructive Pulmonary Disease

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Abstract

Depression and chronic obstructive pulmonary disease (COPD) are major causes of disability. Identifying COPD patients at risk for depression would facilitate the alleviation of an important comorbidity conferring additional risk for poor outcomes. The purpose of this study was to determine the utility of a brief screening measure, the 15-item Geriatric Depression Scale (GDS-15), in detecting the mood disorders in persons with COPD. This is a cross-sectional study of 188 persons with COPD, stratified by age (65 and older versus less than 65) and COPD severity using Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging. Screening cut-points were empirically derived using threshold selection methods and receiver operating characteristic (ROC) curves were estimated. The GDS-15 was used as a screening measure and diagnoses of Major Depressive Disorder (MDD) or other mood disorders were determined using a “gold standard” standardized structured clinical interview. Of the 188 persons with COPD, 25% met criteria for any mood disorder and 11% met criteria for MDD. Optimal threshold estimations suggested a GDS cut score of 5, which yielded adequate sensitivity and specificity in detecting MDD (81% and 87%, respectively) and correctly classified 86% of participants. To detect the presence of any mood disorder, a cut score of 4 was suggested yielding sensitivity and specificity of 67% and 82%, respectively; correctly classifying 79%. These results suggest that mood disorders are relatively common among persons with COPD. The GDS-15 is a useful screening measure to identify patients at risk for depression.

Keywords

Chronic Obstructive Pulmonary Disease; Depression; Screening; Validity

BACKGROUND

Depression and Chronic Obstructive Pulmonary Disease (COPD) are currently the first and fifth leading causes of disability worldwide, respectively (1). It is well understood that in the medical setting, depression confers additional risk for poor health outcomes, increased

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Declaration of Interest

Dr. Julian has no conflicts of interest, Dr. Gregorich has no conflicts of interest, Ms. Earnest has no conflicts of interest, Dr. Eisner has no conflicts of interest, Dr. Chen has no conflicts of interest, Dr. Blanc has no conflicts of interest, Dr. Yelin has no conflicts of interest, Dr. Katz has no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

disability, and increasing health care costs (2–5). More specifically, persons with concomitant depressive symptoms and airway disease are at increased risk for decreased mobility and function, increased symptom burden, and increased mortality (6–10). Rates of depression among persons with COPD and related airway diseases vary widely and range from 7% to 56% (10–12). The variability in such estimates is due, at least in part, to differences in assessment criteria, cohort validity, and sample sizes.

Identifying patients with sufficient depressive symptoms requiring treatment or referral to specialty care is an ongoing challenge in the medical setting, particularly with the overlapping somatic symptoms common to both chronic medical conditions and depression. Conventional methods considered to be the gold standards for diagnosing depressive disorders are lengthy, require highly trained evaluators, and are typically unavailable and/or prohibitively costly in the general medical settings. Yohannes and colleagues observed that the Brief Assessment Schedule Depression Cards may be a useful interviewer administered screening tool to detect clinical depression among older adults with COPD (13,14). Self-report screening instruments have also been studied in COPD (15,16), however few instruments have been validated against standardized structured interview methods commonly considered to be the “gold standards” for determining diagnoses of depressive disorders.

The Geriatric Depression Scale and the validated 15-item short form (GDS-15) are commonly utilized screening instruments for depression among older adults (17,18). These measures were developed for the purposes of detecting depression, while minimizing the potential confounding effects of overlapping somatic symptoms. Although these measures were initially developed for use in the elderly, they have been found to be useful among younger persons with a range of medical conditions, including Parkinson’s disease (19), chronic heart failure (20), eating disorders (21), and rheumatic conditions (22). The primary goal of this study was to determine the utility of the GDS-15 for depression screening in a cohort of persons with COPD and related airway conditions.

Specifically, the GDS-15 was utilized to detect diagnoses of mood disorders as determined by a gold standard structured clinical interview, the MINI International Neuropsychiatric Interview (MINI)(23). We hypothesized that due to the limited emphasis on somatic symptoms, the GDS would be a useful screening measure for depression in this population. Although there is some evidence that the GDS may be less useful among persons classified as “old-old”, there is also some evidence that the GDS did not perform differently across age groups in other studies (24). Additionally, there is little information on how this measure performs among persons with varying levels of disease severity. As such, secondary aims included evaluating the utility of the GDS among younger versus older COPD patients as well as among COPD patients stratified for disease severity.

METHODS

Recruitment procedures

Participants are derived from a population-based, multi-wave longitudinal cohort study of U.S. adults with airway disease (Cohort description presented previously) (25). Briefly, the cohort was assembled in two separate recruitment waves. In 2001 2,113 adults aged 55 to 75 years were recruited by a random digit dialing procedure among residents of the 48 contiguous U.S. states, using sets of random telephone numbers systematically selected across all eligible telephone blocks within a defined area by Field Research Corporation (San Francisco, CA, USA). This initial recruitment included oversampling from areas with increased airway disease mortality rates, as identified by geographic “hot spots” based on Health Service Areas with the highest COPD mortality rates, derived from the National Institute of Occupational Safety and Health’s *Atlas of Respiratory Disease Mortality, United States: 1982–1993* (26). The telephone

area codes corresponding best to the areas in the top quartile of elevated age-adjusted mortality rates were selected to increase the yield of individuals with COPD, and was further enriched by a pre-screening procedure to identify participants reporting a physician diagnosis of COPD conditions or asthma.

The initial overall study participation rate was 53% among households with an eligible respondent present. The data derived for this investigation was from Wave 5 of this longitudinal study (2006) which included the original cohort along with a supplemental recruitment restriction to northern California.

Wave 5 interview data included a total of 375 subjects; 300 reported diagnoses of COPD. Participants were classified as COPD if they responded “yes” to the following question: “*Has a medical doctor ever told you that you have any of the following medical conditions that can affect that lungs or breathing? COPD or chronic obstructive lung disease.*” All of the participants who resided in northern California were invited to participate in a home based assessment; of these 188 participants completed a home-based assessment. For this study we included participants who were English speaking, age 55 or greater, self-reported physician diagnosis of COPD, and, for the purposes of participation in home visits, residence in the northern California geographical area. All participants provided informed consent according to institution human subject’s protection guidelines.

Interview and home visit procedures

As part of the larger cohort study, all individuals participated in a structured interview performed by trained personnel using computer-assisted telephone interviewing (CATI) software. This CATI interview was approximately 35 minutes in duration and included content such as sociodemographics, symptoms, comorbidities, health care utilization, oxygen use, medication use, smoking status, and functioning across psychosocial and disability domains. In addition to the CATI interview, home-based evaluations were conducted by a team of 2 trained clinical evaluators. The home-based assessments were approximately 2 hours in duration and included a comprehensive assessment of airway symptoms, physical function, lung function (spirometry), disability, a structured psychiatric interview, and self-report questionnaires.

MEASURES

Depression

Geriatric Depression Scale – 15 (GDS-15 (18))—The GDS-15 is a 15-item yes/no self-report questionnaire that can be quickly administered in typically less than 5 minutes. The GDS-15 was developed to assess depressive symptoms without somatic symptoms (e.g., fatigue) which may confound the diagnosis of depression in the elderly or among those with medical conditions (17). The total score on this measure (maximum of 15, with higher scores indicating increased symptom severity) was used as the screening measure.

MINI International Neuropsychiatric Inventory (MINI)(23)—The MINI was utilized as the “gold standard” to determine the presence vs. absence of current Major Depressive Disorder (MDD), or any mood disorder (AMD), including current dysthymia, minor depression and MDD. The MINI was designed as a structured interview to determine diagnoses for the major Axis I psychiatric disorders in the Diagnostic Statistical Manual of Mental Disorders – IV (DSM-IV) and the International Classification of Diseases – 10th Edition (ICD-10). Validation and reliability studies have been conducted comparing the MINI to the commonly utilized Structured Clinical Interview for the DSM-III-R and the Composite International Diagnostic Interview (a structured interview developed by the World Health Organization for lay

interviewers for ICD-10)(23,27), with results of these studies indicating that the MINI has acceptably high validity and reliability scores. The MINI has been used in a range of medical (28), rheumatologic (29) and neurological (30) populations. Evaluators were trained to conduct the MINI and instructed on the administration of standardized clinically informed prompts by a licensed clinical psychologist (LJ), in 12 training days over the course of 3 weeks, including assessments observed by the trainer, and results for all patient interviews were reviewed for proper diagnostic conclusions. On average, the MINI administration is approximately 15–25 minutes. The MINI was administered at the home visit evaluation at least 1 hour after administration of the GDS, by an interviewer blind to the results of the GDS questionnaire.

Disease severity

Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (31)— Spirometry was conducted according to American Thoracic Society (ATS) Guidelines(32, 33), using the EasyOne™ Frontline spirometer (NDD Medical Technologies, Chelmsford, MA), which is known for its reliability, accuracy, and durability (34,35). The Easyone spirometer has been used by large scale multicenter international epidemiologic studies of COPD including the BOLD Study (Burden of Obstructive Lung Disease) and the Platino Study (Latin American Project for the Investigation of Obstructive Lung Disease)(34,36). Percent predicted values were calculated using predictive equations derived from NHANES III (37). COPD severity was staged based on GOLD criteria (stage 0 to IV)(38,39). We used a dichotomous variable (e.g., GOLD Stage ≥ 2 versus <2) to categorize participants with mild disease compared to those with at least moderate disease as patients at GOLD stage ≥ 2 are typically symptomatic, prone to disease exacerbations, and require medical attention (38).

Statistical analyses

Descriptive statistics were used to characterize participant sociodemographic and disease status. To determine the optimal screening cut-point of the GDS-15 for MDD and AMD, receiver operating characteristic (ROC) curves were estimated and two threshold selection methods were utilized: the Youden and a second technique that determines the proximity to perfect correspondence (referred to in this paper as a “Distance to Perfect” index) (40). Briefly, the Youden Index determines the maximum vertical distance from the ROC curve to the diagonal reference, or ‘chance’ line; i.e., the “optimal” cut-point corresponds to the point on the ROC curve farthest from the reference line, which has also been used as a measure of the accuracy of a diagnostic test in clinical epidemiology (41). Similarly, the Distance to Perfect Index selects the point on the ROC curve that is closest to the upper left-hand corner of the graph (0,1), which represents perfect classification (42), thereby minimizing misclassification. Participants were subsequently stratified by age [younger (55–64) and older (65 and older)] and disease severity (GOLD criteria) to determine the utility of the GDS-15 among older and younger respondents and among those with different severities of COPD.

RESULTS

Sociodemographic characteristics of the cohort are presented in Table 1. Fifty percent of persons with COPD met criteria for at least moderate disease severity using GOLD criteria (Class 2 or greater), 19% reported currently smoking, and 79% reported ever smoking. According to MINI diagnostic criteria, any mood disorder (AMD) was present in 24.5% of the cohort (Table 1), with minor depression to be the most prevalent disorder (12.2%), followed by Major Depressive Disorder (MDD)(11.2%), and Dysthymia (1.6%). One person met criteria for both minor depression and dysthymia (.01%).

ROC curve analyses are presented in Figure 1. Results from the Youden and Distance to Perfect indices both suggested that the optimal GDS-15 cut-point to identify cases of MDD was a 5

and above, with a sensitivity of 81% and a specificity of 87%. To detect cases of AMD, the indices yielded two different cut-points. Specifically, a 5 and above cut-point was suggested by the Youden Index with a sensitivity of 59% and a specificity of 82%. Conversely, the Distance to Perfect index yielded a cut-point of 4 and above with a sensitivity of 67% and specificity was 82%. Due to the relatively low sensitivity yielded using the cut-point suggested by the Youden index, a cut-point of 4 and above was selected as the optimal cut-point to detect the presence of AMD in this cohort. Finally, we evaluated threshold characteristics for a diagnosis of Minor Depression. Although both threshold selection methods yielded a suggested cut-off of 3 or more for a diagnosis of Minor Depression, the resulting sensitivity and specificity characteristics were worse than the prior two diagnostic categories (i.e., sensitivity - 69%, specificity - 62%).

Diagnostic statistics stratified by age and disease severity (65 and older versus less than 65, GOLD stage 2 and greater versus less than stage 2, respectively) are presented in Table 2. Performance of the GDS in classifying MDD or AMD was very similar across age groups. The stratification by GOLD criteria is a subset analysis as 22 participants (12%) were unable to be classified on GOLD stages due to contraindications for spirometry. The GDS also performed similarly across disease severity classifications, although the sensitivity was slightly reduced for the GDS to classify MDD among those participants with greater symptoms severity as compared to participants with reduced symptom severity (71% vs. 88%, respectively).

DISCUSSION

The purpose of this investigation was to determine the utility of a brief screen for depression, the GDS-15, for use among persons with chronic airway conditions. In this cohort 11% of persons with chronic airway conditions met criteria for MDD, and 25% met criteria for any mood disorder including MDD, minor depression, and dysthymia, using a comprehensive structured clinical interview for the DSM-IV. Results of the threshold estimation techniques suggested a cut-point score of 5 and above on the GDS-15; which correctly classified approximately 87% of adults as current MDD present versus absent. Diagnostic accuracy for a major depressive episode was not substantially different among older and younger patients, or among those with greater disease severity compared to those with milder disease. Therefore, the GDS-15 is likely a useful screening measure to identify patients who range in age and disease severity to detect the presence of Major Depression.

In detecting major depressive disorder, our study yielded sensitivity and specificity characteristics of 81% and 87%, respectively. These results are comparable with studies using the GDS-15 in other chronic medical conditions (19,20). In airway conditions, the diagnostic accuracy of the Primary Care Evaluation of Mental Disorders (PRIME-MD) depression screen was also investigated and yielded a very good sensitivity rating of 95%, however unfortunately yielded a relatively low specificity rating of 50% (15). Importantly, in this study the self-report PRIME-MD was validated against another self-report questionnaire measure of depressive symptoms (i.e., the Beck Depression Inventory) rather than the gold standard structured clinical interview used in the present study.

We also investigated the utility of the GDS-15 for detection of any mood disorder, including Major Depression, Minor Depression, and Dysthymia. To detect any of these three mood disorders, the threshold estimation techniques suggested a cut-point score of 4 and above which was observed to yield the optimal diagnostic accuracy. However, diagnostic accuracy was decreased in comparison to detection of major depression (79% versus 86% correctly classified), likely due to the heterogeneity of the category of mood disorders, and the low threshold suggested by the DSM-IV to meet criteria for minor depression.

These results suggest that the GDS may be less useful for the detection of this broad category of mood disorders including minor depression. Although a cut-point of 4 and above appears low, subsyndromal depressive symptoms not meeting criteria for a depressive disorder have been observed to place patients at risk for the development of Major Depressive Disorder (43), increased healthcare costs (44,45), and increased disability (46). An optimal approach to treat subthreshold symptoms of depression is unclear; however it may be warranted to monitor those patients who endorse these symptoms of depression more closely in the course of clinical care.

Limitations of this study include the lack of confirmed diagnoses of COPD and the potential for response bias in that healthier individuals may be more likely to participate in this study. However, the inclusion of home-based visits likely captured a wider range of persons as compared to clinic based investigations.

COPD is a leading cause of mortality that is increasing (47), and comorbid depressive symptoms further contribute to the high rates of morbidity and mortality in this condition. Although this study focused on symptoms of depression, other psychiatric syndromes, including anxiety, also can impede the daily lives of patients with COPD. Future studies evaluating tools that can capture a range of psychiatric syndromes that place patients at risk for can help us to quickly identify patients who require treatment could substantially improve health outcomes and quality of life in patients with chronic airway diseases. Results from this study suggest that the GDS-15, which is quickly administered and easily scored, may be a useful tool to identify depression among persons with obstructive airway disease.

Abbreviations

COPD	Chronic Obstructive Pulmonary Disease
GDS-15	Geriatric Depression Scale – 15 item
CATI	Computer-assisted telephone interviewing
MINI	Mini Neuropsychiatric Inventory
MDD	Major Depressive Disorder
AMD	Any mood disorder
DSM-IV	Diagnostic and Statistical Manual of Mental disorders – 4th edition
ICD	International Classification of Diseases
GOLD	Global Initiative for Chronic Obstructive Lung Disease
FEV₁	Forced Expiratory Volume
FEV₁/FVC	Forced Expiratory Volume/Forced Vital Capacity
ROC	Receiver operating characteristic

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Figure 1.
Receiver operating characteristic curves for the Geriatric Depression Scale – Short Form in predicting a diagnosis of mood disorders in pulmonary disorders.

Table 1

COPD patient characteristics

	Total Sample (n = 188)
	M ± SD or n (%)
Age	66.4 ± 5.9
Female (%)	113 (60.1%)
White (%)	172 (91.5%)
College degree or above (%)	62 (33.0%)
Married or with partner (%)	107 (56.9%)
Currently working (%)	34 (18.5%)
GOLD Class 2 or greater ^a	82 (49.4%)
Current smoking (%)	36 (19.1%)
Ever smoked (%)	149 (79.3%)
Geriatric Depression Scale	2.9 ± 2.9
Depressive disorder	
MDD (%)	21 (11.2%)
Minor Depression (%)	23 (12.2%)
Dysthymia (%)	3 (1.6%)
Any mood disorder (%)	46 (24.5%)

Abbreviations: GOLD, Global Initiative for Obstructive Lung Disease; MDD, Major Depressive Disorder.

^a n = 166, 22 participants were unable to complete spirometry studies.

Sensitivity and specificity of the GDS-15 cut-off scores for identifying COPD patients with mood disorders using the MINI Neuropsychiatric Inventory

Table 2

	Major Depressive Disorder Cut-point 5 and above				Any mood disorder Cut-point 4 and above			
	<65 yrs n = 78	≥65 yrs n = 110	Total n = 188		<65 yrs n = 78	≥65 yrs n = 110	Total n = 188	
Stratified by age								
Prevalence n(%)	8 (10.3%)	13 (11.8%)	21 (11.2%)		20(25.6%)	26(23.6%)	46(24.5%)	
Sensitivity	0.75	0.85	0.81		0.75	0.62	0.67	
Specificity	0.84	0.89	0.87		0.83	0.82	0.82	
Positive Predictive Value	0.35	0.50	0.44		0.60	0.52	0.55	
Negative Predictive Value	0.97	0.98	0.97		0.91	0.87	0.89	
Correctly Classified (%)	83%	88%	86%		73%	77%	79%	
Stratified by disease severity								
	GOLD<2 n = 84	GOLD≥2 n = 82	Total n = 166		GOLD<2 n = 84	GOLD≥2 n = 82	Total n = 166	
Prevalence n(%)	8(9.5%)	7(8.5%)	15(9.0%)		18 (21.4%)	17(20.7%)	35 (21.1%)	
Sensitivity	0.88	0.71	0.80		0.61	0.59	0.60	
Specificity	0.90	0.85	0.87		0.85	0.79	0.82	
Positive Predictive Value	0.47	0.31	0.39		0.52	0.42	0.47	
Negative Predictive Value	0.99	0.97	0.98		0.89	0.88	0.88	
Correctly Classified (%)	89%	84%	87%		80%	74%	77%	

Abbreviations: GDS-SF, Geriatric Depression Scale- Short Form; GOLD, Global Initiative for Chronic Obstructive Lung Disease criteria.