Health-related quality of life in individuals with chronic obstructive pulmonary disease (Findings presented in part at the Annual Meeting of the American Thoracic Society in 2001 held in San Francisco, California)

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Hu, J. & Meek, P. (2005). Health-related quality of life in individuals with chronic obstructive pulmonary disease. *Heart & Lung: Journal of Acute and Critical Care*,34(6), 415-422. doi:10.1016/j.hrtlng.2005.03.008

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Abstract:

Background

Health-related quality of life (HRQOL) is an individual's perception of physical and mental health.

Objective

The objective of this study was to examine the relationships between symptoms and HRQOL in individuals with chronic obstructive pulmonary disease (COPD), using a modification of a HRQOL model in COPD.

Design

A correlational descriptive design was used to examine the relationships between symptoms and HRQOL in individuals with COPD.

Subjects

A convenience sample of 58 subjects with a medical diagnosis of COPD, specifically chronic bronchitis or emphysema, was evaluated.

Measures

The Vertical Visual Analogue Scale, Baseline Dyspnea Index, Bronchitis-Emphysema Symptom Checklist, Positive and Negative Affect Scales, Pulmonary Functional Status and Dyspnea Questionnaire, and Medical Outcome Study Short Form-36 Health Survey were used.

Results

Variables that affected the physical health component of HRQOL included breathlessness, physical impairment, and reduced activities of daily living (adjusted $R2 = .52$, $P < .001$), and variables that affected the mental health component of HRQOL were breathlessness, hopelessness and anxiety, and negative affective trait (adjusted $R2 = .58$, $P < .001$).

Conclusions

Breathlessness, physical impairment, reduced activities of daily living, hopelessness and anxiety, and negative affective trait seem to contribute to physical and mental components of HRQOL in individuals with COPD.

Article:

Health-related quality of life (HRQOL) has been defined as an individual's perception of physical and mental health.1 Individuals with chronic obstructive pulmonary disease (COPD) experience breathlessness and limitations in physical functioning,2, 3 and 4 which can lead to disability, alter an individual's lifestyle, and impaired HRQOL.5, 6, 7 and 8 Individuals with COPD are less satisfied with their life and report less ability to perform activities of daily living and poorer physical, social, and emotional functioning than those with coronary artery disease and other chronic conditions. They also rate their health as poorer.9, 10 and 11

Jones' theoretic model of HRQOL in COPD12 was proposed to explain the impact of breathlessness on HRQOL. The model posits the consequences of breathlessness and the progression of decreased functioning and physical impairment, leading to decreased HRQOL. In the original model, the relationships among breathlessness, depression and anxiety, exercise limitation (physical impairment), reduced mobility (reduced

activities of daily living), attitudes and expectations (negative affective trait), and lifestyle restriction (HRQOL) were viewed as reciprocal (Fig 1). The model was modified in the current study to examine simple causal order without reciprocal relationships (Fig 2). On the basis of the modified model, we hypothesized that in individuals with COPD, pulmonary function (airway obstruction), breathlessness, and physical impairment would have indirect effects on HRQOL, whereas depression and anxiety, negative affective trait, and reduced activities of daily living would have direct effects on HRQOL. The model is supported by the strong correlations between breathlessness, physical impairment, reduced activities of daily living, and HRQOL in patients with COPD.13, 14, 15 and 16

FIGURE 1 IS OMITTED FROM THIS FORMATTED DOCUMENT

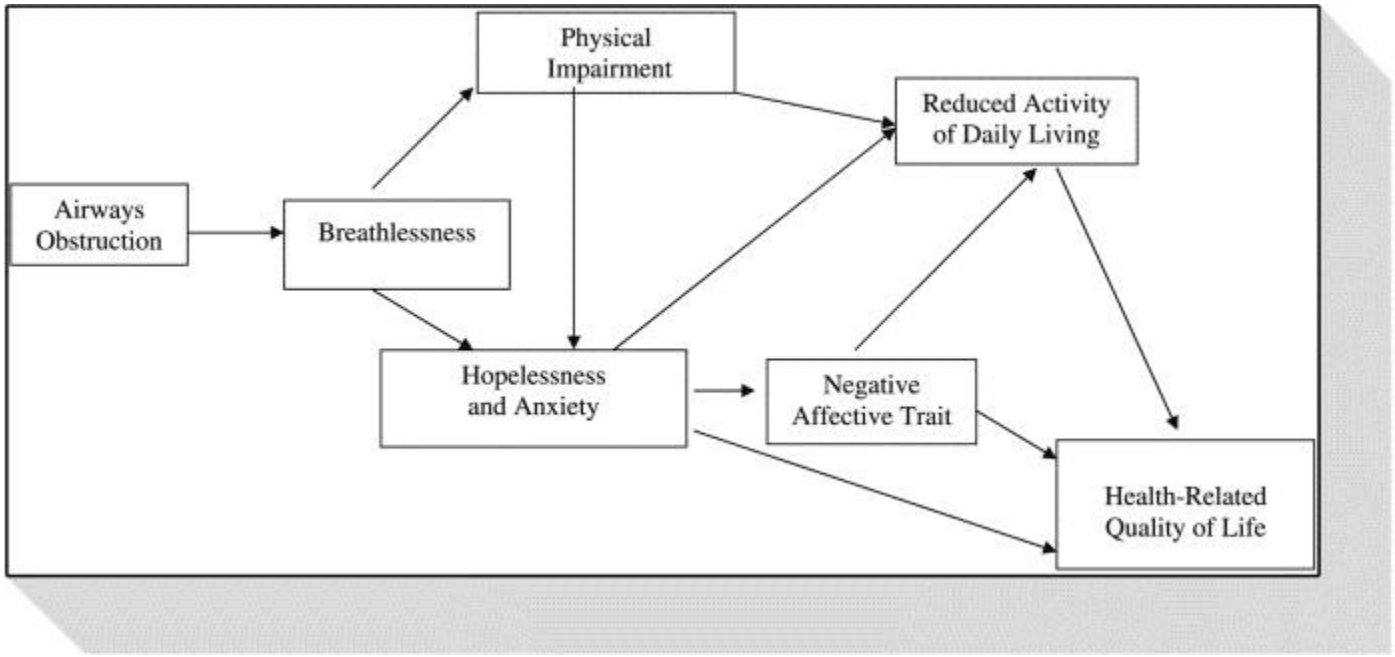

Fig 2. Modified Jones' HRQOL model in COPD.

The most common symptom of COPD is breathlessness, a distressing experience that is associated with limitations in activities of daily living, disability, and poorer QOL.17 Viramontes and O'Brien,18 for example, found that patients with more severe dyspnea had more deficits in domains of health perception, physical functioning, physical role, and energy. Schlenk and colleagues,11 who compared the impact of disease on HRQOL in individuals with COPD, and other chronic diseases, found that individuals with COPD showed lower physical and social functioning and reported poorer role-physical, role-emotional, and mental health than individuals with other chronic disorders.

In sum, physical functioning and psychologic well-being have been found to be the most important determinants of HRQOL in elderly individuals with COPD.8 A.M. Yohannes, J. Roomi, K. Waters and M.J. Connolly, Quality of life in elderly patients with COPD: measurement and predictive factors, Respir Med 92 (1998) (10), pp. 1231–1236.8 Inability to participate in leisure activities and interactions with friends decrease in these individuals, leading to social deprivation and isolation.19 Moody and colleagues20 found that reduction in functional status was significantly correlated with HRQOL ($r = .49$). Several studies of patients with COPD have found that anxiety and depression were significantly associated with reduced HRQOL.2, 3, 21, 22 and 23 Bosley and colleagues,24 for example, reported that patients with COPD who perceived poor HRQOL were also more likely to be depressed. Morgan and colleagues19 suggested that psychosocial factors such as social deprivation and isolation, rather than physical limitation, might be the major determinants of HRQOL in patients with COPD.

Negative affective trait, which is defined as human trait that when manifest negatively influences on both ways of thinking and behavior, often coexists with chronic illness and may also relate to an individual's functional status, symptom perception, and HRQOL.25

Few studies have examined the relationships among breathlessness, functional status, depression, and HRQOL in individuals with COPD using a theoretic model of HRQOL. Validation of hypothesized relationships among these variables would provide direction for nursing assessment and intervention. Therefore, to test these hypotheses, this study examined the relationships between symptoms and HRQOL in individuals with COPD by using path analysis.

Methods

Research design

The relationships between symptoms and HRQOL in individuals with COPD were examined as part of a longitudinal study26 that investigated the ways in which individuals evaluated symptoms, specifically breathlessness. The data used in the current study were obtained at the initial measurement point.

Subjects

A convenience sample of 58 subjects with a medical diagnosis of COPD, specifically chronic bronchitis or emphysema, was obtained from communities and pulmonary rehabilitation clinics in the Southwest and from a large Veterans' Affairs medical center on the West coast. The criteria for inclusion were clinical diagnosis of COPD with a ratio of forced expiratory volume in 1 second (FEV1) to forced vital capacity less than 65% or FEV1 values less than 65% of predicted; age 40 years or older; ability to read and speak English; without hospitalization or emergency room visits in the last 6 weeks, or history of uncontrolled congestive heart failure; without recent history of alcohol or drug use, or mood altering drug use; and ability to record/report breathless episodes two to three times per week.

Data-collection method

The study was approved by the Human Subjects Committee of the University and participating institutions. Individuals who met the study criteria were recruited though telephone contact, and the research was explained. A baseline visit was then scheduled, at which time the study procedures were explained and spirometric testing was conducted to confirm the presence and severity of COPD. Subjects who met the criterion of pulmonary impairment, measured by FEV1 percent of predicted, were enrolled in the study.

Instruments

A demographic questionnaire was used to obtain subjects' demographic and disease information. The Vitalograph alpha 1® Spirometer was used to measure airway obstruction according to the guidelines established by the American Thoracic Society.27 The Vertical Visual Analogue Scale (VAS) was used to measure both the distress of breathlessness and effort of breathing. The VAS28 is a vertical line from 0 to 100 mm with the anchors "no distress" and "greatest possible distress" or "no effort" and "greatest possible effort" associated with breathing; higher scores indicated more distress or effort. The reliability of the VAS in general has been established for individuals with breathlessness.29, 30 and 31 The VAS has been used successfully to measure breathing distress and efforts in patients with pulmonary disease and normal subjects.30 and 31 The VAS breathing effort and distress scales have been found to be stable using intraclass correlations.32 In addition, the mean of these scores taken daily over a 2-week period were found to be moderately correlated (r = .48, .56) with self-reported number of breathless episodes per day, supporting their validity as a measure of breathlessness.32 The intraclass correlations were .96 for breathing distress and .94 for effort in the present study.

The Baseline Dyspnea Index (BDI) was used to assess individuals' physical impairment. The BDI measures the impact of dyspnea on functional impairment, magnitude of physical effort, and magnitude of tasks in patients with respiratory and cardiac diseases.33 Each component of the BDI has a score from 0 (severe) to 4 (no impairment). The three components (ranging from 0 to 12) are summed, with lower scores indicating greater

impact of breathlessness on function. Reliability and validity of the BDI are well established.33 and 34 The BDI's internal consistency in this sample, using Cronbach's alpha, was acceptable ($\alpha = .77$).

The BDI score has been shown to be highly related to exercise limitation, measured with the 12-minute walking distance ($r = .60$, $P < .01$) a common measure of exercise limitation in patients with COPD.33 and 35 The BDI was used in this investigation as a self-report measure of exercise limitation that is closely related to physical measures such as the walk test.

The anxiety and hopelessness/helplessness subscales of the Bronchitis-Emphysema Symptom Checklist (BESC) were used to measure anxiety and hopelessness, which is a mood state closely aligned with depressive mood.36 The BESC is a 73-item questionnaire that measures symptoms, sensations, and feelings associated with an episode of dyspnea. Items are scored on a 5-point scale from "never," scored 0, to "always," scored 5. Higher scores indicate more frequent occurrences. Internal consistency reliabilities indicate that each symptom category is highly reliable, with Cronbach's alphas of .81 to .94, BESC-A: $\alpha = .90$; and BESC-HH: $\alpha = .91$.36 In this study, Cronbach's alpha was .94.

The Positive and Negative Affect Scales (PANAS) were used to measure negative affective trait. The PANAS measures two dimensions of attitude, but only Negative Affect (PANAS-N) was used in this study. The PANAS-N measures an individual's subjective distress, anger, contempt, disgust, guilt, fear, and nervousness. The PANAS-N consists of 10 items scored on a Likert scale, with 1 indicating "very slightly" or "not at all"; 2 "a little"; 3 "moderately"; 4 "quite a bit"; and 5 "extremely."37 The lower the score, the less negative trait detected. Cronbach's alphas for the PANAS-N range from .84 to .87.37 Examination of the PANAS-N in this sample revealed excellent internal consistency ($\alpha = .92$).

The changes in activity scale of the Pulmonary Functional Status and Dsypnea Questionnaire (PFSDQ-Act)38 was used to measure activities of daily living. The PFSDQ-Act consists of 79 activities of daily living scored based on changes subjects have experienced in performing those activities since the onset of disease. It measures intensity of dyspnea with activity changes in individuals with COPD. A Likert scale is used, with 1 indicating "as active as I've ever been," and 10 indicating "have omitted entirely." The higher the score, the more change or disability experienced. The coefficient alphas for the PFSDQ-Act subscales ranged from .86 to .94. Cronbach's alpha was .97 in this study.

The Medical Outcomes Study Short Form (SF-36) Health Survey was used to measure the physical and mental components of HRQOL. The SF-36 consists of two major constructs: physical health and mental health, with eight health concepts represented by 36 items. The SF-36 uses Likert scaling for summed ratings. Each subscale score is transformed from normal scaling to a 0 to 100 standardized score, with higher scores indicating better health status and QOL. The SF-36 scales are normed using means and standard deviations and aggregated using weights. T-score transformations are used for the aggregated Physical Component Summary (SF-36-PCS) and Mental Component Summary (SF-36-MCS) scores.39 In this study, the physical and mental components (SF-36-PCS and SF-36 MCS) were used as outcome variables because it was believed separate analysis provided greater information about the proposed relationships particularly as it related to the mental (emotional) HRQOL. For example, potentially the emotional components such as hopelessness and anxiety will have a different impact on the SF-36 MCS compared with the SF-36 PCS. The SF-36 has demonstrated good internal-consistency reliability with alpha coefficients for components ranging from $\alpha = .78$ on general health to $\alpha = .93$ on role physical.40 Validity has been established for the SF-36.41 In the current study, the Cronbach's alpha was .83 for SF-36-PCS and .89 for SF-36-MCS.

Statistical analysis

Path analysis was used to test a just-identified relationship of the model in which both direct and indirect paths among variables were tested. Statistical significance level was set at P less than .05. The variables and proposed relationships met the assumptions of path analysis as described by Pedhazur.42 A separate path analysis using multiple regression was used for the physical (SF-36-PCS) and mental (SF-36-MCS) components of the SF-36.

Steps in the analysis and the variables entered into the regression are presented in Table I. Pearson's correlational analysis was used to screen the variables in the model (Table II). For relationships to be examined in the regression analysis, coefficient values of .20 were required to reflect at least minimal relationship strength (small effect size).43 Airway obstruction measured with FEV1 % had correlations less than .20 with other variables in the model, and therefore Step 1 as proposed was not carried out. As each independent variable was entered into the regression model, the change in R2 was examined for statistical significance. Adjusted R2 values and the standardized regression coefficients (betas) were computed.

Table I.

Regression equations to test just-identified relationships in the model

Step	Dependent variables	Independent variables
1	Breathlessness (VAS-D, VAS-E)	Airway obstruction (FEV_1 and FVC)
2	Physical impairment (BDI)	Breathlessness and airway obstruction
3	Anxiety and Hopelessness (BESC-A, BESC-HH)	Physical impairment, breathlessness, and airway obstruction
4	Negative Affective Trait (PANAS-N)	Anxiety and hopelessness, physical impairment, breathlessness, and airway obstruction
5	Reduced Activities of Daily Living (PFSDQ-Act)	Negative affective trait, anxiety and hopelessness, physical impairment, breathlessness, and airway obstruction
6	HRQOL (SF-36: PCS, MCS)	Reduced activities of daily living, negative affective trait, anxiety and hopelessness, physical impairment, breathlessness, and airway obstruction

VAS, Visual Analogue Scale; *FEV_1*, forced expiratory volume in 1 second; *FVC*, forced vital capacity; *BDI*, Baseline Dyspnea Index; *BESC-A*, Bronchitis Emphysema Symptom Checklist-Anxiety; *BESC-HH*, BESC-hopelessness/helplessness; *PANAS-N* Positive and Negative Affect Scale–Negative Affect; *PFSDQ-Act*, Pulmonary Functional Status and Dyspnea Questionnaire changes in activity scale; *HRQOL*, health-related quality of life; *SF*, Short Form; *PCS*, Physical Component Summary; *MCS*, Mental Component Summary.

Table II.

Pearson product moment correlation coefficients for model variables (N = 58)

Variables	1	2	3	4	5	6	7	8
1. FEV_1%	—	.01	−.17	.17	.12	.03	−.07	−.08
2. VAS			.26*	.32*	.41*	.33*	.29*	.54†
3. BDI				−.24*	−.27	−.56*	−.66†	−.18
4. BESC					.58†	.23	−.28*	−.47†

Variables	1	2	3	4	5	6	7	8
5. NAS						.11	−.06	−.74†
6. PFSDQ							.62†	.14
7. SF-36 PCS								.01
8. SF-36 MCS								—

Numbers in bold and italics represent those below the .20 criteria.

FEV1%, Forced expiratory volume in 1 second percentage of predicted norms; VAS, Visual Analogue Scale combined average breathing distress and effort score; BDI, Baseline Dyspnea Index; BESC, Summated scores of the helplessness/hopelessness and anxiety subscales of the Bronchitis Emphysema Symptom Checklist; NAS, Negative Affect Scale; PFSDQ, The activity component of the Pulmonary Functional Status and Dyspnea Questionnaire; SF-36 PCS, Short Form-36 Physical Component Summary; SF-36 MCS, Short Form-36 Mental Component Summary.

* $P < .05$.

† $P < .01$.

Results

Subjects' ages (N = 58) ranged from 55 to 88 years, with a mean of 70.2 years (standard deviation = 8.28). Thirty-four (59%) were men, and 24 (41%) were women. Subjects had moderate to severe airflow obstruction (M = 40.49%), as evidenced by the values on FEV1 percentage of predicted. The average time since diagnosis with COPD was 15.53 years (standard deviation = 16.39). Approximately 97% of the subjects used an inhaled bronchodilator (β-2 agonist or anticholinergic type), and 74.1% used two or three different kinds of inhalers. Oral prednisone was taken by 16.3% of the subjects. Twelve subjects (21%) were on continuous supplemental oxygen.

Four just-identified paths were included in the model: (1) direct effect of breathlessness on reduced activities of daily living; (2) direct effect of breathlessness on negative affective trait; (3) direct effect of breathlessness on mental health component of HRQOL; and (4) direct effect of physical impairment on physical component of HRQOL (Fig 3).

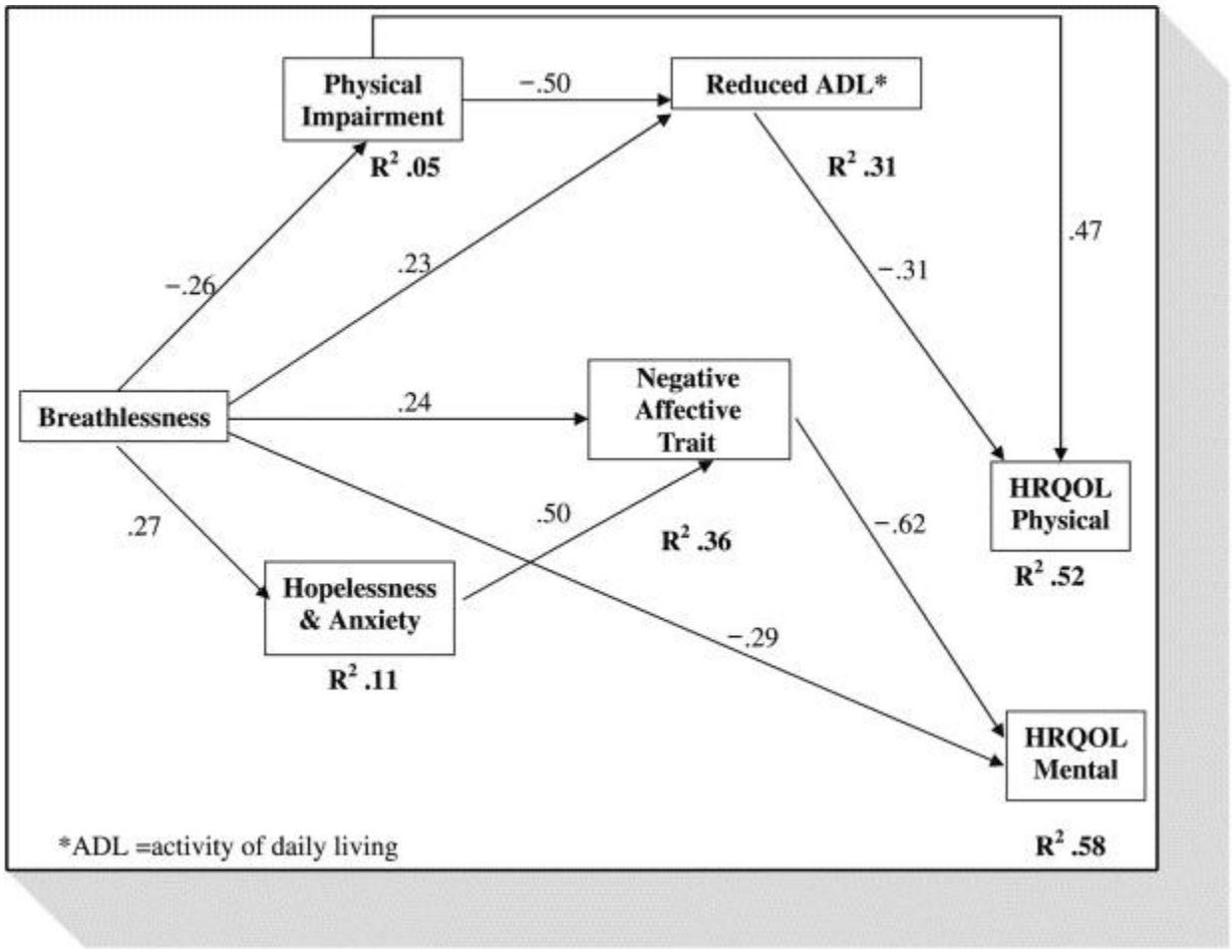

Fig 3. HRQOL in COPD.

In the final model, variables that have impacts on the physical health component of HRQOL included breathlessness, physical impairment and reduced activities of daily living (adjusted R2 = .52, P < .001), and variables that had an impact on the mental health component of HRQOL were breathlessness, hopelessness and anxiety, and negative affective trait (adjusted R2 = .58, P < .001). Breathlessness and negative affective trait had significant direct impacts on mental health component of HRQOL and physical impairment, and reduced activities of daily living had significant direct effects on the physical health component (Fig 3). Also, breathlessness (β = −.26, P < .05) through physical impairment (β = −.50, P < .001) and reduced activities of daily living (β = −.31, P < .001) had a strong effect on the physical component of HRQOL and breathlessness (β = .27, P < .05) through hopelessness and anxiety (β = .50, P < .001) and negative affective trait (β = −.62, P < .001) had a strong effect on the mental component of HRQOL. Although it was hypothesized that hopelessness and anxiety would have a direct effect on HRQOL, this was not supported by the data; hopelessness and anxiety had only indirect effects through negative affective trait.

Discussion

Breathlessness, negative affective trait, physical impairment, and reduced activities of daily living had significant impacts on HRQOL in these individuals with COPD. Breathlessness had particularly adverse effects on an individual's perception of mental health. This finding is congruent with a recent study that examined the relationships of breathlessness and disease severity to HRQOL in individuals with COPD44 and found that individuals with more severe breathlessness had poorer scores on the mental health component of HRQOL and on two areas of physical HRQOL. The results are also consistent with Moody et al's20 model for individuals with COPD, in which dyspnea severity has a direct effect on HRQOL. Unlike Moody et al's study,20 however, in this study breathlessness was more associated with the mental component of HRQOL than the physical

component. Breathlessness was related to physical impairment in this study: the greater the breathlessness, the greater the physical impairment. Previous studies45 and 46 have also found that breathlessness was a predictor of physical impairment. Finally, the relationship observed here between breathlessness and hopelessness and anxiety is also consistent with other findings.31, 36, 47, 48 and 49

Reduced activities of daily living and physical impairment had significant impacts on the physical health component of HRQOL. This is in consistent with the work of Schrier and colleagues15 and Viramontes and O'Brien,18 who found an association between reduced activities of daily living and decreased HRQOL. Similarly, Mahler and Mackowiak50 found that physical impairment was strongly correlated with the physical health component of HRQOL, and Moody and colleagues20 found that reduced activities of daily living were associated with decreased QOL.

Negative affective trait had a strong direct impact on the mental health component of HRQOL: the higher the negative affective trait score, the lower the score on the mental health. Similarly, Koller and colleagues51 found that in individuals with cancer, those with negative affective trait had poorer general HRQOL. Watson and Pennebaker52 and Watson et al37 also reported that people with more negative affective trait were more likely to have negative perceptions of their health and were less satisfied with their lives. A unique implication of these findings for nurses and health care providers is the need to be aware that breathlessness has a direct impact on negative affective trait. Negative affective trait is strongly associated with decreased mental component of HRQOL in individuals with COPD, and this association has been neglected in practice. People with higher negative affective trait are more likely to perceive decreased HRQOL.

This study was a secondary analysis of data, however, limiting the fit between the conceptual definitions of variables and the instruments used in the original study, and restricting variables to those in the original data set.53, 54 and 55 Another limitation of this investigation was the lack of control on temporal ordering of predictor variables. Jones' original model proposed numerous reciprocal relationships that were not tested in this investigation and speak to the cyclical relationship of breathlessness, emotions, HRQOL, and the difficulty establishing cause and effect. Also the small sample in the study poses a problem. In causal modeling, a large sample is required to test the theoretic model to reduce the artificial inflation of relationships.56 Many factors that were not examined in the present study might influence the perception of HRQOL of an individual with COPD, including demographic variables, disease severity, weather conditions, participation of pulmonary rehabilitation program, self-efficacy, and social support. Also small sample size reduced statistical power and increased the risk of type II error. Therefore, given these limitations, the study needs to be replicated with temporal ordering a larger sample and analysis techniques that allow examination of reciprocal relationships to make any definitive statements about these HRQOL relationships in individuals with COPD.

Although more research is needed, the study findings suggest that breathlessness has significant adverse effects on an individual's perception of HRQOL. The major implication of these findings for clinical practice is that nurses and other health care providers should assess dyspnea and activity levels and be aware of how these may influence HRQOL. Health care providers can help individuals with COPD decrease breathlessness through participating in educational, rehabilitation, or other programs, designed to decrease breathing effort and associated distress. Nurses and other health care providers should also be aware that both physical impairment and reduced activities of daily living can lead to poorer HRQOL and implement interventions to decrease physical impairment and increase activities of daily living such as encourage patients participating in pulmonary rehabilitation program as a mechanism to improve symptoms and increase HRQOL. Finally, nurses should assess for signs of negative affective trait and be aware that hopelessness and anxiety may be associated with this trait. Nurses need to recommend treatment for hopelessness and anxiety even though negative affective trait may not be amenable to treatment. Nurses need to consider implementing interventions that are targeted at symptom experience, and that are coordinated with family, other health care providers, and the health care system to decrease the impacts of breathlessness, physical impairment, and negative affect on HRQOL.56

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Supported by Grant 5R29NRO1437 from the National Institute of Nursing Research.