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Health-related quality of life and chronic obstructive pulmonary disease in North Carolina

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Abstract

Background: Comparisons of health-related quality of life (HRQOL) between persons with chronic obstructive pulmonary disease (COPD) and adults in the general population are not well described. **Aims:** To examine associations between COPD and four measures of HRQOL in a population-based sample. **Patients & Methods:** These relationships were examined using data from 13,887 adults aged ≥18 years who participated in the 2007 Behavioral Risk Factor Surveillance System (BRFSS) conducted in North Carolina (NC). Logistic regression was used to obtain adjusted relative odds (aOR). **Results:** The age-adjusted prevalence of COPD among NC adults was 5.4% (standard error 0.27). Nearly half of adults with COPD reported fair/poor health compared with 15% of those without the condition (age-aOR, 5.5; 95% confidence interval [CI], 4.4 to 6.8). On average, adults with COPD reported twice as many unhealthy days (physical/mental) as those without the condition. The age-adjusted prevalence of ≥14 unhealthy days during the prior 30 days was 45% for adults with COPD and 17% for those without. The aOR of ≥14 unhealthy days was 1.7 (95% CI, 1.4 to 2.2) times greater among adults with COPD compared with those without. **Conclusions:** These results suggest COPD is independently associated with lower levels of HRQOL and reinforce the importance of preventing COPD and its complications through health education messages stressing efforts to reduce total personal exposure to tobacco smoke, occupational dusts and chemicals, and other indoor and outdoor air pollutants linked to COPD and early disease recognition. Our findings represent one of the few statewide efforts in the US and provide guidance for disease management and policy decision making.

Keywords: Health-related quality of life, chronic obstructive pulmonary disease, North Carolina, behavioral risk factor surveillance system, age-adjusted prevalence, adults, pollutants, tobacco, occupational dusts, chemicals, policy decision making.

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Introduction

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines COPD as "a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases" [1]. In

2006, COPD affected approximately 12 million US adults with nearly 24 million Americans having evidence of impaired lung function based on GOLD criteria [2, 3]. In 2005, approximately 125,000 persons aged ≥25 years in the United States died with COPD as the underlying cause, an increase of 8% from COPD deaths in 2000, with considerable variations in mortality rates across states [4].

Health-related quality of life (HRQOL) has evolved to include aspects of life that affect perceived physical, emotional, and social aspects of health and well-being, and it is a fundamental measure used to understand the health status of a population [5]. HRQOL is increasingly used as an outcome measure in clinical populations with COPD, but few studies have compared the HRQOL of persons with COPD with health of adults in the general population (i.e., population-based samples) to monitor the burden of COPD. In this study, we examined associations between COPD and HRQOL among a large sample of adults aged 18 years or older residing in North Carolina during 2007 using data from the Behavioral Risk Factor Surveillance System (BRFSS).

Patients and Methods

The BRFSS is a state-based surveillance system which collects data on many of the behaviors and conditions that place adults (aged ≥18 years) at risk for chronic disease. Trained interviewers collect data on a monthly basis using an independent probability sample of households with landline telephones from the noninstitutionalized North Carolina population. In 2007, complete survey data were collected for 13,887 persons in North Carolina (partial complete surveys totaled 890). The Council for American Survey Research Organizations (CASRO) response rate for North Carolina in 2007 was 55%, and the cooperation rate (*i.e.,* the proportion of all respondents interviewed of all eligible units in which a respondent was selected and actually contacted) was 75% [6]. Although response rates have declined for BRFSS, as well as for other telephone and personal interview surveys globally, research suggests little bias as a result of the nonresponse rate at this point-in-time with BRFSS estimates paralleling those of other national surveys in the US [7,8,9]. A detailed description of the survey's design and random sampling procedures is available [10]. The BRFSS has been approved as exempt research by the Centers for Disease Control and Prevention's institutional review board.

COPD was defined by an affirmative response to the question, "Have you ever been told by a doctor or health professional that you have chronic obstructive pulmonary disease (COPD), emphysema or chronic bronchitis?" The crude prevalence of COPD was greater among those excluded from the analysis (9.4% [standard error, 1.03] vs. 5.6% (0.27)).

All survey respondents were also asked four questions related to their health status or HRQOL: (1) "Would you say that in general your health is excellent, very good, good, fair, or poor?"; (2) "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?"; (3) "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"; and (4) "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" Respondents were not asked for specific underlying reasons of any reported unhealthy days. These questions and their validity and reliability are described elsewhere [5, 11-14]. We calculated overall unhealthy days as the sum of physically and mentally unhealthy days, not to exceed 30 days. We defined a dichotomous HRQOL variable as <14, ≥14 unhealthy days. A total of 14 unhealthy days is a meaningful cut point for those reporting substantially impaired HRQOL and corresponds to the upper 10% to 15% of the distribution for each healthy day's measure in the BRFSS [15]. With the exception of unhealthy mental days and activity limitation days, measures of HRQOL were lower among those excluded from the analysis (data not shown).

Prevalences were age-standardized to the 2000 US standard population [16]. We used logistic regression to obtain odds ratios (ORs) and 95% confidence intervals (CIs) adjusted for age (<45, 45 to 54, 55 to 64, 65 to 74, ≥75), gender, race/ethnicity (white, black, other, Hispanic), veteran status (yes/no), education (< high school, high school, some college, college graduate), employment status (employed, self-employed, unemployed, not able to work, other), income, health insurance (yes/no), time since last routine checkup (<12 months, 12 to 23 months, 24 to 59 months, ≥60 months, never), smoking status (current, former, never), body mass index (<18.5, 18.5 to 24.9, 25.0 to 29.9, ≥30.0 kg/m^2), diabetes (yes/no), high blood cholesterol (yes/no), hypertension (yes/no), heart disease or stroke (yes/no), and asthma (yes/no). Confidence interval functions [17] are provided for associations between measures of health-related quality of life and COPD. The data were weighted to account for the age, race, and gender distribution in the state. We used SUDAAN 9.0 (RTI International, Research Triangle Park, NC) to account for the survey's complex sampling design.

Results

For this analysis, data were available for 11,878 persons aged 18 years or older who had complete information for study variables. Overall, 11% of adults were 18 to 24 years of age; 19%, 25 to 34; 20%, 35 to 44; 19%, 45 to 54; 15%, 55 to 64; 9%, 65 to 74; and 7%, 75 or older. Half (51%) of the sample were women; and 74% were white, 18% black, 8% other, and 7% Hispanic. Nearly 59% of adults had more than a high school education, nearly one-quarter were current smokers (23%), 29% were obese [body mass index (BMI) ≥30 kg/m^2], 9% reported diabetes, and 9% had cardiovascular diseases. Persons excluded from the analysis were slightly younger and less likely to be men, of white race, non-Hispanic ethnicity, or a college graduate

compared with those included in the study.

The age-standardized prevalence of self-reported, physician-diagnosed COPD among adults aged ≥18 years was 5.4% (standard error, 0.27) (n=1198). The age-adjusted prevalence of COPD is shown in Table 1 by respondent characteristics including sociodemographics, access to care, and comorbid conditions. As expected, we observed an increased prevalence with increasing age. The slightly lower prevalence among those aged 75 years or older is not surprising since BRFSS is a point-in-time survey and those who survive to age 75 and are able to complete the survey are more likely to be healthier overall (and therefore less likely to have COPD). The prevalence of COPD was greater among those with lower education levels (vs. college graduates), the unemployed or those unable to work (vs. employed persons), persons with lower income levels (vs. those with incomes ≥$75,000), as well as among those who reported never visiting a doctor for a routine checkup (vs. those with a routine doctor visit within the past 12 months). Finally, the prevalence of COPD was greater among persons with selected comorbid conditions including asthma, diabetes, hypertension, hypercholesterolemia, and cardiovascular diseases than for those without these conditions (Table 1).

The age-standardized prevalences of 14 or more unhealthy days during the previous 30-day period and fair or poor health status by COPD status are shown in Figure 1. For each HRQOL measure, the prevalence of 14 or more unhealthy days and fair or poor health was greater among persons with COPD compared with those without.

We examined the relationship between the number of unhealthy days during the previous 30-day period and COPD. Overall, the mean (standard error) number of unhealthy days (physical or mental) for all adults was 6.1 (0.13); 51% of respondents reported no unhealthy days (physical or mental). On average, adults with COPD reported more than twice as many physically or mentally impaired days (13.7 [0.68] vs. 5.7 [0.14]). After age adjustment, adults with COPD had 8 (95% CI, 6.6 to 9.3) more unhealthy days (physical or mental) on average than adults without COPD.

We estimated the relative odds of reporting 14 or more unhealthy days comparing adults with COPD with those without after multivariable adjustment (Fig. 2). Adults with COPD were more likely to have lower levels of HRQOL for each of the 4 unhealthy day measures compared with adults without COPD. For example, the relative odds of 14 or more unhealthy (physical or mental) days were 1.7 (95% CI, 1.4 to 2.2) times greater among adults with COPD than among those without after multivariable adjustment. Compared with those without the condition, persons with COPD were 2.8 (95% CI, 2.1 to 3.7) times more likely to report fair or poor health after multivariable adjustment (age-adjusted OR, 5.5; 95% CI, 4.4 to 6.8).

Table 1 Prevalence of self-reported, physician-diagnosed COPD by respondent characteristics, North Carolina, 2007, Behavioral Risk Factor Surveillance System.

Respondent Characteristic	Age-Adjusted* Prevalence of COPD % (standard error)	aOR (95% CI)†
Overall	5.4 (0.27)	
Age, years		
< 45	2.5 (0.40)	1.0 (referent)
45–54	5.5 (0.55)	2.5 (1.7–3.6)
55–64	8.5 (0.66)	4.0 (2.8–5.7)
65–74	13.1 (0.94)	5.7 (4.0–8.1)
≥ 75	11.1 (1.03)	4.3 (3.0–6.4)
Sex		
Men	5.3 (0.46)	1.0 (referent)
Women	5.5 (0.29)	1.1 (0.9–1.3)
Race		
White	5.5 (0.31)	1.0 (referent)
Black	4.2 (0.55)	0.6 (0.4–0.8)
Other	7.8 (1.90)	1.1 (0.6–1.9)
Hispanic ethnicity		
No	5.2 (0.26)	1.0 (referent)
Yes	8.6 (1.93)	1.2 (0.7–2.7)
Education		
Less than high school	10.9 (1.11)	4.0 (2.9–5.6)
High school	6.1 (0.51)	2.2 (1.7–2.9)
Some college	5.3 (0.61)	1.9 (1.4–2.6)
College graduate	3.1 (0.30)	1.0 (referent)
Veteran		
No	5.5 (0.30)	1.0 (referent)
Yes	4.5 (0.55)	1.0 (0.8–1.4)

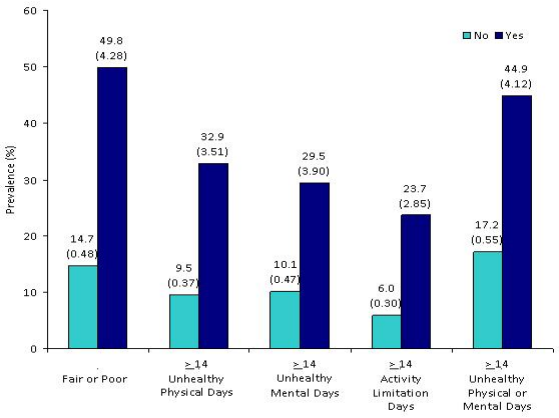
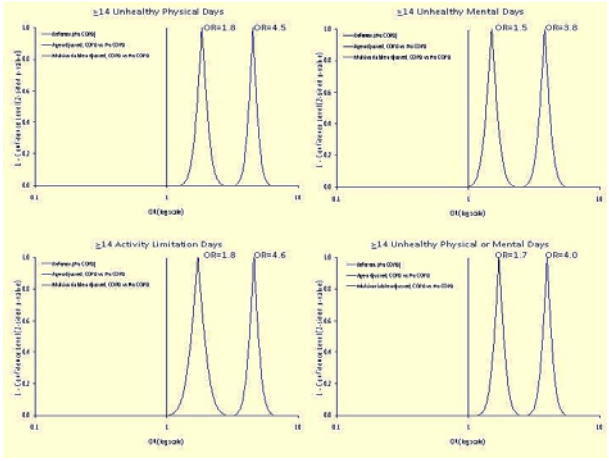


Fig. 1 Age-adjusted prevalence of fair or poor health and unhealthy days by COPD status, North Carolina, 2007, Behavioral Risk Factor Surveillance System.



COPD: Chronic obstructive pulmonary disease, OR: Odds ratio, CI: Confidence interval, *Multivariable-adjusted models adjusted for all variables shown in Table 1.

Fig. 2 Confidence Interval Functions for Associations Between Measures of Health- Related Quality of Life and COPD, North Carolina, 2007, Behavioral Risk Factor Surveillance System.

Discussion

COPD is a growing public health problem. According to projections, COPD is predicted to become the third leading cause of death worldwide by 2030 [18]. In this population-based, cross-sectional study, we observed that adults with COPD have lower levels of HRQOL than those without the condition. After age adjustment, adults with COPD reported 8 additional days of impaired physical or mental health during the previous 30 days than adults without COPD. Furthermore, adults with COPD were 70% more likely to report 14 or more unhealthy days (physical or mental) during the previous 30 days.

The results of this analysis are subject to some limitations. These data are cross-sectional; therefore, determinations of cause-and-effect are not possible. BRFSS is a telephone-based survey; therefore, persons of low socioeconomic status or those who are institutionalized are less likely to have a telephone and be included in BRFSS. Recent research also identifies differences between persons who only maintain a cell phone, and therefore are not included in the BRFSS, compared with persons who maintain a household landline [19]. Nonresponse is always a concern in survey research with regards to the possible introduction of bias; findings of others suggest that low response rates in the BRFSS do not appear to bias estimates at the national level [7-9].

Severity of COPD is not taken into account in this analysis. Also, because BRFSS interviews only noninstitutionalized persons, persons with COPD in this study may have less severe disease and/or comorbid conditions than the total COPD population in North Carolina. Data are self-reported; it is unclear how well self-reported COPD reflects true presence of disease. Also, the HRQOL measures used in this study are global measures; research comparing global with disease-specific HRQOL measures may provide different results.

Considering these limitations, the results of this study are consistent with prospective population-based studies. The Third US National Health and Nutritional Examination Survey reported a 7% prevalence of diagnosed COPD [20], and a meta-analysis of COPD epidemiological studies showed the overall prevalence of COPD to be 7.6% [21]. We also found a higher prevalence of COPD in women than men, consistent with other studies [22].

The relationship between COPD and HRQOL is complex and not well understood. Our findings of poor HRQOL among adults with COPD are consistent with previous studies, although we were able to identify only a few studies comparing HRQOL between persons with and without COPD or in population-based samples. In a study of adults aged >65 years, Peruzza and associates observed substantial impairment in quality of life measured by the Saint George Respiratory Questionnaire among 60 men with COPD (diagnosed based on European Respiratory Society criteria for respiratory functional impairment) compared with 58 men without COPD who were recruited from patients seen for a routine clinical examination [23]. In a population based sample of 2300 adults from the Hordaland County Cohort Study in Norway, Voll-Aanerud and colleagues found strong inverse associations between physical and mental quality of life (measured by the SF-12® Health Survey [SF-12]) and the number of respiratory symptoms as well as with presence of COPD or impaired lung function (measured by spirometry and classified according to GOLD criteria) [24]. Most studies have examined measures of HRQOL among patients with COPD and examined predictors for poor HRQOL levels, such as presence of acute exacerbations, level of dyspnea, and select medications [25-48].

Associations between COPD and lower levels of HRQOL are not surprising, as proper management of COPD often requires individuals to make extensive lifestyle changes. These changes may involve physical or behavioral adjustments, such as modifications in smoking behavior, physical activity, or prescription therapy, and may be accompanied by psychological consequences including depression and treatment-related frustration or emotional distress [49]. At the same time, persons with COPD who are better able to manage their disease may report higher levels of HRQOL due to fewer acute exacerbations or COPD-related complications. Also, whether COPD has a greater impact on either physical or emotional dimensions of HRQOL is unclear. Population-based studies with prospective designs will be helpful to assess the COPD outcomes. In our study, COPD was associated with perceived general health status and measures of impaired physical health or functioning as well as with impaired mental health.

Conclusion

We observed that self-reported, physician-diagnosed COPD was associated with lower levels of HRQOL compared with persons without COPD in a population-based sample of adults. COPD is a serious lung

disease that is treatable. Early diagnosis is important. Persons at risk for COPD who have cough, sputum production, or shortness of breath should talk with their physicians and be tested for the disease using spirometry, a simple breathing test for assessing lung function.

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