Respiratory Impairment and Symptoms as Predictors of Early Retirement With Disability in US Underground Coal Miners

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Abstract: A five-year prospective study of 1,394 United States underground coal miners was undertaken to study the effects of respiratory impairment on the rate of early retirement with disability (ERD). Using a logistic regression analysis, ERD was found to be related to reported persistent phlegm after adjustment was made for other respiratory symptoms, respiratory function measurements, cigarette smoking, and some demographic characteristics. No prediction of ERD occurred for spirometrically determined measures of respiratory function. The data thus give limited support to the hypothesis that early retirement with disability in underground coal miners can be predicted prospectively by measures of respiratory symptoms. (*Am J Public Health* 1984; 74:837–838.)

Introduction

Several studies reporting a relation between self-reported health status and early retirement or withdrawal from the labor force have been based upon the US Department of Labor's National Longitudinal Study (NLS)[1–4] while others have been based on the Social Security Administration's Survey of Newly Entitled Beneficiaries (SNEB)[5] and the Department of Health, Education and Welfare's Retirement History Study.[6–7] Meyers[8] has questioned the validity of using self-reported health to predict labor force participation. We address this more general question by obtaining objective measures of respiratory function and respiratory symptoms, operationalizing the concept of Early Retirement with Disability (ERD), and utilizing a five-year prospective study design.

Methods

Data used in this analysis were collected by the National Institute for Occupational Safety and Health (NIOSH) from 1,394 miners at four diesel and three matched non-diesel coal mines in Colorado, Utah, and Kentucky. In 1977, an attempt was made to examine all miners from each study mine; participation was 95 per cent in the diesel mines and 59 per cent in the non-diesel mines. Miners were administered a questionnaire and given chest radiographs and spirometry on-site in a NIOSH van using NIOSH-trained technicians and NIOSH procedures.

In 1982, mine managers updated the 1977 work rosters indicating whether each 1977 participant had left the mine (mobiles) or had remained (non-mobiles). The 408 mobiles were mailed a questionnaire to ascertain occupational, residential, and mobility information for the years between 1977 and 1982. Miners who reached age 65 by 1981 were eliminated from further consideration in this analysis. Of the 374 remaining miners, 36 were determined to have retired early with disability,* 161 had other status changes, and 177 were untraceable or did not respond. All miners with a valid address, and who did not respond to the first questionnaire, were sent two follow-up mailings. Efforts to trace miners whose questionnaires were returned by the Post Office included attempts to locate them through telephone listings in the last known area of residence as well as sending lists of untraced miners to the mine managers who posted them at the mine bathhouse; several respondents were located this way. A comparison, by 1977 baseline data, of miners who returned questionnaires with those who did not do so, showed that older miners had lower questionnaire return rates but respiratory function and symptom relationships to the rate of questionnaire return were similar in both groups when adjusted for age.

Respiratory function measures, defined through spirometry, are: obstruction, restriction, and Forced Expiratory Flow Rate at 50 per cent of Forced Vital Capacity.[9] Respiratory symptoms, defined through a modified British Medical Research Council (BMRC) questionnaire[10] are: chronic cough, chronic phlegm, and breathlessness (dyspnea).[9] Smoking status was defined in terms of current smokers versus ex- and non-smokers in 1977. Age, education, and years of mining were included as possible confounding variables.

Analysis was based on a logistic regression model of ERD.[11] The prediction model included terms for obstruction, restriction, FEF_{50}, cough, phlegm, breathlessness, age, smoking status, education, years mining, and diesel, non-diesel exposure. A test of the statistical significance of the adjusted regression coefficients is based on Z-values.

Results

Of the measures of respiratory function and respiratory symptoms, only one measure of respiratory symptoms, chronic phlegm, $Z = 2.71$, $p < .01$, provided statistically significant prediction of early retirement with disability when adjusted for the other variables in the model, Table 1. The presence of chronic phlegm was positively associated with early retirement with disability.

Discussion

Given the wide range of occupational and non-occupational causes for disability, it is significant that ERD was predicted by a respiratory symptom measure net of the explanation of ERD by the other symptoms, respiratory functions, smoking status, and the demographic factors. Controversy has centered around whether smoking was an explanation for disability previously attributed to occupation[12] or whether occupation was a mask for smoking-related disability.[13] These data suggest that, for this sample of coal miners, cigarette smoking is not an independent predictor of early retirement with disability.

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*Early retirement with disability was measured by questionnaire responses indicating the respondent had not worked since leaving the job, and reported "retirement" with either "disability" or "concern over health" as reasons for leaving the job.

TABLE 1—Logistic Regression Analysis of ERD with Respiratory Function, Respiratory Symptom, and Demographic Predictors

Prediction Model	Regression Coefficients	Standard Error
Obstruction[1]	−.04	.03
Restriction[2]	−.02	.02
FEF_{50}	−.04	.22
Cough (3+ mos/yr)	−.20	.48
Phlegm (3+ mos/yr)	1.24*	.46
Breathlessness	.16	.45
Age	.04	.03
Smoking Status	.34	.40
Education	.07	.08
Years Mining	.03	.02
Diesel, Non-Diesel	−.50	.49
Y-intercept	.15	2.97

[1]FEV_1/FVC%.
[2]FVC v. Std %.
*$p < .01$.

The traditional measures of respiratory impairment, obstruction and restriction, were not significant predictors of ERD. It has been suggested that these traditional measures do not reflect pulmonary changes in small airways, the site where respirable coal dust (particles <5 μm) would be most likely to affect coal miners' health.[14] However, for this sample of coal miners, flow rate at 50 per cent of FVC, a measure of small airways disease, does not provide an improved prediction of ERD. It has also been noted that there does not appear to be a strong relation between spirometric measures of pulmonary function and subjective reports of disability.[15]

We found phlegm, an indicator of a chronic respiratory disease associated with coal mining,[15] to be a strong predictor of ERD. Breathlessness, which did not contribute strongly to the prediction of ERD, is more general and may also be an indicator of heart and other diseases.[15] Rom, *et al*,[16] reports that dyspnea (breathlessness) should not be taken at face value as an indicator of respiratory disease in coal miners.

In summary, these data give limited support to the hypothesis that early retirement with disability in underground coal miners can be predicted prospectively by a measure of respiratory symptoms after adjusting for other respiratory symptoms, respiratory function measures, age, cigarette smoking status, and some demographic factors. The need for further empirical research on respiratory health and its relation to labor force participation is clearly suggested.

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