
Relationship of Pulmonary Dysfunction to Respiratory Infection

A study of New York City office workers

WILLIAM H. BECKER, MD, MAHADEO P. VERMA, PhD., MPH,
and EDWARD F. SCHORTMAN, MD

CHRONIC OBSTRUCTIVE DISEASE of the lung and other chronic pulmonary conditions have been arousing increasing interest in the medical community. This interest may have been stimulated by a true increase in the incidence of pulmonary disease, by the newer laboratory techniques that permit a more precise diagnosis, or by both factors. Upon the advent of simpler methods for quantitating pulmonary function, a number of mass screening programs to uncover respiratory disease have been undertaken, and pulmonary function tests are now included in many multiphasic health screening programs. Several industrial medical departments have added tests of pulmonary function to the periodic health examinations of their employees.

The proportion of abnormal results on pulmonary function tests found in these populations is a matter of record, ranging from 3 to 20 percent (1). These values are dependent upon the age, sex, and other characteristics of the study population, as well as on the circumstances of the tests. Yet few results of continued followup of these groups have been published, even though it is widely recognized that no system can function well in evaluating a disease unless continuing inquiries are conducted into all its aspects. We describe the results of one such inquiry that was

designed to ascertain if those persons in a population with pulmonary dysfunction were more disposed to upper and lower respiratory tract infection than those without such dysfunction.

Materials and Methods

The study population was comprised of male and female office workers 30 years of age and older

□ *Dr. Becker, formerly director, Continental Research Institute, New York City, is now chief of the Pulmonary Disease Section and associate director of the Department of Medicine, Methodist Hospital of Brooklyn, N.Y. Dr. Verma, formerly epidemiologist, Continental Research Institute, is now public health administrator I and director of the Division of Public Health Laboratory, Delaware State Board of Health, Dover. Dr. Schortman is associate director of the medical department of the Continental Insurance Companies.*

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Table 1. Distribution of subjects according to pulmonary function test results and sex

PFT results	1,573 subjects		882 men		697 women	
	Number	Percent	Number	Percent	Number	Percent
Normal	1,350	85.83	764	86.63	586	84.81
Abnormal	223	14.17	118	13.37	105	15.19
Restrictive phenomenon	51	3.24	21	2.38	30	4.34
Obstructive phenomenon	172	10.93	97	10.99	75	10.85

located in the New York City metropolitan area. The pulmonary functions tests (PFT) on which our results are based were performed during the annual health examinations of these workers.

The Jones Pulmoror was the pulmonary function testing apparatus selected for this project because of its low-resistance bellows and the reproductivity of the tests in which it is used (2). To preclude the adverse influence that confining clothing might have on results, the pulmonary function studies were administered after the chest roentgenogram while the subject was still disrobed. Inspiring the room air, each subject accomplished a maximum inspiration followed by a forced maximum expiration into the Pulmoror bellows system. This procedure was repeated three times, and the best of the three flow curves was used to calculate the results. The curves that were technically adequate did not differ by more than 5 percent. In rare instances the subject continued the breathing performance until satisfactory records were obtained. The test results were calculated as total vital capacity, forced expiratory volume—1 second, and maximum expiratory flow rate. Normal values for the test were based on those listed in the Veterans Administration-Armed Forces Cooperative Series of Kory and associates (3). Values below 70 percent of ideal performance, either total or timed, were considered abnormal.

The frequency of upper and lower respiratory infections during the 1-year study period was obtained from each subject's medical records file.

Results

Within 1 year, 1,573 persons were tested. Their distribution according to their pulmonary function test results is shown in table 1. Eighty-six percent were found to have normal pulmonary function. Among the 14 percent with abnormal function, the obstructive phenomenon was almost three times as prevalent as the restrictive phenomenon. No significant differences in any of the categories were found to be related to the sex of the subject. These results are comparable to those obtained in a previous study in which similar techniques were used (1).

A comparative analysis of the respiratory infections of the subjects with normal and abnormal pulmonary function was done to test the common conjecture that persons with pulmonary dysfunction are at risk of a higher incidence of respiratory infections and of more severe ones. When 223 subjects having pulmonary function abnormalities were matched according to age, sex, and smoking history with 223 subjects having normal pulmonary function, no

significant differences were found in respect to the presence or absence of respiratory infections (table 2). A further analysis of the frequency of respiratory infections among matched subjects with normal and abnormal PFT results once again showed no differences (table 2).

Distribution of the 223 subjects with abnormalities according to the type of abnormality and the frequency of respiratory infections is shown in table 3. When the group with abnormal pulmonary function was subdivided into two subgroups according to whether the abnormality was restrictive or obstructive, the frequency of respiratory infections appeared to be higher in the subgroup with a restrictive type of abnormality.

Similar analyses were done on the 446 subjects for 2 subsequent years, and the results were found to be comparable with those reported here. Nevertheless, serial yearly pulmonary function testing of these subjects during these subsequent 2 years showed a series of conversions from abnormal function to normal 4.5 percent in the first year and 4.7 percent in the second. Conversions

Table 2. Occurrence and frequency of respiratory infections in matched subjects with normal and abnormal results on pulmonary function tests

Infections and frequency	Normal results (N=223)		Abnormal results (N=223)	
	Number	Percent ¹	Number	Percent ¹
No infections	96	43.04	103	46.18
Infections (times in study year)	127	56.95	120	53.81
1 to 2	76	34.08	70	31.39
3 to 5	47	21.07	47	21.07
More than 5	4	1.79	3	1.34

¹ Percentages do not add to 100.00 because of rounding.

NOTE: Subjects were matched according to age, sex, and smoking history.

Table 3. Occurrence and frequency of respiratory infections in matched subjects with abnormal results on pulmonary function tests, by type of dysfunction

Infections and frequency in study year	Restrictive dysfunction (N=51)		Obstructive dysfunction (N=172)	
	Number	Percent	Number	Percent
No infections	18	35.3	85	49.4
Infections	33	64.7	87	50.6
1 to 2 times	17	33.3	53	30.8
3 to 5 times	16	31.4	31	18.0
More than 5 times	0	.0	3	1.8

NOTE: Subjects were matched according to age, sex, and smoking history.

from normal to abnormal were almost 2 percent for both years.

Discussion

The etiologies of pulmonary dysfunction are varied since certain aspects of the lung structure that play a major part in determining pulmonary function assume a particular importance in a particular case. Past epidemiologic studies have incriminated atmospheric pollution, smoking, and low socioeconomic status as adverse elements in the development of chronic pulmonary diseases and have suggested that respiratory infections and climatic conditions may also be involved (4-6). For these reasons, varying prevalence figures for pulmonary dysfunction have been reported in epidemiologic surveys. When, however, the populations studied generally resemble each other in habitat, comparable prevalence figures are obtained. Our results are in agreement with those of the Queensboro Respiratory Disease Mass Screening Project (2) because

both study groups are from the New York City metropolitan area.

The corrections made for age and sex in some studies have been based on a common assumption that males are at higher risk of pulmonary disorder than females. In our study, however, pulmonary function was abnormal in 15.2 percent of the women and 13.4 percent of the men (table 1). Results of a study of 1,045 subjects from the same population 4 years earlier than our study corroborate our results (table 4). The women in the earlier study had the same percentage of abnormality in pulmonary function as the men. The percentage of restrictive abnormalities was reported to be higher in the women. A common factor that could explain these results in respect to sex might be that the sedentary occupation of office workers predisposes both the middle-aged man and the middle-aged woman to obesity. Indeed, an examination of this factor revealed that approximately 70 percent of the women in our study with pulmonary dysfunction were short

of stature, overweight, and underexercised. Also, approximately 60 percent were cigarette smokers.

As to the risk of respiratory infections, the study data suggest that the subjects with abnormal results on pulmonary function tests were at no greater risk of increased frequency of respiratory infections than subjects with normal pulmonary function.

Summary

Pulmonary function tests were administered to 1,573 male and female office workers 30 years of age or older during their annual periodic health examinations. The frequency of respiratory infections was established from the workers' medical records. Fourteen percent had pulmonary function abnormalities; the men and women were equally abnormal. A comparison of the frequency of respiratory infections in subjects with normal and abnormal pulmonary function, matched according to age, sex, and smoking history, showed no significant differences. Two subsequent years of retesting produced similar data for pulmonary function as well as for the occurrence of respiratory infections.

References

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Table 4. Distribution of 1,045 subjects of an earlier study according to results of pulmonary function tests given during their periodic health examinations and by sex

PFT results	489 men		556 women	
	Number	Percent	Number	Percent
Normal	395	81.1	457	82.2
Abnormal	94	18.9	99	¹ 17.8
Restrictive phenomenon	11	2.2	37	6.7
Obstructive phenomenon	52	10.3	41	7.4
Both phenomena combined	31	6.4	21	3.8

¹ Percentages do not add to 17.8 because of rounding.