FOLLOW UP STUDY OF RESPIRATORY SYMPTOMS, VENTILATORY FUNCTION AND PERSONAL BREATHING ZONE DUST LEVELS IN LANCASHIRE TEXTILE WEAVERS

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Abstract

Ten years ago this department investigated 1295 textile weavers in the Lancashire area. A very low prevalence of byssinosis was found. However, there was a moderate prevalence of other upper and lower respiratory symptoms. Ten years later, three of the original mills were visited and their workforce studied with respiratory symptom questionnaire, spirometry and measurement of total inhalable dust in the personal breathing zone. Altogether, 317 workers were seen, 117 of them for the second time (ie., ten years later). None of them were diagnosed as having byssinosis. The prevalence of upper and lower respiratory symptoms was very similar to that ten years ago. Logistic regression showed personal factors (young age, female sex) to be predictors of upper respiratory symptoms. No independent factors emerged when the same analysis was attempted for lower respiratory symptoms. Overall, FEV1 decline for the 117 operatives was 11.5 ml/year (CI 1.7-21.3). Corresponding values for non-smokers and smokers were 4.1 ml/year (CI –5.9-14.0) and 28.8 ml/year (CI 7.4-50.2) respectively. Independent predictors for FEV1 and FVC decline were current smoking and work with man-made fibre respectively.

Introduction

From 1987 to 1989, the Department of Occupational and Environmental Medicine at Wythenshawe Hospital, Manchester surveyed employees of textile weaving mills in Lancashire. The aim was to document the prevalence of byssinosis in this occupational group. Workers were administered a respiratory symptom questionnaire in order to identify those suffering from byssinosis and other respiratory symptoms. Prevalence and work relatedness of symptoms were ascertained. This was supplemented with spirometric evaluation of their respiratory function and measurement of total inhalable dust in the personal breathing zone of a representative number of workers in each occupational group.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:172-174 (1999)
National Cotton Council, Memphis TN

Altogether, 1295 operatives (in sixteen mills) participated in this survey; the findings have been the subject of two publications (Raza et al., accepted for publication). Only three individuals volunteered a history suggestive of byssinosis. This is far less than the prevalence of this symptom in Lancashire spinners (Cinkotai et al., 1988). However, workers complained of work related upper and lower respiratory tract symptoms and some of them suffered from permanent respiratory disability. Smoking and the work environment contributed to these complaints and lung function loss. It is important to ascertain the trend in respiratory symptoms, lung function and dust levels in Lancashire textile weaving establishments. The present study was designed to document current prevalence of respiratory symptoms, ventilatory function and personal breathing zone dust levels in textile weavers and to ascertain a change, if any, in the lung function, personal breathing zone dust levels and prevalence of respiratory symptoms in textile mill operatives who were seen a decade ago.

Methods

The study had the support of the mill management and unions. Only three of the original sixteen mills could participate in the study. The current workforce of these mills was the target population. The investigative tools employed were respiratory symptom questionnaire, spirometry and personal breathing zone dust level estimation.

Questionnaire

Each worker was administered a questionnaire. This was the same as the one used on the previous occasion and was identical to the one used in the study of cotton spinners(Fishwick et al., 1994). This included questions on personal characteristics, occupational history, smoking history and respiratory symptoms, ie., cough, phlegm, chest tightness, wheezing, shortness of breath and nasal and eye irritation. The prevalence as well as the work relatedness of a symptom was established.

Lung Function

A Vitalograph spirometer was used to measure the forced vital capacity and the forced expiratory volume in the first second. The same instrument was used throughout the study. It was calibrated before each mill visit with a one litre precise calibration syringe. Forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) were measured in each worker. Three forced expiratory manoeuvres within 5% of each other were obtained in the standing position. The forced vital capacity manoeuvre was carried out, and the measurements recorded according to ATS guidelines (American Thoracic Society 1987). The greatest values for FEV1 and FVC were read off the scale, regardless of whether or not they occurred on the same curve. For White Caucasians, predicted spirometry values were derived from the summary equation of reference values (Quanjer et al., 1983). For Asians, correction factors, suggested by Cotes(Cotes et al., 1979), were used, i.e., for Asian males, 0.7 litres and 0.45 litres were subtracted from the predicted FVC and FEV1 of age and height matched White Caucasians; for Asian females, corresponding figures were 0.6 litres and 0.4 litres.

Dust Sampling

Personal breathing zone dust was measured with the IOM head (Mark et al., 1986). Dust was deposited on Whatman GF/A micro glass fibre filters mounted in the cassettes inside the sampling head. In the mill, sampling heads were pinned onto the lapels of operatives, secured safely and connected to Casella pumps, flow rate 2 litres/min, (worn on the waist) for the duration of the shift. A representative number of workers were chosen randomly from each occupational group to wear the sampling device. The mean dust levels for each occupational group in a mill were then obtained. T'his average value for each occupational group was ascribed to all members of the same occupation not undergoing sampling in the same mill.

Statistical Analysis

Data about questionnaire responses, personal details, occupational history, lung function tests and dust levels were stored in a database (dbase III plus). Further analysis was carried out using the SPSS programme. Frequency of each symptom was determined. Predictors of symptoms were identified. The magnitude and independent predictors of lung function decline were determined in those individuals seen on both occasions. Value of p=< 0.05 was treated as significant throughout.

Results

Only 317 operatives in three mills could be seen (response rate 86.4%). Of these, only 116 individuals were seen for the second time. These mills were also surveyed in 1988. On that occasion, 453 operatives were seen. The personal characteristics of the two populations are given in table 1. The majority were white caucasian and nearly half were current smokers. Table 2 lists the prevalence of work related respiratory symptoms. Apart from work related eye irritation, there is very little change in the proportion of workers reporting these symptoms. The results of logistic regression were reported separately for nasal and eye irritation in 1988. However, in 1998, the number of cases in each diagnostic category were not enough to warrant a separate logistic regression analysis for each symptom. Hence the two were merged and analysed as a single group (prevalence 14.5%). The results of the analysis are given in table 3. 12.6% workers suffered from one or more lower respiratory symptoms. However, no independent factors emerged for this group on logistic regression. Mean dust levels by workroom and mill are presented in table 4. 117 operatives were seen both in 1988 and 1998. FEV1 decline by smoking category is listed in table 5. Table 6 shows the independent factors predicting FEV1 and FVC decline (multiple regression).

Discussion

The difference in number of people examined in the three mills in 1988 and 1998 was because of a smaller workforce and not a reduced participation rate. The cross-sectional aspect of the survey in 1998 shows that the prevalence of respiratory symptoms is about the same ten years on. No individuals were diagnosed to be suffering from byssinosis, confirming its low prevalence. Due to small numbers of individuals in each diagnostic group, category merger was required. For work related upper respiratory symptoms, personal factors emerged as independent predictors. None could be identified for the merged category of lower respiratory symptoms. Dust levels in 1998 are very similar to what they were ten years ago. The only exception was the workroom of cloth inspection in mill B (cotton blend). The high level is due to a single high reading.The finding of greater FEV1 decline in smokers seen ten years apart, was expected. The emergence of current smoking as a predictor for FEV1 decline is consistent with the fact that smoking was the strongest predictor of reduced lung function during the cross sectional study ten years ago. The prediction of FVC decline by work with man-made fibre is in agreement with the findings from the prospective study of Fletcher et al (reported in this issue) on spinners in the Lancashire area.

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Table 1. Personal characteristics of the workers.

Factor	1998	1988
Study population	37.4	453
White Caucasian %	91.5	92.9
Male %	59.6	60.9
Age (years)	41.4	
Current smokers %	43.2	43.7
Former smokers %	18.3	15.2
Never smokers %	38.5	41.1
Cotton/blend exposure	241	360
Synthetic fibre exposure	76	93

Table 2. Prevalence of work related symptoms.

Symptom	1998	1988
Chronic phlegm production	3.5	3.5
Persistent cough	1.9	4.4
Non specific (non-byssinotic) chest Tightness	3.5	5.3
Wheezing	5.7	6.4
Eye irritation	5.0	8.2*
Nasal irritation	12.0	16.3
Shortness of breath	4.1	1.6

*p<0.05

Table 3. Predictive factors for work related upper respiratory tract symptoms.

Factor	Nasal+Eye 1998	Nasal 1988	Eye 1988
Female sex	P<0.0001	P<0.0001	P<0.01
Younger age	P<0.05	P<0.0001	P<0.05
Cotton rather than mmf	NS	P<0.005	P<0.01
White Caucasian ethnicity	NS	P<0.05	NS
Work in preparation room	NS	NS	P=0.0001
Fine cotton grade	NS	P=0.0001	NS

Nasal+Eye = Nasal & eye irritation categories combined
Nasal = Nasal irritation
Eye = Eye irritation
NS = Not significant at p<=0.05

Table 4. Mean dust levels (mg/m3) by workroom in mills A (pure cotton), B (cotton/blend) and C (pure synthetic).

	Mill A		Mill B		Mill C	
Workroom	1998	1988	1998	1988	1998	1988
Weaving	2.54	1.91	1.22	2.51	0.30	0.78 (0.7)
Preparation	1.76	3.64	1.03	-	0.46	0.43 (0.2)
Cloth inspec.	-	3.08	6.68	1.07	0.10	0.32 (0.1)
Sewing	1.46	2.32	-	-	-	-

Table 5. Forced expiratory volume in one second (FEV1) in ml/year for individuals seen in 1988 and 1998.

Category	FEV1 Decline	Confidence Limits
All cases (N=117)	11.5	1.7 – 21.3
Non-smokers in 1988 & 1998 (N=61)	4.1	-5.9 – 14.0
Smokers in 1998 (N=39)	28.8	7.4 – 50.2

Table 6. Predictors of lung function decline (multiple regression).

Forced expiratory volume one second (FEVI)		
Current smoking (1998)	T=2.7	P<0.01
Forced vital capacity (FVC)		
Work with synthetic fibre rather than cotton	T=2.03	P<0.05

(Dust exposure p=0.07 Age p=0.07)