Work characteristics and lifestyle as predictors in the development of chronic non-specific lung disease among elderly municipal employees

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Abstract

Objectives—This study prospectively evaluated factors of working conditions and lifestyle in the development of chronic non-specific lung disease (CNSLD).

Methods—Baseline data were collected in 1981 from 5386 municipal employees born in 1923–35 who had no diagnosed CNSLD. The subjects were studied again in 1985 with a postal questionnaire. The predictors of CNSLD were selected by multivariate logistic regression analysis.

Results—159 (3%) reported the development of CNSLD confirmed by a physician. During the 4–6 year follow up period the average annual incidence was 6.5/1000 subjects. In men the logit model followed was: smoking (odds ratio (OR) 1.17, 95% confidence interval (95% CI) 1.06–1.29), tight work schedule (OR 1.31, 95% CI 1.03–1.65), loss of a close friend (OR 2.21, 95% CI 1.13–4.31), and retirement of a spouse (OR 3.31, 95% CI 1.35–8.11). In women the selected risk factors were: smoking (OR 1.22, 95% CI 1.01–1.38), atopy (OR 1.99, 95% CI 1.12–3.53), physically heavy work (OR 1.65, 95% CI 1.09–2.29), poor physical working conditions such as heat, cold, changing temperature (OR 1.41, 95% CI 1.13–1.75), and infrequent communication with other people at work (OR 1.25, 95% CI 1.05–1.49).

Conclusion—The differences in the predictors of the incidence of CNSLD between men and women were partly explained by different smoking habits, frequency of atopy, and working conditions. In men the significance of life events (loss of close friend and retirement of wife) need further investigation.

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The increased mortality and cost of chronic non-specific lung disease (CNSLD) have accentuated the need for knowledge on the distribution of the disease in the community and its relation to possible risk factors.

Questionnaire diagnoses of bronchial asthma and chronic obstructive disease are based on symptoms typical of bronchial asthma and chronic obstructive lung disease,¹

self reported diagnoses of disease,^{2,3} or self reported physician's diagnoses of disease.⁴

Chronic non-specific respiratory diseases are usually of multiple aetiology, and they are mainly or partly occupational in origin. Those with an occupational exposure to dust, gases, and fumes had an increased incidence of CNSLD.⁵

Tobacco smoking is the most important cause of obstructive lung disease, but variation between people in response to this exposure and the development of disease in non-smokers have indicated that other factors are also involved.⁶ Atopy, even defined as atopic manifestations, is associated with asthma and chronic bronchitis.⁷ The recognition of personal and environmental factors that characterise high risk subjects, and the identification of other predictors, would improve the potential to prevent and control the disease.

Already in 1956, Rees identified the importance of psychological factors in the development of asthma.⁸ He found that asthmatic people were more often sensitive, timid, and anxious than their non-asthmatic controls. Psychosocial factors are generally thought to cause CNSLDs.⁹ Stress and emotion have been mentioned as triggering factors in asthma.¹⁰ The role of life events in the development of CNSLD is less clear. The onset of asthma has been reported to follow life events such as bereavement.¹¹ Well designed prospective research studies that would decisively prove that psychosocial factors or life events do play a part in the development of CNSLD, have not been done.

The main objective of our study was to examine the connection between the development of CNSLD during the study period and the rate of work and lifestyle factors. The data on the Finnish research project on aging workers in municipal occupations suited this purpose well, because of the numerous variables that described work, lifestyle, and health.¹²

Subjects and methods

SUBJECT SELECTION

The subjects of the research project ($n = 6257$) were born in 1923–35, lived in different parts of Finland, and were active municipal workers with at least five years of experience in their current occupations at the beginning of the study.¹³ They answered a postal questionnaire in 1981 and in 1985. The response rate was 85% and 89%

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respectively. Those subjects who in 1981 did not report bronchitis or asthma diagnosed by a physician ($n = 5386$) were chosen for this study. Questions that were asked on other respiratory diseases in 1981 included "Do you have emphysema?" and "Do you have tuberculosis?" Patients who had these diseases were excluded from the study.

DIAGNOSIS OF DISEASE

During the follow up 1981–5, the percentage of those diagnosed by a physician with chronic bronchitis or asthma (CNSLD) was 3.0% (159/5386). The dichotomous health outcome variable was: 159 had developed chronic bronchitis or asthma, and 5227 had not. The occurrence of disease was ascertained by the questions: "Do you now have any disease, defect, or injury of long duration?" and "Indicate on the following list what kind of diseases or injuries you have at present. Also indicate whether a physician has diagnosed or treated the above disease." One of the response alternatives was both chronic bronchitis and asthma. The MRC (Medical Research Council)¹⁴ definition of chronic bronchitis could not be used because the MRC questions were not included in this survey.

RISK FACTORS

The potential explanatory variables found from the questionnaire at baseline in 1981 have been presented earlier.¹⁵ They included 72 questions on features of work (physical and psychological demands, possibilities for development, the physical and chemical environment, the organisation and the social environment, changes in work stress during the last two years), 34 questions concerning lifestyle (habits and hobbies, life events during the past half year, living conditions), and questions on life history (smoking, vocational education, change of occupation). The variables of work described either its prevalence or harmfulness.

Sex, age, smoking, atopy, and work content were treated as confounders (table 1). Subjects were classified in 1981 as non-smokers if they have never smoked daily for as much as one year. Exsmokers were those who had been smoking for more than one year and had given up before the survey. Current smokers were those who had been smokers for more than one year and were still smokers.

The respondent was classified as atopic if he or she at the time of the questionnaire had chronic rhinitis or allergic eczema confirmed by a physician. Asthma was not included in the definition of atopy because it was the dependent variable. The subjects were selected from three categories of work content: physical (auxiliary, home care, and installation work), mixed (transportation, nursing, kitchen supervision, dentistry, and dump work), and mental (office, administration, teaching, technical supervision, and physician) by the "ergonomic job analysis procedure", Arbeitswissenschaftliche Erhebungsverfahren zur Tätigkeitsanalyse (AET) method.¹⁶ The AET method incorporates observations of the work and interviews of the workers and foremen. The work content groups were different for men and women. Installation work, transportation, dump work, administrative work, and technical supervision were almost purely men's work categories, whereas home care, nursing, and kitchen supervision were purely women's groups.

At baseline in 1981 more men smoked than women. Of the men, 31% had never smoked, 44% were exsmokers and 25% were current smokers; the corresponding figures for women were 77%, 16%, and 7%. Women had more atopic symptoms than men: 9% (280) of women and 6% (133) of men were classified as atopic. The work content of 48% of the men but only of 36% of the women was physical. The group of mixed mental and physical work contained 25% of the men and 35% of the women, whereas 27% of the men and 29% of the women were in the group of purely mental work.

STATISTICAL ANALYSIS

The statistical analyses were as follows: all variables were first included in a fixed discriminate analysis between the incidence and CNSLD, the outcome variable. Next, those variables where the F test probability for predicting CNSLD was $\leq 5\%$, were chosen for backward stepwise discriminate analyses. These analyses excluded variables that had a weak discriminative power within the potential risk factor groups of correlated variables.^{17,18} The remaining variables and other confounding factors except sex were included in the stepwise logistic regression analysis.¹⁸ The multifactorial analysis was performed separately for men and women.

Results

Of the 5386 subjects at risk, 159 reported in the second questionnaire that they had CNSLD confirmed by a physician. This gave an average annual incidence of 6.5/1000 subjects.

Univariate analysis showed that sex and age did not significantly associate with the development of CNSLD (table 1). Smoking and atopy were associated with an increasing incidence of CNSLD, specially among women. Men who were in the mixed work category

Table 1 Four year incidence (%) of chronic bronchitis or bronchial asthma by sex, age, work content, smoking, and atopy

Group	n*	Cases (%)	OR (95% CI)
Men	2321	76 (3.3)	1.2 (0.89–1.67)
Women	3065	83 (2.7)	
44–48 y	2370	61 (2.6)	
50–58 y	3016	98 (3.2)	1.3 (0.92–1.76)
Non-smokers	2891	63 (2.2)	
Current or exsmokers	2495	96 (3.8)	1.8 (1.31–2.47)
No atopy	4973	138 (2.8)	
Atopy	413	21 (5.1)	1.88 (1.18–2.98)
Physical	2222	87 (3.9)	
Mixed physical and mental	1645	46 (2.8)	2.34 (1.52–3.6)
Mental	1519	26 (1.7)	
All	5386	159 (3.0)	

*No chronic bronchitis or bronchial asthma in 1981.

(5.2%) had a higher risk of CNSLD than did men in the mental work category (1.8%). Women in the physical work category (4.7%) had higher risk of CNSLD than women in the mental work category (1.7%).

The univariate analysis of work factors showed that, above all, physical and psychological work demands and the physical and chemical work environment had an effect on the development of CNSLD (table 2).

Among lifestyle factors during the past half year, own unemployment, loss of a close friend, and retirement of spouse were associated significantly with the development of CNSLD (table 2).

Table 3 shows the best fitting multivariable models calculated by stepwise logistic regression analysis.

In men smoking was confirmed as a risk factor in the model. As well as this, tight work schedules, loss of a close friend, and retirement of wife were associated with a high incidence of CNSLD.

In women, smoking and atopy were confirmed by the model. The risk factors at work that were noted in the work environment (physical and psychological) were physically heavy work, poor communications with other

Table 2 Independent variables in 1981 and their associations with the development of chronic bronchitis or bronchial asthma among all subjects ($n = 5386$; F tests and their significance; - = preventive effect)

	<i>F</i> test	<i>P</i> value
Work:		
Physical:		
Sudden exertion†	23.7	***
Physically heavy work	20.5	***
Difficult and uncomfortable postures†	20.4	***
Whole body exertion	18.6	***
Bent or twisted postures	16.3	***
Carrying objects by hand	13.5	***
Frequent walking or moving	7.5	**
Repetitive movements	5.9	*
Psychological:		
Paced work†	14.3	***
Tight time schedule†	11.0	***
Communication with other people	-9.6	**
Monotonous and uninteresting work†	6.1	**
Responsibility in work†	4.1	*
Possibilities for development and influence:		
Planning own work	-6.2	**
Applying own abilities	-4.2	*
Learning new things and education	-3.9	*
Physical and chemical environment:		
Dust, smoke, steam, etc†	31.5	***
Heat, cold, changing temperature†	28.5	***
Dirty†	22.6	***
Poor lighting, glare†	20.4	***
Draught†	19.9	***
Risk of accident†	18.7	***
Dryness, dampness†	17.7	***
Acids, alkalis, solvents, oils, etc	12.2	***
Restless environment, noisy people†	9.2	**
Organisation and social environment:		
Quality and quantity of tools†	11.4	***
Tasks and responsibility inconsistent†	8.8	**
Safety equipment†	5.6	*
Rest breaks†	4.8	*
Possibility for meals at work†	5.4	*
Lifestyle:		
Life events in the last half year:		
Own unemployment	12.0	***
Loss of a close friend	7.1	**
Retirement of spouse	8.7	**
Living conditions:		
Number of unemployed household members over 15 years of age	-5.5	*
Poor economy	4.3	*
Education, change of occupation:		
Age at first employment	-11.9	***
Vocational education	-6.8	**
Best age for work (measured in 1985)	-6.7	**

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. †Strain from; ‡Dissatisfied with.

Table 3 Variables related to 4-6 year incidence of CNSLD with a logistic regression model in men ($n = 2321$) and women ($n = 3065$) (Finnish municipal employees born in 1923-35)

Variables	OR (95% CI)
Men:	
Smoking	1.17 (1.06-1.29)
Tight work schedule	1.31 (1.03-1.65)
Loss of a close friend	2.21 (1.13-4.31)
Retirement of wife	3.31 (1.35-8.11)
Women:	
Smoking	1.22 (1.01-1.38)
Atopy	1.99 (1.12-3.53)
Physically heavy work	1.65 (1.09-1.49)
Infrequent communication with other people at work	1.25 (1.05-1.49)
Heat, cold, changing temperature at work	1.41 (1.13-1.75)

Table 4 Incidence of CNSLD by level of work related factors and life events in univariate analysis, in men and women, adjusted by smoking (Finnish municipal employees born in 1923-35)

	<i>n</i>	Incidence
Men:		
Tight work schedule:		
Never	505	2.7
Seldom	647	2.2
Sometimes	780	4.3
Often	389	5.1
Loss of a close friend:		
No	2156	3.2
Yes	165	7.3
Retirement of wife:		
No	2263	3.3
Yes	58	9.0
Women:		
Atopy:		
No	2785	3.1
Yes	280	8.6
Physically heavy work:		
Light	1662	2.1
Moderate	1143	4.0
Too heavy	260	11.0
Communication with other people at work:		
Never	85	5.7
Seldom	177	9.8
Sometimes	674	5.9
Often	572	3.1
Very often	1557	2.0
Heat, cold, changing temperature at work:		
Never	1201	1.7
Seldom	639	4.6
Sometimes	867	3.3
Often	357	9.0

people at work, heat, cold, and changing temperature in the workplace.

Table 4 depicts the cumulative annual incidence of CNSLD, adjusted for smoking, for increasing levels of the univariate predictors identified in the final model that showed a dose-response effect. In male smokers loss of a close friend (OR 3.19, 95% CI 1.29-7.85) and retirement of wife (OR 3.49, 95% CI 1.19-10.15) were significantly associated with development of CNSLD. In other men the association was not significant (OR 2.62, 95% CI 0.64-10.71, OR 1.76, 95% CI 0.69-4.49, respectively) mainly because of small numbers of cases.

Discussion

In this prospective study we investigated the relation between development of diagnosed CNSLD and working conditions and lifestyle. The study population consisted of 5386 Finnish municipal employees born in 1923-35. The number of non-respondents was low (15% in 1981 and 11% in 1985). Because the categories of work, smoking

habits, and prevalence of atopy were quite different in men and women multivariate analyses were done separately for men and women.

The incidence of CNSLD was associated with smoking and atopy, as is well known. In women, along with smoking and atopy, physically heavy work, heat, cold, changing temperature, and infrequent communication with other people at work independently predicted the development of CNSLD. Blue collar workers have had a higher prevalence for several of the respiratory symptoms and even for diagnosed CNSLD, than white collar workers.¹⁹ Heat, cold, and changing temperature at work reflected poor physical working conditions that are usually associated with outdoor work, dust, etc. Many municipal workers may have a high exposure to organic or inorganic dust—for example, carpenter, dump and park worker, streetsweeper, construction worker—and also to indoor respiratory allergens—for example, cleaner, domestic help, housekeeper, hospital aid, painter, mechanic, janitor). Heat and outdoor work have been strongly related to diagnosed CNSLD.¹⁹ People with occupational exposure to dust or gases have an increased risk of CNSLD.²⁰ Also in incidence studies, occupations that involve dusty work have a high risk of CNSLD.⁵

In men, smoking, tight work schedules, loss of a close friend, and retirement of wife were independently associated with the development of CNSLD. Tight time schedules among men, and in women infrequent communication with other people at work represent poor psychological working conditions and mental stress that may exacerbate asthma.¹⁰ Stressful life events such as the illness, death, or fear of losing a close relative or friend, or the feeling of loneliness have preceded outbreaks of asthma.¹¹

This prospective study confirmed earlier results that smoking, atopy, and working conditions influenced the development of CNSLD. Stressful work (physically heavy work, poor physical working conditions, infrequent communication with other people at work, tight work schedule) and social life (loss of a close friend, retirement of spouse) may precede the development of CNSLD. It is difficult to generalise these results in terms of risks attributable to populations related to work characteristics and life events. The num-

ber of cases was small for selection by age and employment and the follow up time was short. The significance of psychosocial factors (loss of a close friend and retirement of wife), especially in men, on incidence of CNSLD needs further investigation.

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