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Respiratory findings in mail carriers

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Abstract The results of the recording of respiratory symptoms and the measurement of lung function in 136 male postal workers employed as mail carriers were studied. In addition, the prevalence of chronic respiratory symptoms in 87 male nonexposed control workers was also examined. There was a significantly higher prevalence of chronic bronchitis (25.0%) and sinusitis (38.9%) in mail carriers than in control workers (13.8%; $P < 0.05$ and 2.3%; $P < 0.01$). A logistic regression analysis performed on the results of the study of chronic respiratory symptoms of mail carriers indicated a significant ($P < 0.001$) effect of smoking in this cohort, with the exception of occupational asthma. Mail carriers who smoked had a significantly higher prevalence of chronic cough (45.3%), chronic phlegm (39.1%), chronic bronchitis (39.1%) and sinusitis (53.1%) than mail carriers who were nonsmokers (18.1%; 12.5%; 12.5% and 26.4% respectively.) ($P < 0.01$). A high prevalence of acute symptoms developing during the work-shift was recorded, in both smokers and nonsmokers, being highest for upper airway symptoms, headache (50.0%), nasal catarrh (42.6%), and eye irritation (57.4%). The results of tests for average measured ventilatory capacity (as a percentage of predicted capacity) were significantly lower than expected, particularly for maximum flow rates at the last 25% of the vital capacity (FEF25), in both smokers (68.5%) and in nonsmokers (74.2%). A multivariate analysis of lung function parameters indicated a significant effect of employment conditions. The only major identifiable occupational exposure of mail carriers was to ambient air pollution for an average of 6 h per day as well as to adverse meteorological conditions. The measured ambient concentrations of major outdoor pollutants, primarily total suspended particulates, sulfur dioxide (SO_2) and black smoke exceeded considerably the recommended Croatian maximum air quality standards over the past 10 years.

Our study of mail carriers demonstrated that these workers were subject to respiratory symptoms associated with their smoking habits. Lung function findings suggested that occupational exposures, possibly to atmospheric pollution in combination with adverse meteorological conditions, may have led to lung function impairment in these workers.

Key words Mail carriers · Respiratory symptoms · Ventilatory capacity

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Introduction

Mail carriers in Croatia spend 80–90% of their workday outdoors delivering mail. They are, therefore, at high risk from exposure to environmental air pollutants and adverse meteorological conditions. Air pollution remains an important environmental risk for human health (Bates 1995). Factors influencing the effects of inhaled agents include the physical and chemical properties of the particular agents as well as host factors: genetic, environmental and acquired (Bascom et al. 1996; Bascom 1996). The role of air pollution in causing

an increased prevalence of respiratory diseases, in particular asthma, has been widely debated. Workers in many industries are exposed daily to low concentrations of many different chemical substances, natural and synthetic. Many of these substances can be toxic at high levels, but typical exposures are far below levels known to produce deleterious effects on the airway. Some investigations suggest that even normal levels of air pollutants i.e., those below existing guidelines and standards, may have an effect on health indices such as lung function, hospital admission for asthma, acute respiratory symptoms, medication use and even mortality (Brunekreef et al. 1995).

During their working hours, postal workers were exposed to particulate matter, which is a complex and variable mixture of substances. Sources include motor vehicle emissions, factory and utility smokestacks, residential wood-burning stoves and furnaces, road dust and construction activity (Maeda et al. 1991/1992; Yamaha et al. 1992; Zuskin et al. 1994; Raaschou-Nielsen 1995; Zuskin et al. 1996a; Bascom et al. 1996). Particles with diameters < 10 μm are felt to pose a greater health risk than larger ones, because smaller-sized fragments are easily inhaled deep into the lung. When individuals breathe through the mouth, approximately 60 to 80% of inhaled particles between 1 and 10 μm in size are deposited in the bronchioles and 40% to 60% of particles between 1 and 5 μm are deposited in the alveoli. When breathed through the nose, virtually no particles above 10 μm descend to the level of the small airways. A significant relationship has been found between asthma, and days when the airborne particulates index is above the acceptable threshold (Rennick and Jarman 1992).

During their work-shift mail carriers are also exposed to different adverse meteorological conditions, varying from very cold to very hot air which may range from dry to very humid; additionally the workers are exposed to the wind. Thunderstorms can trigger epidemics of asthma attacks (Bellomo et al. 1992). Ito et al. (1989) demonstrated that a major meteorological factor affecting the frequency of visits of asthmatic children to a physician was an air temperature of more than 150 °C, a relative humidity greater than 65% and a wind speed of less than 3.5 m/s. During episodes of air pollution, the lung function of exposed children was approximately 2% to 4% lower immediately following an alert (Dockery et al. 1982).

Considering these observations we thought it plausible that mail carriers form a population which is at risk of developing respiratory diseases, including chronic bronchitis, asthma and emphysema, as a result of their "occupational" exposure. Because there are no available data on respiratory function in postal workers working as mail carriers, we studied a group of postal workers employed in a large main General Post Office in Zagreb, Croatia. These workers deliver mail throughout the year to most of the metropolitan area, walking or driving motor vehicles.

Subjects and methods

Subjects

This study investigated a group of 136 male postal workers employed as mail carriers. The study was conducted during a 2 week period in April 1997. These individuals accounted for 90% of all mail carriers employed by the main Post Office in Zagreb. The workers delivered mail intermittently via motor vehicle or on foot, spending their working days outdoors, exposed to different atmospheric air pollutants and adverse meteorological conditions. This study group included mail carriers who covered predominantly the central and peripheral area of Zagreb. Because of the many industries throughout the city, some areas were more polluted than others. However, it was not possible in this study to group the workers by their exposure to pollutants in different postal zones, because they frequently changed the areas in which they delivered mail. Their mean age was 43 years (range: 18 to 59 years), mean height was 174 cm (range: 156 to 192 cm), and the mean duration of employment was 20 years (range: 1 to 35 years). Sixty-four (47.1%) were regular smokers, i.e., smoking an average of 20 cigarettes daily. Subjects were categorized as smokers and nonsmokers since only one postal worker and one control were ex-smokers. In addition a group of 419 nonexposed people employed as packers in the food industry was previously studied (Zuskin et al. 1996b) and served as a control for the prevalence of acute and chronic respiratory symptoms among exposed workers. From this group we selected a subgroup of 87 personnel for comparison with the current workers (Table 1). The subgroup was determined by matching the sex, age, duration of employment and smoking habits of the two groups. All those studied gave their informed consent prior to their inclusion in the study. The consent was approved by the Human Investigation Committee of the School of Public Health in Zagreb.

Respiratory symptoms

Chronic respiratory symptoms were recorded using the Medical Research Council questionnaire on respiratory symptoms (1960) with additional questions on occupational asthma (World Health Organisation 1986; Maestrelli et al. 1992; Godnic-Cvar 1995). For all workers a detailed occupational history and answers to questions about their smoking habit were recorded. The following definitions were used:

- Chronic cough or phlegm: cough and/or phlegm for a minimum of 3 months per year
- Chronic bronchitis: cough and phlegm for a minimum of 3 months per year and for not less than 2 years in succession
- Dyspnea classification: grade 3 – shortness of breath when walking with other people at an ordinary pace on level ground; grade 4 – shortness of breath at the individual's own walking pace on level ground
- Occupational asthma: recurring attacks of dyspnea, chest tightness and pulmonary function impairment of the obstructive type, diagnosed by physical examination and spirometric measurements during exposures at or following work [decrease of 1-s forced expiratory volume (FEV1) $> 15\%$] and confirmed by medical records

Acute symptoms that developed during the work-shift were also recorded in both postal workers and controls. Symptoms included dry cough, dyspnea, irritation or dryness of the throat, upper respiratory secretions, dryness or bleeding of the nose, eye irritation and headache.

Ventilatory capacity

Ventilatory capacity was measured in all mail carriers by the recording of maximum expiratory flow-volume (MEFV) curves on a

portable spirometer [the Atospiror-Hi (Chest Company, Tokyo, Japan)], which was calibrated daily for volume. The MEFV curves were analysed for forced vital capacity (FVC), FEV1, and maximum flow rates at 50% (FEF50) and the last 25% (FEF25) of the vital capacity. Measurements were taken in the morning during working hours. Testing was performed according to the recommendations of Quanjer et al. (1993). At least three MEFV curves were recorded for each subject and the best value of the three technically satisfactory MEFV curves was used. The measured values of ventilatory capacity were compared with the predicted values of Quanjer (1983).

Environmental and meteorological conditions

In order to obtain an appreciation of the meteorological conditions to which the workers were exposed, we analyzed atmospheric parameters, including temperature, wind and relative humidity in the Zagreb area during the past 10 years (1987–1997). The results were expressed as the temperature-wind-humidity (TWH) index, which combines the three elements and is expressed by a single parameter (Zaninovic 1992). In addition, concentrations of total suspended air particulates ($\mu g/m^3$), sulfur dioxide (SO_2) ($\mu g/m^3$) and black smoke ($\mu g/m^3$) in the same area were reviewed throughout the same 10 year period. The measured values were compared with the recommended Croatian air quality standards (1995; 1996).

Statistical analysis

Odds ratios were calculated by logistic regression analysis for each respiratory symptom among postal workers, with age, employment and smoking as predictors (SAS/STAT 1990). The Chi-square test (or when appropriate Fisher's exact test), was used for testing differences in the prevalence of respiratory symptoms between groups. The results of ventilatory capacity measurements were analyzed by the paired *t*-test when comparing baseline with predicted values. Ventilatory capacity measurements were also analyzed by multiple regression analysis, with age, employment and smoking as predictors and FVC, FEV1, FEF50 and FEF25 as criteria variables (SAS/STAT 1988). A level of $P < 0.05$ was considered statistically significant.

Results

Respiratory symptoms

Table 1 shows the prevalence of chronic respiratory symptoms in postal workers and their matched controls. Prevalences of chronic bronchitis (25.0%) and sinusitis (38.9%) were significantly higher for the exposed workers compared to controls (13.8%; 2.3%) ($P < 0.05$; $P < 0.01$). Only one postal worker (0.7%) complained of symptoms typical of occupational asthma.

A logistic regression analysis for individual symptoms in postal workers was performed. Odds ratios for symptoms were all statistically significant for smoking ($P < 0.001$) (with the exception of asthma) but not for age or duration of employment.

Prevalences of work-related acute symptoms in postal and control workers, categorized by smoking habit, are presented in Table 2. There were high prevalences of all symptoms in both smokers and nonsmokers, particularly for eye irritation, nasal catarrh and headache. A single difference was statistically significant only for nasal catarrh (smokers: 56.3%; nonsmokers: 30.6%; $P < 0.01$). Prevalences of all acute symptoms in the 87 controls were considerably smaller in smokers and nonsmokers in comparison with the postal workers. Statistical analysis of the symptom prevalences between postal and control smokers demonstrated significant differences for nasal secretion ($P < 0.05$) and for eye irritation, nasal catarrh and headache ($P < 0.01$). For nonsmokers, these differences were statistically significant for cough and nasal bleeding ($P < 0.05$) and for dyspnea, irritation and dryness of the throat, nasal secretion, dryness of the nose, nasal catarrh and headache ($P < 0.01$).

Ventilatory capacity

Table 3 presents the ventilatory capacity data, categorized by smoking habit, for 136 postal and 87 control workers, in relation to predicted values. The measured FVC, FEF50 and FEF25 in postal workers were significantly lower in comparison with measured values in controls ($P < 0.01$). The mean FEF25 in particular was decreased in relation to the prediction (smokers: 65.1%; nonsmokers: 72.6%).

Table 4 shows the findings of our multiple regression analysis, with employment and smoking as predictors, and lung function parameters as outcome variables. This table shows employment to be a highly significant predictor of lung function. When age is added to the regression analysis, the effect of employment is no longer significant. This finding is presumably due to the high correlation between age and exposure ($r = 0.92487$). In this analysis there was no significant documented effect of smoking on the lung function parameters. This was the result of the large variability in lung function (SE) among smokers. Smoking workers, nevertheless, had significantly lower lung function than predicted.

Analysis of the measured individual data on ventilatory capacity as a percentage of predicted values revealed that FVC was less than 80% of the predicted amount in six workers (4.4%), FEV1 was decreased to less than 80% in four workers (2.9%), FEF50 was decreased to less than 65% in 42 workers (30.9%) and FEF25 was decreased to less than 65% of the predicted value in 82 workers (60.3%). Among the controls, none had a decreased FVC (<80% of predicted) and two (2.3%) had a decreased FEV1; for FEF50 such a decrease was found in four workers (4.6%) and for FEF25 in seven workers (8.0%).

Environmental measurements

The data on environmental measurements are presented in Table 5, showing the TWH index, the temperature (T °C) and the relative humidity (RH) (%) as ranges of mean values by month over a 10 year period (1987–1997). The highest temperature reached in summer was 36.6 °C, the highest relative humidity was 97%, the

Table 1 Prevalence of chronic respiratory symptoms in 136 postal workers and 87 control workers [*NS* difference statistically not significant ($P > 0.05$)]

Group	Mean age (years)	Mean height (cm)	Mean employment (years)	Chronic cough	Chronic phlegm	Chronic bronchitis	Dyspnea grade 3 & 4	Occupational asthma	Chest tightness	Sinusitis
Postal $n = 136$	43 ± 8	174 ± 7	20 ± 7	42 (30.9%)	34 (25.0%)	34 (25.0%)	13 (9.6%)	1 (0.7%)	5 (3.7%)	53 (38.9%)
Difference				NS	NS	<0.05	NS	NS	NS	<0.0 1
Control $n = 87$	42 ± 7	173 ± 7	21 ± 8	16 (18.4%)	14 (16.1%)	12 (13.8%)	4 (4.6%)	0 (0%)	0 (0%)	2 (2.3%)

Table 2 Prevalence in 136 postal workers and 87 control workers of acute symptoms which developed during the work-shift, categorized by smoking habit [*NS* difference statistically not significant ($P > 0.05$)]

Group	Smoking habit	Cough	Dyspnea	Throat		Eye irritation	Nose			Nasal catarrh	Headache
				Irritation	Dryness		Secretion	Dryness	Bleeding		
Postal workers	Smokers $n = 64$	15 (23.4%)	12 (18.8%)	12 (18.8%)	11 (17.2%)	36 (56.3%)	14 (21.9%)	6 (9.4%)	4 (6.3%)	36 (56.3%)	33 (51.6%)
		NS	NS	NS	NS	NS	NS	NS	NS	<0.01	NS
	Nonsmokers $n = 72$	9 (12.5%)	11 (15.3%)	14 (19.4%)	8 (11.1%)	42 (58.3%)	10 (13.9%)	10 (13.9%)	6 (8.3%)	22 (30.6%)	35 (48.6%)
Control	Smokers $n = 41$	4 (9.8%)	2 (4.9%)	4 (9.8%)	4 (9.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Nonsmokers $n = 46$	1 (2.2%)	0 (0.0%)	1 (2.2%)	1 (2.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3 Ventilatory capacity in 136 postal workers and 87 control workers [*NS* difference statistically not significant ($P > 0.05$)]

Group	Smoking habit	Mean age	Mean height	Mean employment	FVC			FEVI			FEF50			FEF25		
					Measured	Predicted	Difference measured-predicted	Measured	Predicted	Difference measured-predicted	Measured	Predicted	Difference measured-predicted	Measured	Predicted	Difference measured-predicted
		(years)		(years)	(l)	(l)	*P*	(l)	(l)	*P*	(l/s)	(l/s)	*P*	(l/s)	(l/s)	*P*
Postal $n = 136$	Smokers $n = 64$	41 ± 7	176 ± 7	18 ± 6	4.33 ± 0.83	4.97 ± 0.57	<0.01	3.70 ± 0.70	3.89 ± 0.40	<0.01	4.33 ± 1.28	5.38 ± 0.52	<0.01	1.74 ± 0.60	2.67 ± 0.31	<0.01
	Nonsmokers $n = 72$	45 ± 8	175 ± 7	22 ± 8	4.19 ± 0.82	4.61 ± 0.50	<0.01	3.61 ± 0.72	3.60 ± 0.39	NS	4.28 ± 1.26	5.10 ± 0.41	<0.01	1.75 ± 0.69	2.41 ± 0.26	<0.01
Control $n = 87$	Smokers $n = 41$	41 ± 7	176 ± 7	18 ± 6	4.86 ± 0.61	4.90 ± 0.40	NS	3.80 ± 0.60	3.90 ± 0.35	NS	5.29 ± 0.95	5.39 ± 0.50	NS	2.59 ± 0.55	2.60 ± 0.25	NS
	Non-smokers $n = 46$	44 ± 9	175 ± 8	22 ± 8	4.62 ± 0.80	4.69 ± 0.20	NS	3.55 ± 0.62	3.60 ± 0.39	NS	4.95 ± 1.10	5.05 ± 0.40	NS	2.30 ± 0.59	2.37 ± 0.20	NS

Ventilatory capacity data are presented as mean ± SE
Predicted values by Quanjer (1983)

lowest temperature was 3.3 °C with the lowest relative humidity of 26%. In winter the highest temperature was 22 °C with the highest relative humidity was 73%, the lowest temperature was –19.61 °C with the relative humidity of 36%.

Table 6 presents the air pollutant concentration data as ranges, for particulates, SO_2 and black smoke, by season over the 10 year period (1987–1997). The concentrations of dust particles ranged from 1 to 580 μg/m^3, for SO_2 from 0 to 502 μg/m^3 and for black smoke from 1 to 533 μg/m^3. After the year 1994, the measured values were considerably lower (since then, the maximum value for dust particles was 315 μg/m^3 and for SO_2 was 260 μg/m^3). For black smoke there was no difference in concentration before and after 1994. According to the Croatian air quality standards, the recommended values are: for dust particles, an annual mean of 75 μg/m^3, maximum 120 μ/mg^3; for SO_2, annual mean 50 μg/m^3, maximum 125 μg/mg^3, and for black smoke, annual mean 50 μg/mg^3, maximum 125 μg/m^3. The values of the Croatian standards are higher than those in the United States, where for particulate matter, the annual standard is 50 μg/m^3, with a daily standard of 150 μg/m^3 which must not be exceeded more than once a year. For SO_2 the US standard is 0.03 ppm. The measured maximum values in our study are considerably above the recommended Croatian values, particularly for dust particles.

Discussion

Our study of mail carriers demonstrates that work in this profession is associated with the development of acute and chronic respiratory symptoms. Since the only known major air irritants, other than cigarette smoke, in this work place are environmental, we reviewed the ambient exposures of these workers over the past 10 years.

The most frequent respiratory disorders due to atmospheric pollution are those caused by the effect of irritant gases and particulates on the mucous membranes and respiratory organs. The consequences of such pollution are eye, nose and throat inflammation, diminished lung function, increased susceptibility to respiratory infections, exacerbation of chronic respiratory disease and increases in emergency department visits and hospitalizations for chronic respiratory illnesses such as asthma (Devalia et al. 1994). Our mail carriers are heavily exposed to traffic-related pollution, as are many municipal workers who spend much of their time outdoors. Their exposure is similar to the conditions, described by the findings of Raaschou-Nielsen et al. (1995), endured by Danish street cleaners who exhibit high prevalences of chronic bronchitis, asthma and other symptoms associated with traffic air pollution. Similarly, Zuskin et al. (1996a) reported a high prevalence of acute and chronic respiratory symptoms in Croatian street cleaners and garbage collectors, that was significantly higher when compared to a control group of unexposed workers.

Table 4 Regression analysis of ventilatory capacity test-values in 136 postal workers (age excluded) (*DF* degrees of freedom, *DF1* number of variables, *DF2* number of subjects, *T* *t*-statistic for the null hypothesis *(H0)* that implies the parameter to be 0)

Test	Variable	DF	Parameter estimate	Standard error	T for H0: parameter = 0	Prob > (T)	F	DFI	DF2	*P*	R^2
FVC	Intercept	1	4.822880	0.20139739	23.947	0.0001					
	Employment	1	−0.029270	0.00821660	−3.562	0.0005					
	Smoking	1	0.024030	0.14008091	0.172	0.8641					
							6.940	2	133	0.0014	0.0809
FEVI	Intercept	1	4.312206	0.16877486	25.550	0.0001					
	Employment	1	−0.032344	0.00688566	−4.697	0.0001					
	Smoking	1	−0.045987	0.11739050	−0.384	0.7015					
							11.359	2	133	0.0001	0.1331
FEF50	Intercept	1	5.570303	0.30001213	18.567	0.0001					
	Employment	1	−0.059337	0.01223987	−4.848	0.0001					
	Smoking	1	−0.203787	0.20867188	−0.977	0.3305					
							11.778	2	133	0.0001	0.1377
FEF25	Intercept	1	2.461718	0.15085166	16.319	0.0001					
	Employment	1	−0.032744	0.00615443	−5.320	0.0001					
	Smoking	1	−0.148080	0.10492410	−1.411	0.1605					
							14.157	2	133	0.0001	0.1631

Table 5 Meteorological conditions over a 10 year period (1987–1997) (*TWH* Index of comfort zone (temperature, wind and relative humidity), *RH* relative humidity)

Month	TWH index		Temperature (°C)	RH (%)
	Description	(kj/kg)		
January–March	Cold	−5.0–15.0	1.0–6.6	81.1–68.7
March–April	Cool	15.1–30.0	6.6–11.1	68.7–67.3
May–July	Temperate	30.1–50.0	15.8–18.7	66.9–66.3
July–August	Warm	50.1–80.0	21.5–20.8	66.3–68.8
September	Temperate	30.1–50.0	18.7–16.5	69.7–76.2
October	Cool	15.1–30.0	15.1–10.7	78.4–82.0
November–December	Cold	−5.1–15.0	5.0–1.2	83.0–83.6

Data are presented as a range of mean monthly values over a 10 year period

Table 6 Atmospheric factors over a 10 year period (1987–1997) (SO_2 sulfur dioxide)

Season	Dust particle size $\mu g/m^3$	SO_2 concentration $\mu g/m^3$	Black smoke $\mu g/m^3$
Winter	3–519	0–397	2–533
Spring	10–580	0–311	6–166
Summer	1–352	0–502	2–125
Autumn	1–362	0–303	1–225

Data are presented as a range of the measured values over a 10-year period at different locations in the Zagreb area

These disorders are, of course, influenced by other factors as well, such as genetic susceptibility, problems of the immune system, allergies, occupational exposure to pollutants, and lifestyle-related activities, particularly smoking (Wanner 1993; Lippman and Lioy 1985). Leikauf et al. (1995) indicated the possible association between ambient air pollutants and the exacerbation of asthma. An increased risk of asthma associated with exposure to increased ambient concentrations of ozone was described by Greer et al. (1993). Among our postal workers, only one complained of work-related asthma symptoms, which began 2 years after the subject began working as a mail carrier (this person was a nonsmoker). Among the mail carriers studied, 47.1% were regular smokers. In Croatia smoking is prevalent in the general population; nearly 60% of the adult male working population smoke. Since 1996, however, new legislative regulations strictly forbid smoking in general public and work places.

Among our mail carriers a large number complained of work-related acute symptoms. Our unexposed control workers rarely mentioned cough, dyspnea and dryness or irritation of the throat. Forsberg et al. (1993) reported a significant correlation between air pollution levels and the frequency of acute ambient pollution-related symptoms.

In our mail carriers the measured values of lung function tests were significantly decreased compared with predicted values, particularly the FEF25, suggestive of obstructive changes predominantly in the smaller airways. Xu et al. (1991) reported that an increase in SO_2 concentration could result in a reduction of FEV1 and FVC. Barnes (1994) stated that the normally-encountered levels of outdoor air pollution were unlikely to contribute to a worsening of asthma and lung function. However, it is possible that a combination of air pollutants may have greater effects on airway function than exposure to single pollutants, particularly in our

cohort which spent a majority of its working time outdoors. Interestingly, our analysis did not reveal a significant effect of smoking on lung function, although as can be appreciated in Table 4 smokers had significantly impaired lung function. Possibly this may suggest a healthy-worker effect or a significant interaction with air pollution.

In our study the concentrations of all measured air quality parameters frequently exceeded the Croatian recommended standards. It is not possible to correlate exposure levels in Zagreb with the findings of the current study, since individual exposures were unknown, but the high levels of pollutants suggest a possible etiology for the respiratory symptoms found in our postal workers.

The nature of any respiratory reactions to weather conditions is probably a function of the intensity of the weather factors and the worker's exposure to them, as well as the individual's adaptive capability. Reactions ranged from slight impairment of general well-being to the triggering of serious consequences for chronically ill patients (Bucher and Haase 1993). Our studied postal workers complained mostly of cold and wind as the meteorological factors which effected their health. For those who used a motorcycle, the effect of winds probably caused the most pronounced acute work-related upper respiratory symptoms such as eye and throat irritation, nasal catarrh, acute cough and headache. A high prevalence of sinusitis (38.9%) among our postal workers was most probably a consequence of frequent acute inflammation of the upper respiratory tract.

Ponka (1990) reported that the level of air pollutants and meteorological conditions were significantly correlated with upper respiratory tract infections. Ponka (1991) reported an increased number of admissions of asthma patients to hospital during cold weather especially of persons of working age, followed by the elderly. Effects of air pollutants and the cold were maximal if they occurred on the same day. Recently Holmen et al. (1997) demonstrated a significant interaction in asthmatic children of low ambient temperature and high nitrogen dioxide levels, and on asthma in adults of high temperature and high levels of ozone. Such data indicated a strong relationship between asthma, air pollution and temperature. Ostro (1995) showed that during the summer, the increased concentration of ozone may increase mortality from asthma. Peters et al. (1997) found that during the winter season, most particulates were in the ultrafine fraction (smaller than 0.1 μm in diameter) and were associated with a decrease of peak expiratory flow and an increase in cough and general malaise during the work-day. Ravelli and Kreis (1991/92) reported a significant association between the incidence of influenza, and SO_2 concentration and low temperature.

The causes of respiratory symptoms and lung function impairment in mail carriers are not well characterized and are poorly understood. The current study suggests that cigarette smoking as well as environmental conditions may play a role. It is certainly desirable to emphasize that the cessation of smoking would prevent the development of the chronic respiratory impairment associated with work-related exposure to pollution in mail carriers. It would be desirable too to improve (or restrict) the ambient conditions to which they are exposed and finally to carry out periodic medical examinations to identify susceptible workers. The protection of susceptible individuals identified by medical surveillance, in addition to more extensive characterization of the interaction between environment and health in this population, is warranted.

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