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Respiratory effects of work in retail food stores

II. Respiratory symptoms

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WEGMAN DH, EISEN EA, SMITH TJ, GREAVES IA, FINE LJ. Respiratory effects of work in retail food stores: II Respiratory symptoms. *Scand J Work Environ Health* 13 (1987) 209—212. This study examined the relationships between the prevalence of respiratory tract symptoms and estimates of environmental exposures in retail food stores, in particular exposures to emissions from the cutting of polyvinyl chloride wrap. When respiratory symptoms were compared with a measure of cumulative exposure, there was evidence that the prevalence of symptoms of episodic airway narrowing was higher for workers who had been exposed directly or indirectly to meat wrapping operations independent of a significant association of these symptoms with allergic or asthmatic history. Whether this finding reflects a nonspecific irritant effect or allergic sensitization cannot be determined from these data. No single substance present in the work environment studied has, as yet, been identified as associated with these effects.

Key terms: meat wrapper's asthma, plastic pyrolysis products, polyvinyl chloride.

The clinical finding of asthma in workers responsible for wrapping meat products in supermarkets was first reported in 1973 (8). Additional reports of acute illness led to the initiation of a study to examine the possibility that long-term respiratory health effects may result from working in such environments. Details of the study protocol, subjects, and methods have been described elsewhere (9). A brief summary follows.

Subjects and methods

Population

All persons over 25 years of age who were employed in one of 75 retail food stores for two or more years and who were working in "exposed areas" (the meat, produce, or delicatessen areas) were asked to volunteer for the study. Workers from store areas where wrapping was not performed were selected for comparison. A total of 685 subjects were studied.

Respiratory symptoms

All the subjects were administered a standard, validated questionnaire which included medical, smoking, allergy, and work histories. Symptoms were grouped according to the following three anatomic and physiological categories: upper respiratory tract effects (nasal irritation, eye/throat irritation), lower respiratory tract effects (usual cough, usual phlegm, breathlessness on stairs, chronic bronchitis), and those that may indicate episodes of airway narrowing or increased airway reactivity (chest tightness and frequent wheezing).

Environmental exposures

A variable which summed hours of exposure working at or near wrapping operations was created and designated as cumulative exposure. The cumulative exposure values were classified into high- and low-exposure categories. "High" was defined as the equivalent of working full-time as a wrapper using a "hot-wire" cutting instrument for a minimum of five years. Any cumulative work experience which involved direct or indirect exposure to wrapping operations but did not meet this minimum was assigned to the "low" category. Similar high-low exposure categories were defined for hot-wire exposures which occurred exclusively in the meat room. A total cumulative exposure index for "cool-rod" wrapping was also made. However, the historical exposures to cool-rod wrapping were small relative to hot-wire exposures because of the overall short duration of its usage.

Results

In order to focus on effects associated with work exposure differences, the original comparison population was reduced to those whose full work experience in the retail food industry had never resulted in their direct or indirect exposure to wrapping operations or

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who were employed in cold sections of the retail food stores. This group included 152 study subjects and was used throughout the evaluation as the unexposed comparison group.

The symptoms were reviewed first from the point of view of the three major job groupings (meat department, delicatessen or produce department and comparison group), restricted to those who had not changed job group during their entire work history.

Table 1. Percentage of females, smokers, ex-smokers and never smokers and the prevalence of respiratory tract symptoms by major job categories.[a]

	Unexposed clerks[b] (N = 152) (%)	Delicatessen/ produce workers[b] (N = 162) (%)	Meat room workers[b] (N = 260) (%)
Females	56	27	40
Smokers	48	58	51
Ex-smokers	21	20	20
Never smokers	31	22	26
Symptoms			
Upper respiratory tract			
Nasal irritation	15	9	20
Eye/throat irritation	13	12	12
Lower respiratory tract			
Usual cough	17	19	22
Usual phlegm	16	26	22
Breathlessness on stairs	9	9	12
Chronic bronchitis	5	11	10
Episodic airway narrowing			
Chest tightness	6	12	12
Frequent wheezing	3	6	5

[a] Only includes subjects who have worked exclusively in one job category.
[b] Mean (SE) age: unexposed clerks 44.5 (1.0) years, delicatessen/produce workers 41.6 (0.9) years, meat room workers 45.7 (0.6) years.

The presence of upper respiratory tract symptoms did not differ systematically between the categories (table 1). Lower respiratory tract symptoms and symptoms of episodic airway narrowing were increased among workers in both the meat room and the delicatessen/produce areas relative to those of the comparison group. None of the differences were significant.

Because the job title alone did not allow for weighting by length of employment or type of wrap-cutting machine, symptoms were examined separately according to the cumulative exposure. We refined the cumulative exposure by limiting exposure to that cumulated in the meat room because the amount of wrapping done in other departments was substantially less than in the meat room, the film wrap used outside the meat room was too variable, and only meat wrapping was conducted in a cold environment. When exposure at any site (median for total cumulative exposure being 45 460 h) was compared with exposure accumulated only in the meat room (median for cumulative exposure in the meat room being 42 306 h), almost all of the estimate derived from time in the meat room.

Cumulative exposure in the meat room was stratified by the "high" and "low" categories as has already been described. In a contrast of these two groups with the comparison group, there was a suggestion of excess nasal irritation in the high-exposure group and a trend for the symptoms of episodic airway narrowing. Lower respiratory tract symptoms also showed some elevation in the two exposed groups, usual cough and breathlessness on stairs being the most elevated for the high-exposure group.

Table 2. Percentage of females, smokers, ex-smokers and never smokers and the prevalence of respiratory tract symptoms by cumulative exposure (CE) in meat rooms stratified by history of allergy or asthma (absent or present).

			Meat room			
	Never exposed		Cumulative exposure low		Cumulative exposure high	
	Absent[a] (N = 132) (%)	Present[a] (N = 20) (%)	Absent[a] (N = 121) (%)	Present[a] (N = 22) (%)	Absent[a] (N = 132) (%)	Present[a] (N = 18) (%)
Females	54	68	34	40	44	33
Smokers	52	21	49	45	52	28
Ex-smokers	18	37	26	15	27	33
Never smokers	50	42	25	40	21	39
Symptoms						
Upper respiratory tract						
Nasal irritation	14	25	14	23	21	44
Eye/throat irritation	11	25	10	14	9	22
Lower respiratory tract						
Usual cough	17	20	16	14	26	39
Usual phlegm	17	15	24	23	21	28
Breathlessness on stairs	8	15	13	5	14	27
Chronic bronchitis	6	0	9	9	10	22
Episodic airways narrowing						
Chest tightness	5	15	12	18	10	39
Frequent wheezing	4	0	6	5	5	39

[a] Mean age (years): never exposed, absent 44.4 and present 40.2; meat room, cumulative exposure low, absent 40.6 and present 39.5; and meat room, cumulative exposure high, absent 50.5 and present 48.9.

Because of the initial concern with "meat wrapper's asthma," the possibility of a history of allergy or asthma being related to the symptom prevalence in each group was examined. The symptom results were stratified by presence or absence of either a personal history of allergy to inhaled materials or a personal history of asthma. Those with either history were labeled as "allergy present."

The vast majority of employees did not have a history of asthma or sensitivity to inhaled allergens. Those with such a history showed a higher prevalence of symptoms in all three exposure strata (table 2). When the prevalence rates of symptoms were examined across the three exposure groups, several had suggestive trends, particularly symptoms of episodic airway narrowing. The high exposure group with allergy present had the highest prevalence of lower respiratory tract symptoms in all cases, but only chronic bronchitis showed a trend across the groups. For the upper respiratory tract symptoms no trend was apparent.

The smoking habit and age distributions differed somewhat in the different exposure groups (tables 1—2).

A multivariate analysis was used to examine for an independent exposure effect. With the use of multiple logistic regression, a model was developed in which the symptom (presence or absence) was the dependent variable. The independent variables were smoking (classified as ever or never smoked, allergic or asthmatic history (classified as presence or absence of either asthma or sensitivity to inhaled allergens), age, and exposure to meat wrapping (high exposure versus never exposed). The odds ratios which resulted from this approach are presented in table 3. Symptoms of episodic airway narrowing were associated both with allergic or asthmatic history and with cumulative exposure. Age was not a significant factor and smoking was significant only for wheezing. In contrast, smoking was significantly associated with the presence of a "usual cough," while cumulative exposure was only weakly associated with this symptom. The models investigated to predict the odds of each of these symptoms also included interaction terms, but none were significant predictors (including the interaction between allergic or asthmatic history and exposure to meat wrapping operations).

The preceding results on relationships between cumulative exposures and selected symptoms included only exposures to hot-wire wrapping operations. An important current concern is the exposure from the use of the cool rod and, in particular, any association of effects with these exposures in the absence of a history of exposure to emissions from hot-wire wrapping. Those exposed exclusively to cool-rod wrapping operations were few (42 in total). When the data for these persons were examined in a manner similar to the hot-wire exposures (dividing the cumulative cool-rod time-weighted exposures into two groups) differences in symptoms were not found between the two groups nor between the entire group and those who had never been exposed to wrapping. Unfortunately the small numbers of subjects and short durations of exposure prevented an adequate assessment of this possibility.

Table 3. Odds ratios for chest tightness, frequent wheezing, and usual cough obtained from logistic regression models.[a]

	Current smoking	Allergic or asthmatic history	Age (years)	Cumulative exposure in meat room
Chest tightness	1.31	5.27***	1.00	2.52**
Frequent wheezing	5.09***	9.35***	0.96	4.11**
Usual cough	4.66***	2.84**	1.02	1.75*

[a] The ratios are reported relative to the values for never smoking, nonallergic, nonasthmatic individuals who were never exposed to wrapping fumes.
* $0.05 < p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Discussion

This population-based survey of respiratory symptoms among workers employed in the retail food store industry was not designed to examine directly the question of meat wrapper's asthma. In fact the restriction of eligible subjects to those who had worked for at least two years in the industry virtually eliminated from the study individuals who were acutely symptomatic to any materials in the retail food store environment.

Nevertheless, the study was able to examine the relationships between the prevalence of respiratory tract symptoms and estimates of exposure to emissions from the cutting of polyvinyl chloride wrap. There was evidence that the prevalence of some symptoms was higher for workers who had been exposed directly or indirectly to meat wrapping operations. This finding is best illustrated by the multiple logistic analysis, in which high cumulative exposure to meat wrapping operations was associated with symptoms of episodic airway narrowing independent of the significant association with allergic or asthmatic history.

It is useful to note that both the stratified prevalence rates and the multiple logistic analysis showed that those with a history of allergy or asthma are more likely to report symptoms in association with cumulative exposure to meat wrapping operations. It is possible that this result is evidence of increased susceptibility to wrapping fume emissions or of the development of specific sensitization. Whether our findings reveal a nonspecific irritant effect or an allergic sensitization cannot be determined from these data.

These findings can be compared with a number of available reports in which populations of retail food store workers have been examined for respiratory symptoms (1—7). None of these studies included any documentation of exposures at the work stations.

Falk & Portnoy (4) surveyed 152 supermarkets and questioned 145 meat wrappers, 150 meat cutters, and

150 grocery checkers. The primary findings were significantly elevated lower respiratory tract symptoms including wheezing, shortness of breath, and chest pain in wrappers when they were compared with cutters and clerks. These symptoms occurred predominantly in cigarette smokers (past or current), but a nonsignificant increase among wrappers was noted for nonsmokers. The symptoms were not related to duration of work or age. Seventeen wrappers who used mechanical cutters did not report work-related symptoms. Meat wrappers reported eye, nose, and throat symptoms with greater frequency than checkers, and eye and throat symptoms with greater frequency than meat cutters.

Barancik & his colleagues (1, 5) have reported studies of food store employees. First (5), a brief postal questionnaire (25 % response rate) suggested that meat wrappers had more symptoms than cutters. In a follow-up study (1, plus unpublished tables), a more elaborate symptom and work environment questionnaire was responded to by 67 % of the sample (116 wrappers, 151 cutters). Those who worked in meat departments using hot wires had a higher symptom prevalence than those not exposed to hot-wire cutting. Adjustment for age, smoking, or allergy was not reported.

Polakoff et al (7) studied 17 supermarket employees who were meat wrappers and compared them with 21 office personnel and store clerks. The comparison group was younger and included more nonsmokers and fewer women. Meat wrappers reported more upper, but not lower, respiratory tract symptoms. Brooks & Vandervort's study (3) included subjects already reported on by Polakoff et al, but it added those studied at another site, including seven meat wrappers and eight meat cutters. It appeared that the wrappers in the new group had more work-related upper and lower respiratory tract symptoms.

Jones & Weill (6) studied 150 employees of a supermarket chain, 72 "exposed" to wrapping film in meat or produce wrapping and 78 not exposed (meat cutters and cashiers). Two to three years before the study, most stores had replaced the hot-wire cutting instruments with mechanical cutters. No information was provided on prior exposure to emissions from the hot-wire cutting instruments. Respiratory tract symptoms unrelated to the work were the same for both groups. The same was true for the small proportion (6 %) of work-related upper or lower respiratory tract symptoms. Atopy and smoking, however, were related to these symptoms.

Finally, Breysse (2) conducted a survey of 272 female meat wrappers. Among those "upset by fumes" (67—70 % of the total group), the most frequent complaint was eye irritation (43—54 %); wheezing occurred less frequently (11—22 %). Only 10 % were "upset" by fumes when they were not cutting the material themselves.

These published findings are consistent with those reported in the present investigation. In addition, our study indicates that the increased prevalence of respiratory tract symptoms appears to be related to the hot-wire cutting of meat wrapping film. The small number of subjects with experience only on cool-rod wrapping machines suggests that this minor environmental alteration may avoid a potential health problem. The report by Jones & Weill (6), on a population which had entirely changed to mechanical cutting machines two to three years prior to the survey, provides further supporting evidence for this corrective action.

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