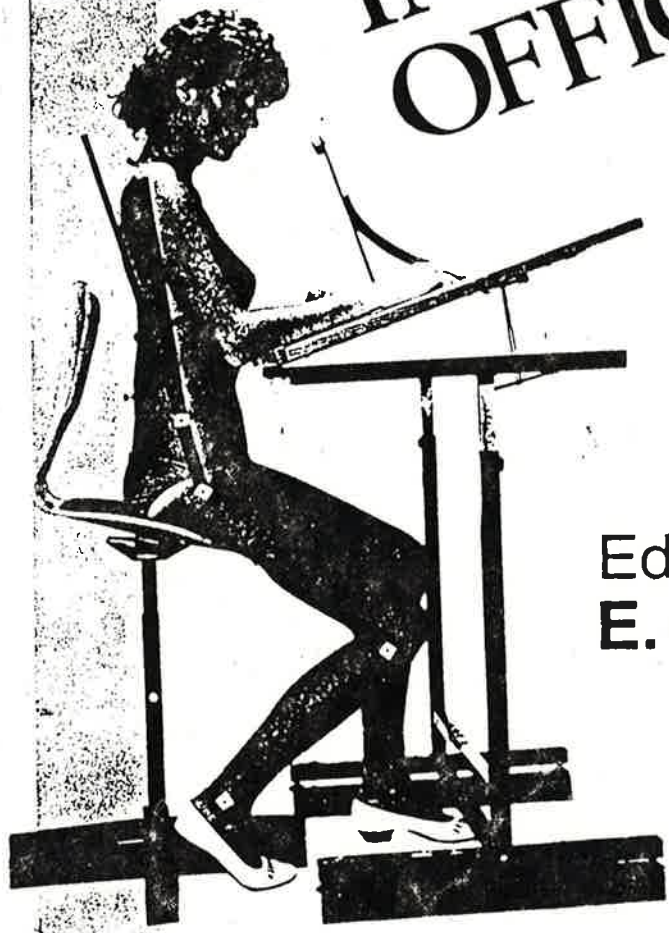


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ERGONOMICS AND HEALTH IN MODERN OFFICES



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*Comparison of Non-Smokers' and Smokers'
Perceptions of Environmental Conditions and Health
and Comfort Symptoms in Office Environments
With and Without Smoking*

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Abstract

One thousand and one hundred branch members of the New York branch of the Office and Professional Employees International Union working in nine office buildings filled out a detailed questionnaire on working conditions and health comfort complaints. Data were classified according to smoking habits of respondents and office rules regulating smoking. Neither smokers nor non-smokers differed in prevalence of complaints for a large variety of symptoms by smoking conditions in the office but more non-smokers complained about stressful conditions in offices where smoking was restricted or prohibited than where smoking was permitted.

Lack of differences in comfort complaints between smoking and non-smoking offices does not contradict findings of irritated responses due to passive exposure to smoke in controlled, especially chamber studies. Responses of the OPEIU members were taken under normal conditions of ventilation and lighting and no specific attention was drawn to the presence or absence of smokers. The findings are also in agreement with a study conducted by the US National Institute for Occupational Safety and Health where no association was found between density of smokers and levels of complaints.

1. *Introduction*

A great deal of attention has been concentrated on smoking as a source of indoor airborne substances and as a possible cause for building illness. However, modern buildings tend to generate a large variety of pollutants as well as entrapping large numbers of them which

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penetrate from the outside (Sterling, 1977; Yocum, 1982). Also, review of the literature has shown that elevated levels of particulates and gases related to smoking have been measured indoors almost exclusively in experimental situations using special chambers, in the absence of ventilation or while excessive amounts of cigarettes were smoked. But for those studies conducted under normal conditions of occupation, smoking and ventilation, indoor levels of contaminants do not exceed substantially those found outdoors (Sterling, 1982).

Corroborating evidence for this also has come from a recent review of some 143 building studies. When pollutant levels are compared in offices where smoking is restricted and/or prohibited and offices where smoking is permitted, no differences are found under normal conditions of occupancy (Sterling, 1983; Sterling, 1983). At the same time, it has been demonstrated that various types of symptoms such as eye irritation or respiratory distress are reported when non-smokers (or smokers, for that matter) are exposed to high levels of tobacco smoke in unventilated offices or chambers (Weber, 1980, 1983). But does smoking affect health and comfort of office workers under normal conditions of office use?

2. *Method*

A computer-readable, self-administered work environment questionnaire was given to approximately 1 100 members in 9 buildings of the Office and Professional Employees International Union, Local 153, New York City. The questionnaire was constructed to document perceived environmental conditions, symptoms and complaints related to building illness among building occupants.

The Health and Work Environment Survey questionnaire contained detailed information about:

1. Environmental conditions.
2. Health-related symptoms.
3. Life-style factors.
4. Stress factors.
5. Questions about equipment use, employment history, types of appliances used at home, and others.

3. *Results*

The major findings of our study (reported elsewhere) were a highly substantial and statistically significant association between all indices of health and disease, on the one hand, and conditions of ventilation, lighting, VDT and CRT use and stress (possibly in that order). The analyses of environment, health and stress indices in relation to smoking are of special relevance to our inquiry.

The reactions of 469 non-smokers, 286 former smokers and 326 present-smokers were compared for a list of ergonomic indices: ventilation, temperature, humidity, lighting, and on specific responses to questions about air movement (too little and too much), lighting levels (too dim, too bright, too much glare), temperature (too hot, too cold), humidity (too dry, too moist), air (too smoky, too stuffy); for a list of health and comfort indices: building illness, neurophysiological, cardiorespiratory, musculoskeletal (related also to seating comfort), visual health; and finally a number of stress related indices: decision-making, job security, physical stress and relationship stress. With one single exception, all these distributions turned out to be similar and not statistically significant for non-smokers, former smokers and present-smokers. That exception, as may well be expected, was that of the specific judgement of 'smokiness of the air' (but not observed for 'stuffiness of air'). Sixty-three of the smokers compared with 52% of the non-smokers felt the air not to be too smoky in their environment. On the other hand, 16.7% of the non-smokers as compared to 6.6% of the smokers found the air very often to be too smoky (with $\chi^2 = 18.74$, d.f. = 4, $p \leq 0.001$). While the differences between groups are small, they do indicate that smokers have the greater tolerance for cigarette smoke than do non-smokers (with former smokers falling in between never- and present-smokers).

Some of the workers smoked and some of them did not. Some of them worked in places where smoking was permitted, some in places where smoking was prohibited, and some in places where smoking was restricted.

TABLE 1. Percentage distribution for 'ventilation index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Ventilation index	1A: Non-smokers working where smoking is		1B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	11.7	10.8	9.7	14.8
Average	56.3	63.1	62.0	69.7
Poor	32.0	26.2	28.3	15.5
	100%	100%	100%	100%
	$\chi^2 = 1.17$	$p \leq 0.88$	$\chi^2 = 10.23$	$p \leq 0.04$

Tables are organized as percentages in such a way that direct comparisons can be made. Each column gives the proportion of individuals who rate their environment, health or stress conditions as good, average or poor. Thus Table 1A shows that of the non-smokers working in places where smoking was permitted, 11.7% rated their ventilation conditions (as measured by the 'ventilation index') as good, and 32.0% as poor, while 10.8% of non-smokers working in places where smoking was either restricted or prohibited, rated their

ventilation conditions as good, and 26.2% as poor. Among smokers working in environments where smoking was permitted, we find that 9.7% rated ventilation as good while 14.8% of smokers did so who worked where smoking was either restricted or prohibited (Table 1B). (The hypothesis of statistical independence between the frequencies was computed for 4 d.f., between groups in smoking permitted, restricted and prohibited offices using chi square statistics for non-smokers and smokers separately. Please note that in order to save space, tables here combine the restricted and prohibited groups.)

For non-smokers, the distribution of responses to questions assessing the quality of environmental conditions of ventilation (Table 1A), temperature (Table 2A), humidity (Table 3A), lighting and odour (not shown here) show no differences between environments with and without smoking. However, the same is not true for smokers who appear to be responsive to variations in ventilation and associated perceived temperature and humidity measures when smoking is restricted or prohibited (Tables 1B, 2B and 3B).

TABLE 2. Percentage distribution for 'temperature index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Temperature index	2A: Non-smokers working where smoking is		2B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	13.1	4.8	10.1	15.0
Average	69.2	85.7	71.5	76.2
Poor	17.7	9.5	18.4	8.8
	100%	100%	100%	100%
	$\chi^2 = 8.06$	$p \leq 0.09$	$\chi^2 = 8.84$	$p \leq 0.07$

TABLE 3. Percentage distribution for 'humidity index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Humidity index	3A: Non-smokers working where smoking is		3B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	30.2	39.1	28.0	40.3
Average	63.6	59.4	69.2	54.9
Poor	6.2	1.6	2.8	4.9
	100%	100%	100%	100%
	$\chi^2 = 3.9$	$p \leq 0.42$	$\chi^2 = 10.28$	$p \leq 0.04$

The distribution of responses to questions assessing the presence of symptoms related to building illness, visual health, neurological, cardiorespiratory, musculoskeletal and somatic health shows no difference between environments with and without smoking, but this time for neither smokers nor non-smokers (not shown here, except building illness). The 'building illness index' is perhaps the most relevant of all these health indices used (Table 4). It summarizes symptoms most often listed in connection with epidemics of health-related complaints in modern sealed structures (e.g. headache, fatigue, nose, throat and eye irritation, sore throat and cold symptoms). Table 5 shows that the percentage distribution of building illness related responses is not related to either smoking practices of the employee or of the workplace. In fact, health-related complaints as a group show no significant relationship or even a consistent trend between the percentage of employees who report health-related symptoms and either their or their workplace's smoking status. These observations are further supported by the lack of differences in the proportion of absenteeism in workplaces with and without smoking (Table 5).

TABLE 4. Percentage distribution for 'building illness index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Building illness index	4A: Non-smokers working where smoking is		4B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	43.1	37.9	38.9	43.0
Average	38.7	51.5	46.5	44.4
Poor	18.2	10.6	14.6	12.6
	100%	100%	100%	100%
	$\chi^2 = 6.49$	$p \leq 0.16$	$\chi^2 = 1.087$	$p \leq 0.90$

TABLE 5. Percentage distribution for 'absenteeism index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Absenteeism index	5A: Non-smokers working where smoking is		5B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	88.8	82.8	87.6	83.0
Average	10.4	17.2	11.4	14.0
Poor	0.7	0	1.0	2.7
	100%	100%	100%	100%
	$\chi^2 = 2.47$	$p \leq 0.65$	$\chi^2 = 7.26$	$p \leq 0.12$

Table 6 shows the relationship of smoking to perceived stress. Employees working in places where smoking is permitted report substantially less stress than employees in smoking restricted or prohibited workplaces. It is likely that this relationship simply reflects a more permissive and tolerant attitude by the employers.

TABLE 6. Percentage distribution for 'job security index' responses for non-smokers and smokers working where smoking was permitted and restricted or prohibited.

Job security index	6A: Non-smokers working where smoking is		6B: Smokers working where smoking is	
	Permitted	Prohibited or Restricted	Permitted	Prohibited or Restricted
Good	66.4	35.9	68.5	46.9
Average	32.8	53.1	29.6	44.8
Poor	0.7	10.9	2.0	8.4
	100%	100%	100%	100%
	$\chi^2 = 25.11$	$p \leq 0.001$	$\chi^2 = 27.29$	$p \leq 0.001$

4. Discussion

The review of available studies does not provide any objective evidence that either pollution levels or patterns of health-related complaints differ in some remarkable way between locations with or without smoking restrictions. But it must be stressed that these observations were obtained during normal working conditions. For this reason, these findings are not comparable to reports of responses to smoking among non-smoking office workers obtained under special conditions (Barad, 1979; Working Women, 1981; Weber, 1980, 1983). Where smoking is felt to be irritating, such complaints ought to be attended to. Yet a question might be asked whether it is the presence of smokers or the act of smoking that causes the complaints about smoking?

In summary, a careful review of available evidence contradicts the belief that smoking is the or even a pivotal source of indoor pollution or of health-related building complaints. Modern buildings tend to generate and entrap pollutants from numerous sources. Under inadequate ventilation, conditions may be created where discomfort and illness result irrespective of whether or not smoking is permitted.

References

- Barad, C.B., 1979, Smoking on the job: the controversy heats up. *Occupational Health and Safety*, 48, 21-24.

- Salisbury, S.K., Kelter, A., Miller, B. and Roper, P., 1982, TA 80-122-1117. 101 Marietta Tower Building, Atlanta, Georgia, US. National Institute for Occupational Safety and Health, Health Hazard Evaluation, Cincinnati, Ohio.
- Sterling, E., McIntyre, D. and Sterling, T., 1984, The effects of sealed office buildings on the ambient environment of office workers. This vol., pp.70-76.
- Sterling, E. and Sterling, T., 1981, The impact of different ventilation and lighting levels on building illness: an experimental study. Proceedings of the International Symposium on Indoor Air Pollution, Health and Energy Conservation, 13-16 October, 1981, University of Massachusetts, Amherst, Massachusetts. *Canadian Journal of Public Health* (in press).
- Sterling, T.D., Dimich, H. and Kobayashi, D., 1982, Indoor byproduct levels of tobacco smoke: a critical review of the literature. *Journal of the Air Pollution Control Association*, 32, 250-259.
- Sterling, T.D. and Kobayashi, D., 1977, Exposure to pollutants in enclosed living spaces. *Environmental Research*, 13, 1-35.
- Sterling, T., Sterling, E. and Dimich-Ward, H., 1983, Air quality in public buildings with health complaints. *ASHRAE Transactions*, 89, 2A and B.
- Weber, A., and Fischer, T., 1980, Passive smoking at work. *International Archives of Occupational and Environmental Health*, 47, 209.
- Weber, A., 1983, Irritating and annoying effects of passive smoking. This vol., pp.28-33.
- Working Women, April 1981, *Health Hazard for Office Workers*, A Report by Working Women Education Fund, 1224 Huron Road, Cleveland, Ohio 44115.
- Yocum, J.E., 1982, Indoor-outdoor air quality relationships. *Journal of the Air Pollution Control Association*, 32, 500-520.