The perceived indoor climate in Swedish schools

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SUMMARY

The perceived indoor climate in Swedish schools has been surveyed in a big scale using standardised questionnaires. Two databases covering 324 schools with 11 191 school personnel, among those 7 136 teachers, have been created between 1998 and 2007. Analyses from these databases show that the school personnel mostly complain about noise, dust and dirt, "stuffy" bad air and to a lesser degree about low and varying temperatures and that teachers give a more negative picture than other occupational school groups about the physical school environment. Fatigue, heavy headedness and headache are frequently reported and often related to both noise and deteriorated indoor air. The prevalence of mucous membrane irritations and skin symptoms are mostly low in comparison to many other occupational groups, i.e. office and hospital workers. Those who complain more also relate their symptoms to a higher extent to the school environment.

KEYWORDS

School environment, Reference databases, MM040 Questionnaire, Teachers

INTRODUCTION

The European Federation of Asthma and Allergy Associations´ project "Indoor Air Quality in European Schools" states that indoor air quality in schools should be recognised as a priority topic for public health and that few European countries have implemented laws, directives and guidelines aimed at improving IAQ in schools (Carrer et al., 2002). In the report "Creation of healthy indoor environment in schools" supported by International Society for Indoor Quality and Climate, methods are discussed about how to investigate school buildings with indoor climate problems in an efficient way, including the use of questionnaires (Gruber and Falck, 2001)

In Sweden there are more than 9 000 schools from primary schools to colleges. Most of the older schools have been rebuilt, especially supplied with better ventilation. Despite this, complaints about deteriorated indoor air quality have been reported by both school personnel, students and parents and symptoms have been related to the school environment. Several surveys covering all schools have been made in dozens of communities to get basic data to prioritise necessary restoring activities. By using standardised questionnaires large databases have been created to support the assessments of individual schools. In a nation-wide energy project in 2007 both inspections of the school environment and a questionnaire survey were used in a stratified random sample of schools in 21 municipalities scattered all over Sweden.

The complaints reported are sometimes related to the school buildings but in many occasions obviously also due to other factors in the school environment. Too many pupils because of large birth cohorts, changed pedagogical techniques demanding more rooms for group activities and different responsibilities for the personnel, all factors can affect the work

environment for the school personnel, especially the teachers. Earlier analyses have shown that changed work situations, i.e. demands for the teachers to stay at the workplace all day besides new responsibilities may increase the work stress (Andersson et al., 2000a). Deteriorated economical possibilities may result in decreased cleaning quality and more frequent complaints about dust exposures (Andersson et al., 2000b)

The purpose of this study was to describe the perceived indoor climate in Swedish schools and symptoms presumed being related to the school environment, to analyse the differences between how teachers and other occupational school groups perceive their work environment and try to analyse the impact of some physical environmental factors on reported symptoms.

MATERIAL AND METHODS

The characteristics of the two current data bases are described in Table 1. The "national sample" of schools contains the outcome of 68 schools out of the 92 schools in the basic stratified random sample. In total 1 965 persons were included. In the basic "survey database" 9 226 employees were included from 256 schools from 13 municipalities during the period 1989 to 2005. The same MM 040 questionnaire was used in all investigations (Andersson et al., 1998). The occupational group "others" contains administrative persons, service personnel and different specialists.

Table 1. Characteristics of the study databases.

	National sample	Survey database	Total
Number of schools	68	256	314
Number of persons	1 965	9 226	11 191
Sex (% men)	21	24	23
Age (mean)	47	45	45
Occupational groups			
teachers (%)	68	64	65
others (%)	32	36	35
Astma/ hayfever (%)	26	26	26

RESULTS

The perceived work environment and current symptoms are presented in Figure 1 below for the two databases. Despite different sampling techniques the outcome is similar and it seems fair to put both databases together in the forthcoming analyses. This is even more strengthened by the fact that the characteristics of the two databases are similar.

The main indoor climate problems in Swedish schools are noise, dust and dirt, stuffy air and to a lesser degree various and low temperature. General symptoms (fatigue, heavy headedness and headache) are more common than in workplaces without known indoor climate problems while the prevalence of mucous membrane irritations and skin problems is close to the reference values.

WORK ENVIRONMENT
(often bothered) %
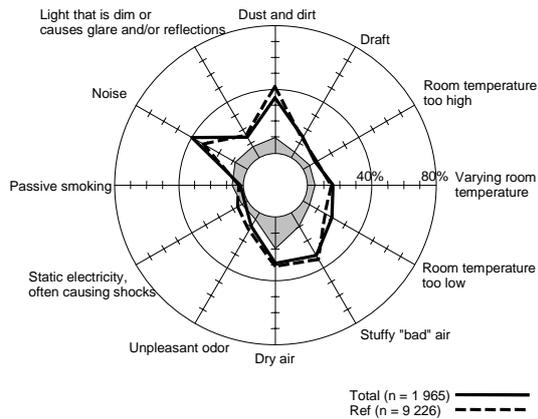
SYMPTOMS
(yes, often) %

Total (n = 1 965) ———
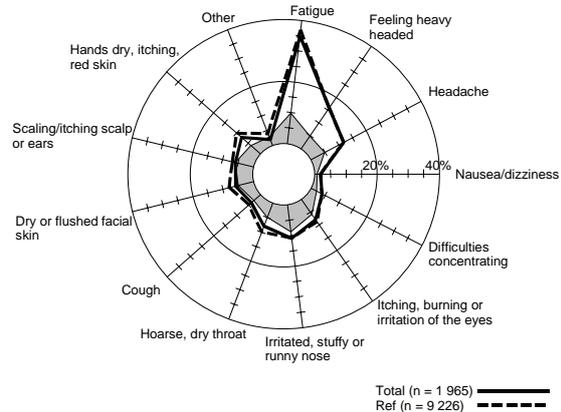Ref (n = 9 226) – – – –

Figure 1. The perceived indoor climate and symptoms for the two databases . The shadowed areas show the reference data for workplaces without known indoor climate problems (Andersson et al., 1998).

Occupational groups

The perceived physical and psychosocial environments are described in Table 2 for the two occupational groups. The teachers give in general a more negative picture for most factors and therefore we will focus on teachers in the next paragraphs.

Table 2. The perceived physical and psychosocial environment and symptoms for teachers and "others".

	teacher n=7 136	others n=3 900	p-value
Number of factors	2.43	2.10	<0.001
Number of symptoms	1.38	1.12	<0.001
Number of work-related symptoms	0.86	0.59	<0.001
General symptoms (%)	44	35	<0.001
Mucous membrane irritations (%)	23	20	<0.001
Skin symptoms (%)	17	17	ns
Psychosocial environ	2.75*	2.61	<0.001
- interesting (%)	83**	74	<0.001
- stress (%)	49**	32	<0.001
- control (%)	19**	28	<0.001
- social support (%)	56**	64	<0.001

* mean of a 5-degree scale from very good (1) to very bad (5)
** "often"

Background factor - sex

Female teachers complain more about the indoor climate and report more symptoms in general as seen in Table 3. Male and female teachers perceive the work differently based on work content, stress, control and social support but no difference is seen in the summarised measure about the psychosocial environment.

Table 3. The perceived environment and symptoms for male and female teachers.

	male n=1 706	female n=5 406	p-value
Number of factors	1.95	2.57	<0.001
Number of symptoms	1.01	1.49	<0.001
Number of work-related symptoms	0.61	0,93	<0.001
General symptoms (%)	34	48	<0.001
Mucous membrane irritations (%)	18	24	<0.001
Skin symptoms (%)	13	19	<0.001
Psychosocial environ	2.77*	2.75	ns
- interesting (%)	75**	86	<0.001
- stress (%)	45**	50	<0.01
- control (%)	24**	18	<0.001
- social support (%)	49**	58	<0.001

* mean of a 5-degree scale from very good (1) to very bad (5)
** "often"

Background factor - allergy

26.5% of the teachers report a history of asthma or hey fever. They are more troubled by deficiencies in the indoor air and report higher prevalence of symptoms in general and specifically more symptoms from the mucous membranes compared to those without allergy.

Table 4. The perceived indoor environment and symptoms for teachers with our without asthma or hay fever.

	allergy n=1 875	no allergy n=5 197	p-value
Number of factors	2.82	2.28	<0.001
Number of symptoms	1.88	1.20	<0.001
Number of work-related symptoms	1.22	0.73	<0.001
General symptoms (%)	0.51	0.42	<0.001
Mucous irritations (%)	0.36	0,18	<0.001
Skin symptoms (%)	0.21	0.16	<0.001

Noise

35% of the teachers are often disturbed by noise, mostly from noisy pupils (81%) but also from ventilation noise (24%). Those who assess the acoustic environment as bad are much more disturbed by noise than those who assess it as acceptable (Figure 3).

Bad air quality

37% of the teachers are often disturbed by "stuffy", bad air and relate the problems to deteriorated air in the afternoon (49%), to extended lessons without a break (47%) or to smells (34%). They also complain about to high temperature in summertime (55%) but also in the winter (20%). Together this figures point to an imbalance between the access to and the demand of fresh air, probably due to too many people in the classrooms.

Dust and dirt

45% of the teachers often complain about dust and dirt and mainly relate the problems to insufficient cleaning (45%) and settled dust on surfaces that are seldom cleaned (51%). 23%

complain about badly performed cleaning, something that has been described being related to purchase of the services (Andersson et al., 2002b)
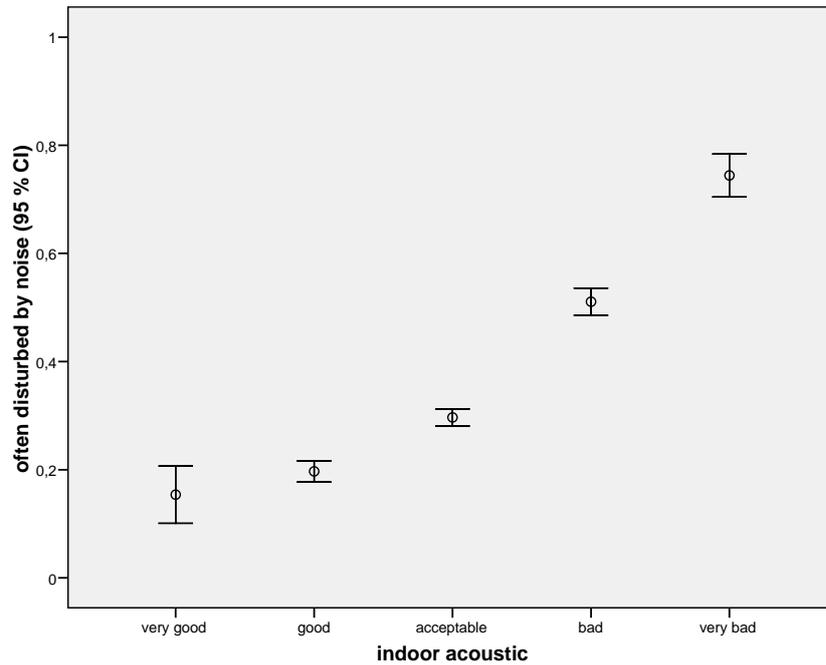

Figure 3. The relation between the perceived indoor acoustics and noise disturbances.

Symtoms

There is a straightforward relation between number of disturbing environmental factors and symptoms (Figure 4). With more factors involved, more symptoms are presumed related to the indoor environment (ratio between 0.45 and 0.80, Figure 5).
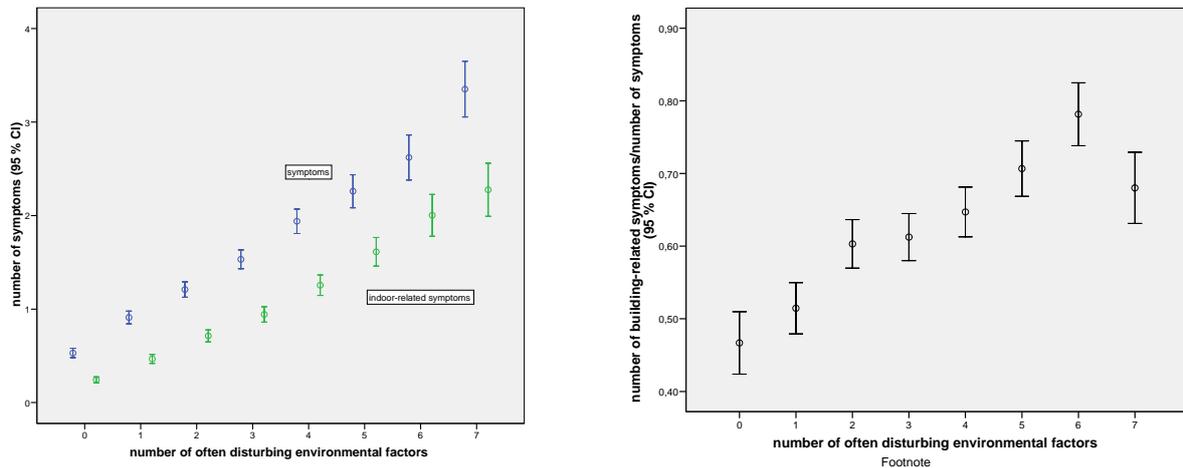

Figure 4. The relation between number of symptoms and indoor-related symptoms and number of often disturbing environmental factors.

Figure 5. The ratio between indoor-related symptoms and symptoms for different numbers of disturbing environmental factors.

Environmental factors and symptoms

Those who complain about noise and stuffy bad air more often report general symptoms such as fatigue, heavy headedness and headache. By using logistic regression technique, controlling for both sex and allergic constitution, the odds ratios were estimated for the specific general symptoms. Both noise and stuffy bad air are significantly related to all these symptoms but in spite of this the interaction terms were never significant. This points to a multiplicative effect, suggested also from Table 5. Heavy headedness and headache seems to be more related to stuffy bad air, while fatigue correlates more to noise disturbances.

Table 5. The odds ratios (OR) for general symptoms with complaints (+) about noise and stuffy bad air, controlling for both sex and allergic constitution. All ORs are significantly different from 1 (p<0.001).

Noise (often)	N-	N+	N-	N+
Stuffy bad air (often)	A-	A-	A+	A+
General symptoms	1.00	2.12	1.90	3.79
fatigue	1.00	2.10	1.83	3.61
heavy headedness	1.00	2.43	2.92	5.22
headache	1.00	1.89	2.07	2.96

Specific cases

When surveying schools with suspected indoor climate problems using standardised and tested questionnaires, multiple comparisons with other schools and other environments open up possibilities to assess these very complex environments and point to actions necessary to make. In this case there were obvious problems both with the physical environment in total but also with temperatures, air quality with odours, noise and cleaning. The high prevalence of mucous membrane irritations, bad air quality and odours obviously indicated that it was necessary to search for humidity problems in the building in addition to evaluating the temperature conditions and cleaning routines.
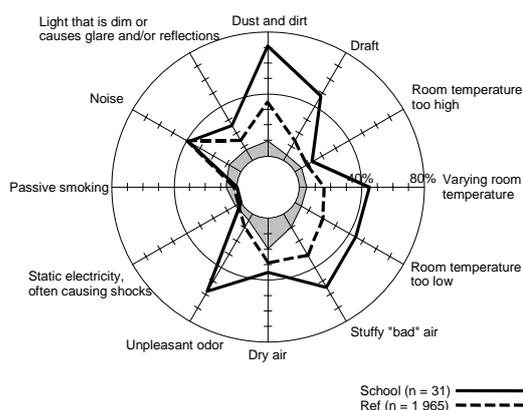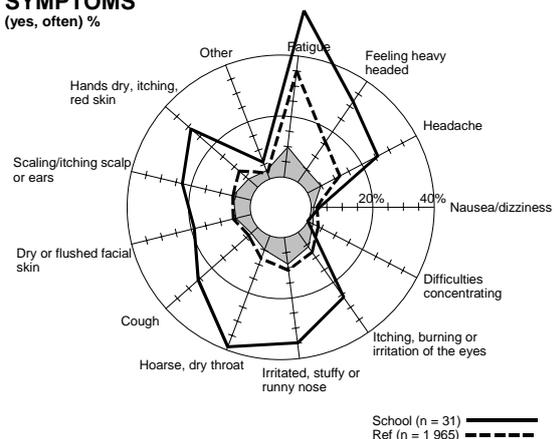

Figure 6. The perceived indoor climate and symptoms for a target school and the reference database . The shadowed areas show the reference data for workplaces without known indoor climate problems (Andersson et al., 1998).

Table 6. The perception of some detailed indoor climate factors in the target school and schools in the reference database (in %).

Factor (% bad)	Target school n=31	National sample n=1 965	Survey database N=9 226
General impression	10	15	21
Access to group rooms	65*	46	59
Acoustics	35	27	29
Staff rooms	61**	34	41
Temperature condtions	74***	31	33
Noisy ventilation	32	17	15
Poor ventilation	61***	26	34
Odours	71***	19	25
Inadequite cleaning	74***	33	42

*p<0.05, **p<0.01, ***p<0.001 (Chi-2 test between proportions) – compared to the "national sample".

DISCUSSION

The school environment is complex with both physical and psychosocial factors involved. General symptoms such as fatigue, heavy headedness and headache are commonly related to the school environment, primary to disturbing noise and deteriorated indoor air. It is interesting to note that these factors have a multiplicative effect on the symptom prevalence, indicating low inter-correlations.

Those who complain more about the school environment also relate their symptoms to a larger extent to this environment, which is to be expected.

The prevalence of mucous membrane irritations and skin symptoms is low compared to what is seen in many other occupational groups, such as office and especially hospital workers (Hellgren et al., 2006). Therefore, it ought to be easier to identify humidity problems in school environments, especially if it is possible to catch information from both the personnel and the students.

CONCLUSIONS

Databases are available for surveying school environments in Sweden. This is especially valuable when assessing surveys in schools with suspect indoor climate problems. The school environment is however very complex and it is important to use the results from a questionnaire survey cautiously and in connection with other information sources.

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The MM Questionnaires are available at www.orebroll.se/amm.