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Sick Building Syndrome in Mauritius: Are Symptoms Associated with the Office Environment?

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Key Words
Sick building syndrome · Indoor air quality · Symptoms · Ventilation · Mauritius

Abstract
A cross-sectional study was carried out to investigate the occurrence of the sick building syndrome (SBS) among office workers in Mauritius. A walk-through inspection and a questionnaire survey were carried out in 21 office building complexes to evaluate the prevalence of risk indicators for SBS symptoms among 302 office workers. Indoor climatic variables monitored were: carbon dioxide, carbon monoxide, nitrogen dioxide, air temperature, relative humidity, air movement, noise and light. All data collected were analysed using the EPI-info software. Results showed that symptoms of SBS were significantly higher among occupants of buildings with mechanical ventilation than those of the naturally ventilated buildings. Among personal factors assessed, there were generally consistent findings associating increased symptoms with age and female gender. The results also revealed that certain SBS symptoms such as a headache across the forehead, nervousness, nausea, irritated sore eyes and sneezing were more widespread among women in these offices. However, measurements of the selected indoor variables were not found to be reliable predictors of the symptoms.

Introduction

During the past few decades various symptoms and il nesses have increasingly been attributed to non-industri indoor environments. In general, exposure indoors t noxious, chemical, physical and biological hazards is at low level but, unlike industrial or accidental exposure such exposures are very common and usually sustainec Problems associated with the indoor environment are common environmental health issue faced by clinician [1–6]; generally the raft of complaints are regarded togeth er as sick building syndrome. This syndrome has receive much attention over the years and, as originally define by the World Health Organisation (WHO) [5], refers t non-specific symptoms including eye, nose, and throa irritation, mental fatigue, headaches, nausea, dizzines and skin irritation, which seemed to be linked to th indoor climate [2, 7]. Other terms have been used such a tight building syndrome, sick office syndrome or offic eye syndrome, but sick building syndrome (SBS) is now the accepted terminology. The syndrome has no prope medical definition, and pinning down a building with thi problem can prove to be difficult [8]. SBS may be diagnosed from the presence of such symptoms as eye, nose and throat irritation; headaches, lethargy, difficulty concentrating, dizziness; nausea, chest tightness and dry skin. It can only be confirmed if it can be established that more than one of the common symptoms is present at a higher prevalence than could be expected among the population generally and the symptoms are caused by, or made worse

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by work, or the work environment. These criteria are important to establish because all of the symptoms are common in the population [2, 9]. SBS can therefore only be diagnosed after carefully establishing, usually by questionnaire or interview, the nature of the symptoms, the number of people affected and the association of their symptoms with being at work [2, 10]. A multitude of risk factors including chemical, physical, biological and psychosocial has been identified and associated with SBS and schemes devised that allow them to operate in a complex synergistic manner. The consequences of SBS are noteworthy. Although neither life-threatening nor disabling, the incidence of SBS among working people does have an economic repercussion [11].

SBS has over the years been identified as a significant problem in the UK and other European countries as well as Canada, Australia, Japan and America [9, 11]. However, this phenomenon has not previously been studied in Mauritius.

Mauritius is a small island and its subtropical climate, densely built environment, and energy conservation requirements pose special constraints to the building industry to ensure that ventilation and indoor air quality within the fully enclosed offices remain acceptable. In tandem with rapid urbanisation as a newly industrialised economy, the prevention of ill health in the office presents a growing challenge to medical practitioners and building managers.

Since no data on indoor air quality including SBS and its health impact among workers are readily available in Mauritius, the present study was undertaken to identify if any possible relationship of these symptoms to personal and indoor environmental factors could be associated with ventilation systems in office buildings.

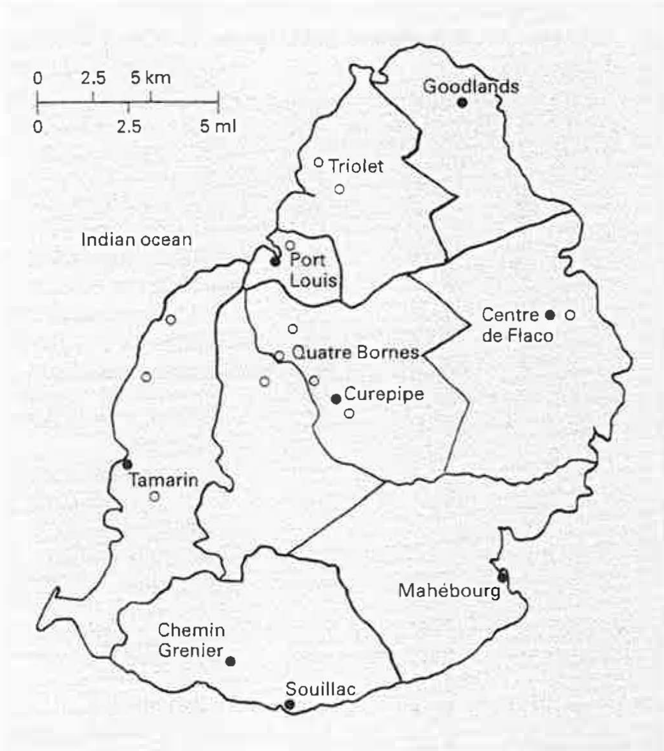

Fig. 1. Map of Mauritius showing the regions where the study was carried out.

Methods

Identification of Sites

Twenty-one office buildings, occupied by public (government-owned), parastatal (government-subsidised) and private companies were investigated during the period January 1998 to December 1999. Buildings surveyed were selected according to type of organisation, type of ventilation and office layout. The building ventilation categories were natural ventilation (buildings with openable windows but no mechanical airflow) and mechanical ventilation which included all types of HVAC and electric fans. The buildings selected were situated at different sites around the island (fig. 1). Most of them did not have any known air quality problems.

Questionnaire Survey

Prior to recruitment and inclusion into the survey, sample size was determined using the Statcalc Calculator of the EPI-Info (version 6.0) statistical package. A self-report questionnaire was distributed in each building before monitoring of indoor air quality. Questions on personal characteristics, work environment and demographic factors formed part of the questionnaire. Other factors of relevance included indoor climate at work, perception of symptoms, psychosocial and physical conditions.

Survey Administration

A letter was mailed together with a copy of questionnaire and information about the scope of the survey to the responsible officer of each building for participation in the study. Workers spending more than half their working hours in the office during the preceding 3 months were included into the study population. The confidentially self-administered questionnaire was distributed individually after explanation and collected a week after or immediately on completion.

Walk-Through Inspection

A detailed walk-through inspection was also conducted to obtain information on the history of the building use and factors, which could influence indoor air quality. During this exercise, observations were made on the building and room characteristics.

Indoor Air Quality Measurements

Indoor environmental measurements were monitored for relative humidity (Griffin sling psychrometer, BS 2842, Griffin, UK), air temperature (digital temperature meter SEI 26 Solex, temperature

Table 1. Characteristics of the study population and the work environment

Characteristics	Natural ventilation	Mechanical ventilation	Sex distribution, %	
			male	female
Number of workers included (response rate, %)	106 (35.1)	196 (64.9)	171 (56.6)	131 (43.4)
Personal characteristics				
Female sex, %	21.9	34.8		56.6*
Female age, mean ± SD	33.4±9.3	32.9±8.8*		
Male sex, %	13.2	30.1	43.4	
Male age, mean ± SD	39.0±11.1	35.1±8.9		
Allergy	5.6	13.2	82.5	79.4
Active smoking	5.3	9.3	22.8	3.8**
Work environment				
Region				
Coastal, administrative	7.9	32.5	39.8	41.2
Inland, administrative	27.2	32.5**	60.2	58.8
Working hours				
Stable time	34.1	64.2	98.2	98.5
Position				
Lower	5.00	8.60	16.4	9.90*
Middle	25.5	49.3	68.4	83.2
Higher	4.60	7.00	15.2	6.90
Occupation				
Managers and professionals	9.6	14.6	18.7	27.5
Technicians, clerk, secretaries	25.5	75.8	81.3	72.5*
Employment				
Public	32.1	43.4*	74.9	76.3
Private	0	4.60	3.50	6.10
Parastatal	3.00	16.9	21.6	17.6
Age of building				
1–25 years	18.5	41.4**	62.0	57.3**
26–50 years	9.60	6.3	17.0	14.5
>50 years	7.00	17.2**	21.0	28.2
Cleaning sessions	14.6	21.2	30.4	42.7*
Wall-to-wall carpeting	19.9	43.7	58.5	70.2*
Pests and insects	18.5	33.8	47.4	58.8*
VDT work				
>4 h	7.3	14.2	10.5	35.9*
Paper work				
High	15.9	20.2*	25.7	49.6**
Equipment present	35.1	64.9*	56.6	43.4**
Environmental tobacco smoke	14.9	22.2	42.7	29.8
Work perception				
Inappropriate temperature	15.6	22.5	60.8	67.2
Lighting problem	10.6	16.2	13.2	31.3
Too little air movement	20.2	39.7	53.2	68.7**
Air too dry	15.6	33.8	45.0	55.0
Air too humid	18.5	31.8	40.9	58.0**
Distracting noise	22.8	39.7	38.6	35.9
Unpleasant odour	18.5	31.8	42.7	60.3**
Dusty air	18.5	27.8	40.9	53.4*
I am satisfied with my job	31.8	58.9	90.6	90.8*

* $p < 0.05$, ** $p < 0.01$.

accuracy ±0.8°C, range 0–60°C, UK), air velocity (Lutron anemometer, AM/4201, speed range 0.4–30 m/s, UK), noise (Griffin sound level meter, detection limit 0.1 dB(A) and range 40–110 dB(A), Griffin, UK), light (Philip Harris luxmeter Log range 0–1,000 lx, Philip Harris Scientific, Linchfield, UK). Carbon dioxide, carbon monoxide and nitrogen dioxide (Detectawl Toxic Gaztell Portable gas detectors, DGT model and range 0–1,000 ppm, UK) were also measured.

Data Analysis

Descriptive logistic analyses were performed using Epi-Info statistical software. Differences in the distribution of independent variables between males and females were assessed using χ^2-test. Odds ratio (OR) was used as a measure of the strength and direction of the association between health outcome and ventilation characteristics. ORs were calculated as a point estimate with a 95% confidence interval (95% CI) within brackets.

Results

Questionnaire Survey

The 21 major office buildings surveyed were mostly (1–8 floor) complexes with an age of occupancy of at least 5 years. The 254 selected offices typically utilised open-concept work stations and a few enclosed rooms for senior staff. A total of 635 questionnaires were distributed to the workers and 331 were returned, giving a response rate of 52.1%. As 29 of these were grossly incomplete and rejected, the final sample consisted of 302 participants (47.6%). Replies were received from 44 managers (14.6%), 24 professionals (7.9%), 64 technicians (21.2%), 97 clerks (32.1%), 57 secretaries (18.9%) and 16 other officers (5.3%).

Table 1 shows the characteristics of the study and the work environment. It was noted that certain factors such as allergy, region of work, working hours, occupation, sector of employment (public and private), age of building, and presence of pests and insects, were equally distributed among both sexes. It was also found that personal factors such as gender ($p < 0.05$), active smoking ($p < 0.01$) and age influenced the prevalence of a symptom among workers ($p < 0.05$). The age of the females was significantly related to the type of ventilation ($p < 0.05$) in their workplace. For employees of both sexes the more lowly their position in the employment hierarchy ($p < 0.05$) seemed to influence the prevalence of symptoms among them as did type of occupation ($p < 0.05$) and if the age of the building where they worked was between 1 and 25 years ($p < 0.01$), or more than 50 years.

Cleaning practices ($p < 0.05$), wall-to-wall carpeting ($p < 0.05$) and presence of pests and insects ($p < 0.01$) were equally found to influence SBS symptoms. Moreover, it was noted that use of video data terminals (VDT) influenced the prevalence of symptoms. Female workers (n = 47, 39.5%) who worked for long periods (>4 h) with VDT were found to be highly vulnerable ($p < 0.05$). Females (49.6%) were found to handle more papers and this was highly significantly related with SBS symptoms ($p < 0.01$).

Workers reported that certain physical conditions such as 'too little air movement' ($p < 0.01$), 'air too humid' ($p < 0.01$), 'unpleasant odour in air' ($p < 0.01$), and 'dusty air' ($p < 0.05$) were factors significantly affecting their quality of life at the workplace. However, our results also showed that most of the workers questioned were satisfied with their job ($p < 0.05$).

The symptoms significantly associated with mechanical ventilation were (table 2): headache across forehead

Table 2. ORs and 95% CIs estimated for work-related health outcomes in office buildings with mechanical ventilation compared with natural ventilation

Outcome	Mechanical vs. natural ventilation	
	ORs	95% CI
Headache across forehead	1.14*	0.67–1.94
Excessive mental fatigue	0.68	0.41–1.14
Nervousness	1.11**	0.66–1.85
Unusual tiredness, lethargy	1.00	0.61–1.67
Lack of concentration/forgetfulness	0.81*	0.49–1.34
Nausea	1.25*	0.65–2.43
Dizziness	0.98*	0.55–1.74
Dry eyes	1.23	0.69–2.21
Watery eyes	0.94	0.55–1.60
Irritated sore eyes	1.07**	0.64–1.79
Tired, strained eyes	1.95**	1.17–3.26
Earache[1]	1.05	0.51–2.18
Tinnitus[1]	0.90	0.44–1.85
Runny nose	1.37	0.76–2.49
Stuffy, congested nose	1.00	0.59–1.72
Sneezing	1.07*	0.64–1.79
Sore, irritated throat	1.28	0.75–2.20
Hoarseness	1.14	0.56–2.35
Chest tightness	0.90	0.44–1.85
Wheezing	0.69	0.35–1.36
Coughing	0.92	0.54–1.57
Skin irritation	1.08	0.60–1.95
Dry skin	0.96	0.57–1.64
Joint stiffness[1]	0.78	0.45–1.38
Joint pain[1]	0.78	0.46–1.32
Body-ache[1]	0.99*	0.60–1.64

* p <0.05, ** p <0.01.
[1] Other symptoms (not SBS symptoms).

($p < 0.05$), nervousness ($p < 0.01$), lack of concentration/forgetfulness ($p < 0.05$), nausea ($p < 0.05$), dizziness ($p < 0.05$), irritated sore eyes ($p < 0.01$), tired-strained eyes ($p < 0.01$), sneezing ($p < 0.05$) and body-ache ($p < 0.05$). However, dry eyes were the only symptom which showed significant difference with natural ventilation. Moreover, in the comparison between the mechanical and natural ventilation, the odds ratios for the different symptoms varied between 0.6 and 1.9. The odds ratios of most of the SBS symptoms were considerably above 1. Other symptoms: dizziness (OR = 0.98, 95% CI 0.55–1.74), watery eyes (OR = 0.94; 95% CI 0.55–1.60), chest tightness (OR = 0.90; 95% CI 0.44–1.85), coughing (OR = 0.92; 95% CI 0.54–1.57) and dry skin (OR = 0.96; 95% CI 0.57–1.64) had odds ratios close to 1. Another symptom (not regarded as an SBS symptom) which showed an odds ratio slightly higher than 1 was earache (OR = 1.05; 95% CI 0.51–2.18).

The mean of the selected indoor variables (table 3) monitored in the vicinity of most workers remained largely within acceptable limits [2, 7, 8]. Table 4 summarises the work-through investigation of the buildings included in our study. Of the 21 buildings studied excepting 2 wooden ones, all were concrete-built. The sampling floor heights of the buildings varied from street level (ground floow) to the 8th floor. The two floor materials that were present most in the buildings were tiles and vinyl (PVC). It was also noted that the reception, waiting and higher officers' floors were covered with carpets.

Table 3. Summary of analytical results for selected indoor variables monitored within 254 offices in Mauritius

Variable	Mean value	Lower limit	Upper limit
Carbon dioxide, ppm	235	150	725
Carbon monoxide, ppm	1	0	3
Nitrogen dioxide, ppm	<0.001	0	0.01
Air temperature, °C	22	19	26
Relative humidity, %	42	37	82
Air movement, m/s	0.1	0	0.6
Noise, dB_A	55	47	72
Lighting, lx	435	75	734

Table 4. Characteristics of the 21 office buildings included in our study

	Building code									
	1	2	3	4	5	6	7	8	9	10
Construction type	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	wood	wood
Floor sampled	1–8		1–3	1–2	1–2	5, 7, 8	1–2	1–2		1*
Floor material	tile	tile	tile	tile	tile	vinyl	vinyl	vinyl	concrete	tile
Ceiling material	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	wood	wood
Inside walls treated with	paint	paint	paint	paint	paint	paint	paint	paint	paint	paint
Wall material	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	wood	wood
Ventilation	natural	natural	natural	natural	natural	mechanical	natural	natural	natural	natural
Work station	3	3	3	3	3	5	2	3	2	3
Occupants	2	2	3	2	3	4	1	3	2	3
Activity level	high	medium	high	high	high	high	high	high	high	medium
Smoking permitted	no	no	no	no	no	no	no	no	no	no
Average smokers	2	1	3	2	2	4	1	4	2	2
Mould growth	no	no	no	no	no	no	no	no	no	yes
Employment sector	parastatal	parastatal	parastatal	parastatal	parastatal	public	parastatal	public	public	public
Damaged floor	no	no	no	no	no	no	no	no	no	yes
Damp spots on walls/ceiling/floor	no	no	no	no	no	no	no	no	yes	yes
Furniture	Fc	Fc/Fs	Fc	Fc	Fc	Fc	Fc	Fc	Fs	Fc/Fs
Age of furniture	a1, a2	a2	a1, a2	a2	a1, a2	a1, a4	a1, a2	a1, a2	a2, a3	a2, a5
Curtain	yes	no	yes	yes	yes	no	no	no	no	no
Green plants	present	absent	present	absent	present	present	present	absent	absent	present
Detergents	high	medium	high	medium	medium	medium	medium	medium	medium	medium
Light	daylight	artificial	daylight	artificial	daylight	artificial	artificial	daylight	daylight	daylight
Type of light	F	F	F	F	F	F	F	F	F	I/F
Dusty shelves	no	no	no	no	no	no	no	no	yes	yes
Visible dust on floor	low	low	low	low	low	low	low	low	low	medium

* Recently reconstructed/modified.

A wide variety of ceiling materials, including particleboard, acoustic tiles, wood and concrete was used in the construction of the buildings. The walls of most offices of the sampled buildings were painted. However, some of them had lacquered wood and wallpaper especially in the reception, waiting and higher officers' rooms. Five buildings had damp spots on ceiling and walls. Some buildings also showed signs of mould growth or damaged flooring.

The ventilation and air conditioning systems included air conditioning units, electrical fans and natural ventilation. The latter was extensively used. In general, daylight was used in the offices. However, some buildings made use of artificial light, especially fluorescent tubes. Half of the buildings used curtains as a solar shading device. Only a few offices among the various buildings had green plants in them and these were mostly situated in reception areas, conference and waiting rooms. None of these plants were treated with any insecticides. Detergents and other solvents used for cleaning and polishing purposes were widely used in all the buildings. Organic (visible) dust was present in carpets and other furnishings and on the open shelving of files and books.

The number of work stations and occupants varied according to the size of the room. However, it was noted that an average of 3 work stations were common among most of the open-plan offices. About 95% of the office sites were busy during the workdays and their activity level varied from medium to high. Smoking was not allowed in any buildings; yet the highest number of smokers reported within the offices was 4.

Discussion

This study shows that personal and work factors were possible risk indicators for SBS symptoms. Among personal factors assessed, there were generally consistent findings associating symptoms with age, female gender and smoke [9–13]. However, in contrast to other reports, allergy did not seem to influence the prevalence of SBS symptoms among females [1–3, 12].

It was noted that certain parameters such as location of the building (by region), working hours, place of employment and type of building were not found to be likely con-

Building code										
11	12	13	14	15	16	17	18	19	20	21
concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete	concrete
1–2	2, 3	1–2	1	1, 2*, 3, 4	1	1–7	1, 2*, 3	1–2	1–2	2*
tile	tile	tile	vinyl	vinyl/tile	tile	tile	tile	tile	tile	vinyl
concrete	concrete	concrete	concrete	concrete	concrete/P	concrete	concrete/A	concrete	concrete	concrete
paint	paint	paint	paint	paint	paint	paint	paint	paint/Ut	paint	paint
concrete	concrete	concrete	concrete	concrete	concrete	concrete	wood	concrete/C	concrete	concrete
natural	natural	mechanical	natural	mechanical	mechanical	natural	mechanical	mechanical	natural	mechanical
3	3	3	3	4	4	4	3	3	3	3
3	2	4	3	4	4	4	2	2	2	2
high	medium	high	medium	high	medium	high	high	high	medium	medium
no	no	no	no	no	no	no	no	no	no	no
4	2	2	1	4	1	3	2	2	2	1
no	no	no	yes	yes	no	no	no	no	no	no
public	public	public	public	public	private	public	private	public	public	public
no	no	no	no	yes	no	no	no	no	no	no
no	no	yes	yes	yes	no	no	no	no	no	no
Fc	Fc	Fc	Fc	Fc	Fc	Fc	Fc	Fc	Fc	Fc
a1, a2, a3	a2	a1, a2, a3	a2	a2, a3, a4, a5	a1, a2	a1	a1, a2	a1	a1, a2	a2
yes/no	no	yes/no	no	yes	yes	yes	yes	yes	yes	no
present	absent	present	absent	absent	absent	absent	absent	present	absent	absent
medium	low	medium	high	medium	high	medium	medium	medium	medium	medium
daylight	daylight	artificial	artificial	artificial	artificial	artificial	artificial	daylight	daylight	daylight
I/F	F	F	F	F	F	F	I/F	F	F	F
no	no	yes	no	yes	no	no	yes	no	no	yes
low	low	low	low	medium	low	low	medium	low	low	low

* Recently reconstructed/modified.

tributing factors to SBS. However, our data are consistent with other studies, which have reported that the age of buildings is associated with the prevalence of SBS [13, 14]. Buildings less than 26 years old were found to influence the prevalence of SBS symptoms among both sexes. Many of these symptoms were thought to stem from exposure to volatile organic compounds emitted from new building materials such as paints and from the furniture and furnishings [5–7]. Volatile organic compounds were not examined in this study.

One specific combination was that female occupants working in buildings more than 50 years old manifested SBS symptoms. This could be due to the poor conditions of the offices. Furthermore, there was a correlation between SBS symptoms and the female workers in respect of a number of other exposure factors in the work environment. Apart from being exposed more often to tobacco smoke, they (mostly clerks and secretaries) were more likely to have routine jobs and handle more paper work. The consequence was that these people were found to be more at risk of developing SBS symptoms [12].

Previous work has shown that gender is an important variable to consider when examining prevalence data for SBS reports [11–15]. Significant associations between symptom reports and hours of computer use were revealed; female workers who used their computers full-time reported more symptoms than infrequent users and non-users. Associations between computer use and the SBS have been confirmed in several studies [12, 16]. Changes to the immediate environment resulting from computer use, such as the electrostatic field generated by a VDT screen, may attract more particulate contaminants into a worker's breathing zone and this may be responsible for the increase in symptom reports among computer users [16, 17]. If this is so it is not affected by ventilation since our results tend to indicate that type of ventilation did not affect the prevalence of SBS symptoms among computer users.

The presence of photocopiers, laser printers and other equipment in the immediate working environment of the workers especially of the mechanically ventilated buildings was also found to influence the prevalence of SBS symptoms in both sexes [7, 12, 16]. Other studies have shown that these devices (especially when not properly maintained) may produce ozone, which is irritant to the respiratory tract [5, 7].

Women working in mechanically ventilated buildings did so under particular physical environmental conditions and they showed a higher prevalence of symptoms. Reports of how they viewed their physical environment included comments such as 'too little air movement', 'air too humid', 'dusty air' and 'unpleasant odour'. These comments were found to be the commonest components of a perception of poor indoor air quality. Our data are consistent with those from other studies, which also showed that an increase in SBS reports with comments of 'little air movement' and 'air too humid' were found in mechanically ventilated buildings [16]. Unpleasant odour and dusty air were reported by a greater number of occupants in the mechanically ventilated office buildings, but this could be due to any of a number of specific pollutants such as widespread use of detergents, particular building materials, presence of mould growth, pests and insects [2, 6]. The present results are consistent with our on-site walk-through inspection, which showed visible dust on carpets, the open shelving and files. Studies in other developed countries have shown that the level of dust to which office workers are exposed can be 4–5 times higher than ambient airborne levels, since people create their own 'dust cloud' in the course of their work by stirring up settled dust. Cleaning practices also seemed to be an important factor to influence the prevalence of symptoms among both sexes. The way in which offices are cleaned, therefore, could be very relevant to the level of airborne particulate if the equipment used did not filter out fine particles or otherwise prevent them from becoming airborne [2–7].

Our finding that significantly more symptoms were reported by women in mechanically ventilated buildings compared to those who work in a naturally ventilated work environment is also consistent with a number of other studies [16–19]. In mechanically ventilated buildings, especially air-conditioned buildings, the air may pass through several potential sources of contamination (e.g. ducting, humidifiers, chillers), whereas in naturally ventilated buildings, ventilation depends solely on openable windows and doors [5, 6]. However, the association between the efficiency of the different types of ventilation and outdoor airflow rates and SBS has yet to be studied.

Measurements of indoor quality were not found to be reliable predictors of the symptoms. Although low thermal comfort (as registered by comments like 'too little air movement' and 'air too humid') were commonly reported by the workers who replied to the questionnaire survey, no obvious relationship of symptoms with fluctuations of temperature, relative humidity and air movement greater than recommended levels was noted [2, 8]. The associations between measured physical environmental conditions and symptoms were not very strong. This suggests that these variables did not determine symptom reports.

However, in this study microbiological contaminants were not measured, whilst recent studies suggest that these may be highly correlated with symptoms [20].

The present study, which is the first of its kind to be undertaken on the island, shows that symptoms of SBS are present in Mauritius. Overall, the results show that women could be more sensitive to environmental conditions in general, but that the effect of a specific exposure in an office environment may be easier to detect among men. We would suggest that the reason for this is that women usually have more body awareness and are more likely to report symptoms and are more often employed in routine jobs [12].

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