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Prevalence of Sick Building Syndrome-Related Symptoms among Hospital Workers in Confined and Open Working Spaces

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ABSTRACT

Despite providing health care to others every day, people who work in a hospital are usually ignored about their healthy issue. This study is aimed to investigate the prevalence of sick building syndrome (SBS)-related symptoms among hospital workers. All participants in this study completed questionnaires during the year 2013. Indoor air pollutants, Carbon monoxide (CO), Carbon Dioxide (CO_2), particulate matter (PM) and Volatile organic compounds (VOCs), as well as bacteria and fungi concentrations were recorded during sampling. Associations between SBS-related symptoms, individual characteristics, and chemical concentrations were evaluated by multiple linear regression. About 84% of the subjects suffered from at least one SBS-related symptom, among which the most frequently reported symptom was nasal symptoms, accounting for 66%. Chemicals such as CO_2, PM, VOCs tended to be significantly associated with SBS-related symptoms. There are various effects depending on the type of chemicals present and whether the working spaces are open or confined.

Keywords: Indoor air pollution; Health effect; Subjective symptoms; Hospital.

INTRODUCTION

Indoor air quality, which is associated with health problems such as aggravation of asthma, headaches, nausea, allergic reactions, and irritation to the eyes, nose and throat (Hodgson, 2002; Bernstein *et al*., 2008) is a significant issue since people spend almost 85–90% of their time indoors. The term "sick building syndrome" (SBS), was first coined in the 1970s. SBS-related symptoms comprises various symptoms ranging from specific symptoms such as itchy eyes, skin rashes, and nasal allergy symptoms, to more vague symptoms such as fatigue, aches and pains, and sensitivity to odors (Redlich *et al*., 1997; Norbäck, 2009). The parameters typically evaluated in previous studies include temperature, humidity, bacteria, fungi, carbon dioxide, and formaldehyde (Wolkoff *et al*., 2006; World Health Organization, 2010). Other factors associated with the perceived indoor air quality include odors, particulate matter (PM), bioaerosol, and volatile organic compounds (VOCs) contamination.

There is advance in the art of indoor air complaints and symptoms, and SBS is not a new idea. Trying to distinct a building as “sick“ or “healthy” is considered futile (Wolkoff, 2013). The authors of this work didn’t regard SBS as a new idea, and the authors also didn’t aim to investigate mechanisms of the SBS-related symptoms. This research was designed to investigate the association between the prevalence of SBS-related symptoms and the indoor air quality among hospital workers in confined and open spaces. Most previous studies on indoor air quality and SBS evaluated office workers. Few investigators have examined the health effects of indoor air quality in hospitals where the health of hospital workers may be affected. It has been reported that the type of office is a factor influencing the prevalence (Li et al., 2013). The prevalence of symptoms increases in the space as in open-planar offices (Pejtersen *et al.*, 2006; Wolkoff, 2013). Therefore, we conducted indoor field measurements and a questionnaire-based study of the health effects of indoor air in a medical center in Taiwan.

METHODS

Study Population

The study population was obtained from hospital workers at a medical center in Taiwan. People with related doctor-diagnosed diseases, such as bronchitis, asthma, allergic conjunctivitis, migraine, gastritis, and arrhythmia

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were excluded. All participants completed questionnaires during the year 2013. Information on age, sex, smoking habit, and working experience was obtained from the questionnaire. Institutional Review Board approval was obtained, and all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.

Environmental Monitoring

Confined spaces were defined as spaces with boundary walls and a closed door when people working in there. Other spaces were defined as open spaces, such as nursing stations. Room temperature and relative humidity were measured with a Thermo Recorder (TR-72U, T&D Corporation, Japan). Indoor air pollutants, Carbon monoxide (CO), Carbon dioxide (CO_2), and PM, as well as bacteria and fungi concentrations were also recorded during sampling. The measurements were carried out in the morning of the interviewing day. CO and CO_2 were monitored continuously for 1 hour using an AirBoxx monitoring system (KD Engineering, USA). The levels of PM were monitored continuously for 1 hour using a mass particle counter (Met One, AEROCET 531). The level of HCHO was monitored for 1 hour by a Formaldemeter htv monitoring system (PPM, United Kingdom). The TVOCs were measured for 1 hour by ppbRAE 3000, which extended range of 1 ppb to 10,000 ppm (RAE systems Inc.). Furthermore, two single-stage microbial cascade impactors (Tisch Environmental, Inc.) were used to sample airborne bacteria and fungi. The sampling flow rate was 28.3 L min^{-1}, the sampling time was 10 mins, and the sampling height was approximately 150 cm. Trypticase soy agar (TSA) with cycloheximide and malt extract agar (MEA) with chloramphenicol were used for capturing bacteria and fungi samples, respectively. Field blanks were also tested during the sampling. After sampling, the Petri dishes were incubated for 48 hrs at 37°C (Taiwan EPA method E301.11C) for bacteria and for 120 hrs at 25°C (Taiwan EPA method E401.11C) for fungi. The concentrations of airborne bacteria and fungi colony-forming units (CFU m^{-3}) were calculated by dividing the total colony count on agar plate by the air volume.

Total VOCs concentration was defined as the sum of the concentrations of the target compounds. For VOCs sampling, clean canisters for sample collection were evacuated before sampling. Time integrated VOCs air samples were obtained using mass flow controllers (Entech CS1200E) at flow rates of 100 L min^{-1} for 1 h air sampling. After sampling, the canisters were immediately transported to an air laboratory for analysis. An Entech Cryogenic Concentrator (Model 7100A) first concentrated canister samples, and then the trapped VOCs samples were subsequently separated by Agilent Gas Chromatography (GC) (Model 6980) and quantified by a Mass Selective Detector (MS) (Model 5973) using the EPA TO-15 method. Separation of VOCs was achieved through a capillary column (60 m × 0.25 mm I.D., 1.0 µm film thickness; DB-5MS, Agilent). The oven temperature was maintained at 32°C for 8 min, followed by an increase at 8 °C min^{-1} to 200°C which was kept for 10 min. The flow-rate of carrier gas (helium) was held at 1.0 mL min^{-1} throughout the GC detector. In order to eliminate interference from residual contamination of devices and pipelines, the GC/MS system was calibrated using USEPA TO-15 Internal Standard gas with 4 BFB gas mixtures. All the direct reading instruments were sent back to agent to process calibration every three to six months. For VOCs, to eliminate interference from residual contamination of devices and pipelines, the GC/MS system was calibrated using USEPA TO-15 Internal Standard gas with 4 BFB gas mixtures. The recovery based on international standards was over 90% and the relative standard deviations (RSDs) were less than 20%.

The Questionnaire

The self-administered questionnaires were distributed to the participants during our visit to the participants' office for environmental monitoring. In the self-administered questionnaire, enrolled hospital workers answered questions regarding their personal characteristics, and SBS-related symptoms in recent 2 weeks. No standardized definition of SBS was used in this study. SBS-related symptoms were defined as any reported "continuous or sporadic" symptom because this broad definition could be useful in identifying a greater number of potential risk factors (Wang *et al.*, 2008). The primary health outcomes included symptoms, such as eye symptoms (i.e., dryness, irritation, and/or itching); respiratory mucosa symptoms (i.e., nasal dryness; and/or nasal congestion); skin symptoms (i.e., dryness, irritation, and/or itching); neurological symptoms (i.e., fatigue and/or difficulties in concentration); musculoskeletal symptoms (i.e., pain and/or spasm). The reliability of the questionnaire was greater than 95%.We used toothache as the "dummy" variable in the self-reported SBS-related symptoms, and we observed that the validity of the questionnaire was excellent.

For each symptom, an answer could be given according to one of five options; "no, never", "yes, 1–2 times/2 weeks", "yes, 3–4 times/2 weeks", "yes, 5–10 times/2 weeks", and "yes, > 10 times/2 weeks". In each category, subjects with no symptom in the category were assigned a score of 0, subjects who reported the symptom 1–2 times/2 weeks were assigned a score of 1, and subjects who reported the symptom > 10 times/2 weeks in the category were assigned a score of 4. In the linear regression analysis, an overall score for SBS-related symptoms ranging from 0 to 20 was constructed by summing up the individual symptom scores.

There was one item that asked whether the respondents attributed the symptoms to indoor climatic factors, but the result was not used in this study, as the symptoms were assessed regardless of the subjects' opinions on the causes. The questionnaires were distributed to all subjects at their workplaces in 2013, and were completed within two weeks. The prevalence of symptoms was calculated for each symptom.

Statistical Analysis

Chi-square test, two-sample t test and multiple linear regression are used in this study. And multiple linear regression was performed in five steps. First, all personal factors were entered into the model. Second, all significant personal factors were kept in the model. Third, measured exposure variables were then entered into the model one by one. The fourth step entailed the maintenance of all significant exposure variables in the model. Finally, all non-significant variables were excluded. Throughout the statistical analysis, two-tailed tests and a 5% level of significance were used. All statistical analyses were performed using the SPSS (SPSS18, IBM Corp., USA).

RESULTS

Personal Characteristics

The overall response rate was 92%. The median employment time was eight years, and 67% of the hospital workers had worked one year or more at their current workplace. Of the subjects, 126 participants in 6 confined and 6 open working spaces remained for analysis after eliminating data with missing values, and 104 of them are female. The participation rate for environmental monitoring was 92% of the questionnaire respondents. The average age of analyzed participants was 43 (range 22–55) years. The mean age was 44 years for female, and 42 years for male. Eleven participants were exposed to tobacco smoke. Other population characteristics are shown in Table 1.

Chemical Concentrations

During the field sampling period, the air temperature ranged from 20 to 26 Celsius, and the relative humidity ranged from 63% to 75%. The carbon dioxide concentrations ranged from 370 ppm to 1250 ppm. The indoor geometric mean concentrations were 50 CFU m^{-3} for fungi and 73 CFU m^{-3} for bacteria, respectively. Most particles were found in the open working spaces. The results were similar for the microbial air sampling, except that the difference between the median bacterial counts in open spaces and those in confined spaces was much larger. Open working spaces had significantly more bacteria and particulates in the indoor air than confined spaces. Indoor chemical concentrations in the investigated spaces are listed in Table 1. Total 103 kinds of VOCs were measured in this study. VOCs showed in Table 1 were high in concentration in this study and have been reported having effects on health symptoms. For VOCs, hydrocarbons such as toluene, xylenes were ubiquitously detected in indoor air. Total VOCs, which was calculated by adding together all the detected VOCs, was higher than 300 ppb in 50% of the working spaces. Anesthetic agents in operation rooms are not discussed in this study, because the operation rooms in this study are only for operations under local anesthesia.

Occurrence of Symptoms

The hospital workers often complained of respiratory mucosal irritation, eye symptoms, and general symptoms. About 84% of the subjects suffered from at least one symptom, among which the most frequently reported symptoms were nasal symptoms, followed by eye symptoms, with frequency rates of 66% and 53%, respectively. Thirty percent of participants reported weekly complaints of fatigue; 19% reported headache; and 33% reported facial dryness. The self-administrated symptom scores of all categories are shown in Table 2. Sixty subjects reported that their symptoms were independent of the season, 46 subjects reported that the symptoms were most prevalent during the winter, and only two people reported that their symptoms were most common in spring.

Associations between SBS-Related Symptoms, Personal Factors and Chemical Concentrations

Relationships among the symptom score, personal factors, and chemical exposures were analyzed. Due to the small

Table 1. Personal characteris1tics, environmental and chemical parameters (Mean ± SD).

	Open	Confined	P-value
Gender (F:M) (n)	96 (79:17)	30 (25:5)	0.57
Age (years)	42.1 ± 5.1	41.1 ± 4.9	0.20
Working experience (years)	10.0 ± 4.5	9.2 ± 3.6	0.18
Tem (°C)	23.1 ± 1.6	22.1 ± 1.3	0.51
RH (%)	66.4 ± 3.7	62.8 ± 3.1	0.60
CO (ppm)	5.6 ± 2.1	5.9 ± 2.3	0.13
CO_2 (ppm)	685.0 ± 162.1	825.0 ± 141.3	0.02
PM_{10} ($\mu g\ m^{-3}$)	12.0 ± 5.2	7.3 ± 4.1	0.03
$PM_{2.5}$ ($\mu g\ m^{-3}$)	4.7 ± 5.3	2.3 ± 4.8	0.02
Bacteria (CFU m^{-3})	58.4 ± 12.6	100.0 ± 21.3	0.01
Fungi (CFU m^{-3})	50.6 ± 10.2	52.3 ± 9.9	0.20
tVOCs (ppb)	215.0 ± 100.2	458.0 ± 189.2	0.02
HCHO (ppb)	0.2 ± 0.1	0.2 ± 1.2	0.85
Styrene (ppb)	0.1 ± 0.1	0.2 ± 0.1	0.51
m,p-Xylene (ppb)	0.8 ± 0.2	0.7 ± 0.4	0.33
o-Xylene (ppb)	0.4 ± 0.2	0.4 ± 0.2	0.42
n-Hexane (ppb)	1.7 ± 0.9	2.9 ± 0.6	0.04
Benzene (ppb)	2.0 ± 1.1	1.7 ± 0.6	0.32
Toluene (ppb)	15.2 ± 5.9	13.8 ± 7.3	0.62

[a] tVOCs: total VOCs.

Table 2. Prevalence of SBS-related symptoms (Mean ± SD).

	Open	Confined	P-Value
Muscle skeleton	2.2 ± 1.1	2.3 ± 1.0	0.38
Eyes	2.3 ± 1.3	2.2 ± 1.5	0.46
Respiratory	2.5 ± 1.1	2.6 ± 1.2	0.22
Neurological	1.9 ± 1.2	2.1 ± 0.9	0.31
Skin	1.8 ± 0.7	1.8 ± 0.9	0.75

number of men, statistical analyses of gender differences were not performed in this study. In the multiple linear regression analysis, the symptom score was significantly related to certain kinds of the measured air pollutants which included CO_2, PM_{10}, $PM_{2.5}$, bacteria, fungi, tVOCs, o-Xylene, and Toluene.

There were significant positive relationships between measured levels of viable airborne fungi and blocked nose, dry throat, dry skin, and mean symptom score (results for each specific symptom category are not shown). Regarding levels of bacteria, there were positive relationships with headache and eye irritation and there were negative relationships with runny nose, blocked nose, dry throat, and fatigue. But none of the relationships were statistically significant. The results of air sampling show that, in general, there were low levels of particulates in the air of all the environments, with higher levels in the open spaces. With regard to particulates, in both the open and confined space groups, relationships were found with SBS-related symptoms. For VOCs, we also tested the associations between concentrations and SBS-related symptoms occurrence in each symptom group. There were positive relationships with musculoskeletal, neurological, and dermal symptoms. After adjusting for other risk factors, the scores of eye, nasal, and overall SBS-related symptoms significantly increased with total VOCs concentration in a dose-dependent manner. Several other chemicals showed significant associations with SBS-related symptoms (Table 3).

DISCUSSION

It is counterproductive to dichotomize buildings into healthy vs. unhealthy; instead the prevalence of health problems related to buildings span a continuum (Brightman *et al*., 2008) We should know that the symptoms reported in this study are not necessarily work-related.

In this study, we evaluated the indoor air quality of confined and open spaces in a medical center. The indoor air quality in the hospital in this study is similar to one previous study included 8 hospitals in Taiwan (Hsu *et al*., 2012). We documented significant associations between questionnaire-reported SBS-related symptoms among medical workers and indoor air quality. The results suggest that a large proportion of hospital workers may have symptoms compatible with SBS. The results obtained in this study demonstrate significantly higher symptom prevalence rates in the confined space group compared with those of the open space group, which are different to the general findings (Pejtersen *et al*., 2006). The noise, unpleasant odor and stuffy air were more pronounced in the larger offices than in the cellular offices in that study. But in hospitals, noise is not the problem and the ventilation effectiveness is good. This is the possible reason that this study is in disagreement with the general findings for offices. This cross-sectional study has certain drawbacks due to the selection processes and the number of available employees, which may limit the validity of the findings. Despite these limitations, we showed significant correlations between symptoms and both personal factors and indoor air pollution exposure. Furthermore, the non-response rate was relatively low (8%).

Most of the earlier studies on illness related to buildings were conducted on office workers. We have shown that symptoms compatible with the SBS are also common in hospital workers. The most common symptoms were throat dryness, eye irritation and fatigue. Unlike earlier studies on office workers, we showed that personal factors did not influence the prevalence of SBS-related symptoms. Because few smokers were included in our study, we do not know if smoking had a significant influence on prevalence of symptoms, which was found in earlier studies of office workers, school personnel (Rogier *et al*., 1989; Skov *et al*., 1989; Norbäck *et al*., 1990a).

With regard to the relationships between indoor air pollution and SBS-related symptoms, our study is not in all respects in agreement with earlier findings found in office workers (Huang *et al*., 2013). One phenomenon that may have existed was lower indoor air humidity at higher air exchange rates. In 1990, an experimental study found that moderate steam humidification during the winter reduced the prevalence of throat symptoms, air dryness, and static electricity (Norbäck *et al*., 1990b). However, this can't be evaluated in this study due to the subtropical climate of Taiwan; steam humidification is not used in winter.

None of the indoor environments contained concentrations of carbon dioxide that exceeded 1,500 ppm; therefore, the ventilation appeared to be adequate (i.e., "fair") in these working spaces. A study conducted in the Netherlands found a significant negative association between CO_2 concentration and symptoms of SBS (Zweers *et al*., 1992). The authors concluded that this was due to the fact that CO_2 concentrations were highest in the naturally ventilated buildings, which had the lowest complaint rates for other reasons. In this study, we also found a significant negative association between CO_2 concentration and SBS-related symptoms. However, CO_2 concentration was higher in confined spaces than in open spaces, which is inconsistent with the results of the previous study, since the confined and open spaces in this study were all mechanically ventilated (Zhang *et al*., 2014).

In the absence of excess moisture in an office building,

Table 3. Associations between personal factors, chemical concentrations and SBS-related symptoms.

	Open		Confined	
	95%CI	P-value	95%CI	P-value
Age (years)	0.05 (–0.91 to 1.01)	0.41	0.05 (–0.79 to 0.90)	0.31
Working experience (years)	0.14 (–0.31 to 0.61)	0.77	0.12 (–0.44 to 0.68)	0.56
Tem (°C)	0.11 (–0.11 to 0.32)	0.64	0.08 (–0.38 to 0.56)	0.54
RH (%)	0.12 (0.04 to 0.22)	0.03	0.13 (0.02 to 0.24)	0.04
CO (ppm)	0.08 (–0.02 to 0.18)	0.08	0.01 (–0.09 to 0.12)	0.08
CO_2 (ppm)	0.02 (0.00 to 0.04)	0.02	0.02 (0.00 to 0.04)	0.02
PM_{10} (μg m^{-3})	0.01 (0.00 to 0.02)	0.02	0.02 (0.00 to 0.05)	0.03
$PM_{2.5}$ (μg m^{-3})	0.01 (0.00 to 0.03)	0.03	0.01 (0.01 to 0.02)	0.03
Bacteria (CFU m^{-3})	0.13 (0.01 to 0.25)	0.04	0.09 (0.05 to 0.13)	0.01
Fungi (CFU m^{-3})	0.04 (0.01 to 0.07)	0.03	0.06 (–0.02 to 0.14)	0.07
tVOCs (ppb)	0.01 (0.00 to 0.03)	0.01	0.02 (0.00 to 0.05)	0.03
HCHO (ppb)	1.30 (–0.50 to 3.11)	0.60	1.3 (–0.05 to 2.64)	0.16
Styrene (ppb)	–0.03 (–0.84 to 0.77)	0.12	0.03 (–0.07 to 0.13)	0.12
m,p-Xylene (ppb)	–0.05 (–1.24 to 1.15)	0.13	–0.02 (–1.10 to 1.06)	0.23
o-Xylene (ppb)	0.06 (0.01 to 0.11)	0.05	0.16 (–0.74 to 1.06)	0.15
n-Hexane (ppb)	–0.02 (–0.12 to 0.08)	0.15	–0.03 (–0.53 to 0.46)	0.15
Benzene (ppb)	–0.01 (–0.28 to 0.25)	0.41	0.01 (–1.30 to 1.32)	0.71
Toluene (ppb)	0.01 (0.00 to 0.03)	0.04	0.01 (0..00 to 0.03)	0.03

[a] 95% CI of each chemical concentration is presented for interquartile range increasing.

e.g., a flooded carpet or standing water in chiller trays, it is unusual to measure levels of airborne fungi greater than 1000 CFU m^{-3}. In this study total viable counts never approached 1000 CFU m^{-3}. Numbers of bacteria grown have been included in the results and there were markedly fewer bacteria in the open spaces. For airborne micro-organisms, there was a strong positive correlation between levels of bacteria and fungi and symptom prevalence rates, both in the open and confined space groups. The finding of a positive correlation between symptom prevalence rates and levels of airborne bacteria and fungi in this cross-sectional study is not evidence of a causal relationship. It is possible that levels of airborne bacteria and fungi merely reflect a more fundamental environmental parameter. The WHO guidelines suggested that microbiological contamination of humidifiers, chillers, or ductwork could be responsible for the symptoms of SBS, perhaps by an allergic- or endotoxin-related mechanism (Heseltine and Rosen, 2009). The strongest associations within both groups suggest that the prevalence rates of blocked nose, dry throat, and dry skin were related to levels of airborne fungi. Current evidence suggests that excessive moisture promotes mold growth and is associated with an increased prevalence of symptoms due to irritation, allergy, and infection (Chen *et al.*, 2013). Specific toxicity due to inhaled mycotoxins is not well documented, and remains controversial (Fung and Hughson, 2003). The positive relationship between the symptom prevalence rates of SBS and airborne micro-organisms within open and confined space groups is interesting and merits further investigation. Further characterization of the bacteria and fungi recovered by sampling is required to explore the varieties of microflora within buildings, in addition to information about their sources. It is unlikely that a particular species of fungus could be implicated in causing the symptoms as a variety of species were isolated in low concentrations from each environment.

Results of previous studies indicate that formaldehyde induces SBS-related symptoms because it was detected at high frequencies and in concentrations high enough to influence subjective symptoms (Garrett *et al.*, 1999; Golden, 2011). However, the relationships between formaldehyde and SBS-related symptoms were not found in this study. It is not clear that if concentration is the reason. Further study will be needed to verify this finding. Overall, the measured concentrations of indoor VOCs were low in this study (Alves *et al.*, 2014). The air pollutant concentrations were similar to those reported in the United States (Hodgson *et al.*, 2000). Our results also suggest associations between VOCs and SBS-related symptoms. It is possible that severe asthmatics exposed to high VOC concentrations may have decreased lung function. Since indoor VOC concentrations are generally orders too low to cause irritation, the perceived indoor air quality by odorous VOCs may potentially cause mental distraction, thus leading to deteriorated performance (Wolkoff *et al.*, 2006; Wolkoff, 2013). Total VOCs concentration was reported to be significantly related to throat and respiratory symptoms in a study in Japan (Saijo *et al.*, 2004) and there was one study reported the relationship between total VOCs and asthma (Hwang *et al.*, 2011); however, no such relationship was found in this study. This could be attributed to differences in the constituents of total VOCs between the two studies. However, the scientific literature is inconclusive with respect to TVOC as a risk index for health and comfort effects in buildings. Continued research is required to establish a risk index for health and comfort effects for TVOC (Andersson *et al.*, 1997).

There were some limitations in this study. First of all, we should keep in mind that the statistical results still might be due to "chance", even they are "statistically significant". Most of the subjects in this study were female; therefore, further evaluation of sex differences is needed using a larger number of hospital workers to confirm the findings. To more thoroughly address the potential impacts of indoor chemicals on human health, future work should target other chemical substances. Moreover, in this study we evaluated a single medical center. Multiple centers should be investigated in future studies. Most of these chemical substances were detected at relatively low concentrations, and it is unknown whether there may be any long-term adverse effects on human health. In addition, to some extent, our participants were self-selected which might have introduced a volunteer bias to the extent that non-participants may have differed from participants. No information on the non-participants was collected in this study. We collected subjects' personal information by questionnaire, and this may have resulted in recall bias. However, regarding the association between chemical concentrations and symptoms, the bias was not predicted because subjects could not know their chemical exposure level even if they had symptoms.

CONCLUSIONS

This study investigated the associations between indoor air pollutants and SBS-related symptoms among hospital workers. We found CO_2, PM_{10}, $PM_{2.5}$, Bacteria and total VOCs have significant effects on SBS-related symptoms among hospital workers. The results are similar to those of other studies for office workers. This study also investigated the difference between open and confined spaces, and revealed the concentrations and effects of air pollutants are not the same in open and confined working spaces. Different kinds of air pollutants are related to SBS-related symptoms of different organ systems. These results emphasize that we can't ignore this healthy issue for those people who provide health care to others every day.

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