

FACTORS AFFECTING SICK BUILDING SYNDROME AMONG HOTEL STAFF

Jinda Kongcharoen^{*}, Nutthajit Onmek, and Seppo Karrila

Received: March 29, 2018; Revised: October 16, 2018; Accepted: January 29, 2019

Abstract

Sick building syndrome (SBS) is commonly found among office staff. There have been few studies on SBS among hotel staff. The main objective of this research was to establish a risk factor model related to the occurrence of SBS among hotel staff. A questionnaire on SBS was used to survey 246 hotel staff based on purposive sampling. Significant factors were detected using chi-square and likelihood ratio tests while binary logistic regression was used to determine the significant difference among personal information, workplace characteristics, and environmental and psychosocial factors in relation to the occurrence of SBS. The outcome of the evaluation indicates the prevalence of SBS as about 7%. The statistical factors related to SBS were female staff (OR = 20.52, 95%CI = 2.91-144.92), smoking habits (OR = 10.67, 95%CI = 1.94-58.61), and presence of animals (OR = 8.09, 95%CI = 2.52-26.01). This study indicates that female smokers surrounded by animals had an elevated risk of SBS. This study could be useful for guiding hotel staff to avert health risk behavior.

Keywords: Sick building syndrome, factors, logistic regression, hotel staff

Introduction

Sick building syndrome (SBS) is often found among office staff. SBS includes various non-specific syndromes that may disappear when staff are away from a building and reappear when they reenter the building. SBS related symptoms include nasal manifestation, throat and respiratory tract symptoms, skin problems,

generic symptoms, and neurotoxic problems (Ekpanyaskul *et al.*, 2005). The signs of SBS associated with being in the causative building include headache, dizziness, eye, nose or throat irritation, dry cough, difficulty in breathing, and itchy skin (Joshi, 2008). The number of workers with SBS has an increasing

Faculty of Science and Industrial Technology, Prince of Songkla University, Surat Thani Campus, 31 Moo 6, Makhantia, Surat Thani, 84000, Thailand. E-mail: jinda.suv@psu.ac.th

^{} Corresponding author*

trend in Bangkok and this was associated with the indoor environmental quality which was affected by office equipment, building materials, work satisfaction, etc. (Ritwichai and Buathong, 2017; Ekpanyaskul, 2005). SBS may possibly cause ill health, reduce work efficiency, and increase healthcare costs, thereby harming both employees and employers.

Factors reported as associated with SBS tend to be debatable. Many studies (Gou and Lau, 2012; Romyen, 2014; Wichitwetchakar *et al.*, 2014) have explored a variety of individual characteristics, such as workplace factors and psychological processes in relation to SBS. Norhidayah *et al.* (2013) recommended that multifactorial etiologies of SBS, such as psychological factors, ergonomics of the work, stress levels, job satisfaction, position in the hierarchy of the organization, and other environmental conditions could be considered. Those studies indicated that associated factors are important predictors of SBS. They were the motivation for this study to evaluate those already mentioned factors, namely individual, workplace, physical environment, and psychosocial factors. Previous studies have indicated significant factors that may affect SBS occurrence in the workplace.

Various studies have investigated the relationship between indoor air quality and the prevalence of SBS in office staff (Zamani *et al.*, 2013; Jafari, 2015). Several studies showed that the characteristics of the prevalence of SBS among staff in a building differ by workplace. Those past studies focused on the staff in high density workplaces such as workers in factories (Wichitwetchakar *et al.*, 2014), nursing staff at hospitals (Romyen, 2014), and students, lecturers, and officers at universities (Wongvijitsuk and Cheamjai, 2010). Some differences might be explained by the different building types used in these contexts. All the buildings were located in the center of a city, near high volume traffic, and equipped with air conditioning amenities. A hotel was in the central business area, had a long history of occupancy, and had adopted energy saving measures to reduce energy usage such as in air-conditioning. Few studies have focused on

staff members in hotel buildings (Prasomwong *et al.*, 2018).

Our previous study investigated indoor air quality including total dust, respirable dust, temperature, humidity, air velocity, and carbon dioxide in hotel buildings. The measurement results showed that temperature and humidity were found to be higher than the recommended limits and poor air quality was also found. SBS needed to be considered for further investigation by using a questionnaire to survey other contributing risk factors focusing on staff members in hotel buildings. The objectives of the study were: 1) to evaluate the symptoms of SBS in hotel staff in Surat Thani, 2) to investigate candidate factors possibly associated with SBS including personal information, workplace, and environmental and psychosocial factors, and 3) to determine possible factors for the SBS occurrence.

Materials and Methods

A cross-sectional descriptive study was conducted during January to March 2016 in Muang district, Surat Thani province. A total of 246 staff was selected from 2 hotels (Hotel A and Hotel B) by purposive sampling. The samples of this investigation were all hotel staff who worked full-time and were stationed in lobbies, kitchens, and office rooms where the staff spent most of their work time. All respondents depended on the management of human resources. To determine the prevalence of SBS among hotel staff, a questionnaire instrument was adopted from Romyen (2014), Wongvijitsuk and Cheamjai (2010), and Magnavita (2014). The questionnaire used in this study had 5 parts.

The first part of the questionnaire contained personal data concerning age, gender, education, smoking habits, health status, and the presence of animals.

The second part was about typical symptoms associated with SBS during the previous 4 weeks (16 items) such as headaches, skin symptoms, and mucosal problems, etc. For each item, 1 of 3 answers could be selected (often, sometimes, never).

In the third part, environmental satisfaction and background information about the respondents and their office areas were also investigated for the previous 4 weeks (13 items). Environmental factors consisted of lighting, chemicals, air pollutants, extreme temperatures, stuffy and humid air, fluctuating air temperatures, and dry air. Some questions were included: “At the workplace do you complain that the temperature is too high?” and “At the workplace do you complain about dry air?”. There were 2 answers, either yes or no.

The fourth part was about workplace characteristics including working experience, having central air-conditioning, new carpets, use of printers, use of photocopying machines, and aromatic chemicals, etc. An example of a question was: “During the past 4 weeks, how often did you use photocopiers?”, and the response choices were often, sometimes, and never.

The last part was concerning the psychosocial factors at the workplace, such as job satisfaction, symptoms of stress, stress from working on time, and stress from working hard, etc. (Magnavita, 2014). Questions included: “How often do you have too much work to do?” and “How often do you complete your work on time?”. There were 3 answer choices: often, sometimes, and never.

Following the assessment of SBS utilized by Ekpanyaskul (2005), Magnavita (2014), Norhidayah *et al.* (2013), and Chirico *et al.* (2017) to interpret the occurrence of SBS, the following characteristics were identified:

1) a person with a pre-existing medical condition listed in the questionnaire such as

allergies to dust, mold, or pets, and asthma or migraine,

2) an improvement in the symptoms after leaving the buildings,

3) the onset of 2 or more SBS symptoms at least once or twice weekly in the previous 4 weeks,

4) an increase in the symptoms for 20 days in the previous month.

For analysis, the occurrences of SBS symptoms were categorized into 2 groups: presence or absence.

Statistical Tools

Data entry and analysis were carried out using R programming. The chi-square and likelihood ratio test were used for categorical independent variables to test the association between factors and SBS occurrence. Binary logistic regression was applied to estimate factors relating the candidate predictor variables with the occurrence of SBS. This technique is commonly used to model the probability of discrete outcomes. Independent and dependent variables used in this study are shown in Figure 1.

Results and Discussion

Summary Statistics

Demographic and Health Factors

A total of 75 staff in Hotel A were sampled, comprising 57.3% females and 42.7% males. The average age was 31 years old and 29.3% held an associate degree or a bachelor's degree. In Hotel B, a total of 171 staff were

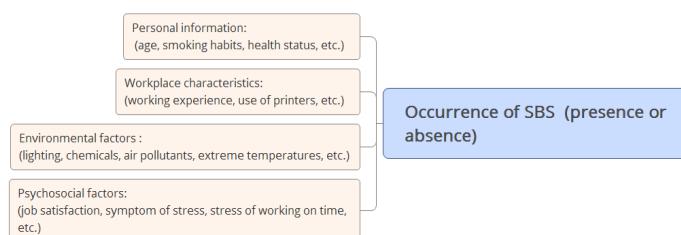


Figure 1. Conceptual framework of variables used in this study

sampled, with 60.8% females and 39.2% males. The mean age was 32 years old and 34.5% held a bachelor's degree.

With regard to the smoking of tobacco, staff in Hotel A and Hotel B had a 26.7% and 29.2% prevalence, respectively. The allergy/asthma history of staff members was reported at 2.7% (Hotel A) and 4.7% (Hotel B). Passive smoking was found in Hotel A and Hotel B staff at 53.3% and 39.8%, respectively. In Hotel A 9.3% of the staff and 12.9% of Hotel B staff lived with animals, such as cats, dogs, and birds, etc.

Workplace Factors

The staff in Hotel A and Hotel B have about 8-hour workdays. Both hotels have 6 workdays per week. The average work experiences of staff in Hotel A and Hotel B were 2.55 years and 3.22 years, respectively. With regard to the work equipment, the use of printers was reported by 52.0% and 41.5% of Hotel A and Hotel B staff, respectively; also 52.0% and 41.5% of Hotel A and Hotel B staff, respectively, used photocopying machines. Moreover, chemicals (including window cleaner, floor wax, and dishwashing liquid, etc.) were used by 61.3% and 43.9% in Hotel A and Hotel B, respectively.

Environmental Factors

Most offices were designed with centralized air-conditioning and windows that can be opened for ventilation. The hotels did not have new furniture or carpets or partitions during the survey. Evaluation of satisfaction with the work environment by staff in Hotels A and B found that satisfaction levels were good at 85.3% and 79.5%, respectively. The physical environmental conditions within rooms in the hotels were moderately appropriate.

The perceptions of the environment during the previous 4 weeks were measured by 1 of the answers in terms of frequency: less than 10 days/month, between 10 and 20 days/month, or more than 20 days/month. Staff reported less than 10 days/month with the temperature too high at 76.0% and too low at 78.7% in Hotel A, while for Hotel B the frequencies were 64.3% (too high) and at 69.6% (too low). Regarding dry air, 81.3% and

70.8% complained in Hotel A and Hotel B, respectively. Moreover fluctuating temperatures were observed in Hotel A and in Hotel B at 84.0% and 71.3%, respectively.

Psychosocial Factors

In terms of psychosocial factors affecting hotel staff, our results show that a high level of job satisfaction was observed at 85.3% and 79.5% in Hotel A and Hotel B, respectively. Stress from working hard was found at 29.3% (Hotel A) and 22.2% in Hotel B. Stress from working under deadlines was found in Hotel A and Hotel B at 32.0% and 19.3%, respectively. Staff reported stress from having to work hastily due to insufficient time with 20.0% (Hotel A) and 18.1% (Hotel B). Stress from work expectations impacted 22.7% (Hotel A) and 43.3% (Hotel B). There were other responsibilities such as housework and taking care of children, etc.

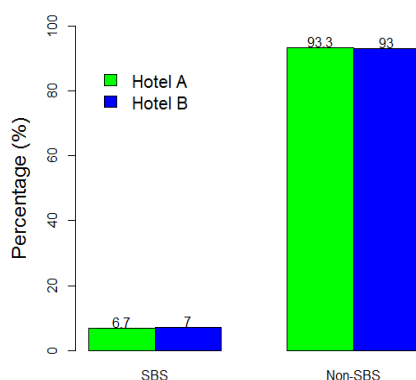
Evaluation of the Occurrence of Sick Building Syndrome (SBS)

The common symptoms of staff in both hotels were general symptoms, including fatigue, general malaise, nasal manifestation, and conjunctivitis (Table 1). According to previous measurements of environmental characteristics, the workplaces were humid and poorly ventilated, causing working inefficiency in both hotels (Prasomwong *et al.*, 2018). The outcome from the evaluation based on the criteria given indicated 6.7% SBS occurrence in Hotel A staff and 7% in Hotel B staff (Figure 2). Both selected hotels had similar comparatively low prevalence of SBS occurrence in this study. The prevalence of SBS was 37.4% in office workers found by Ritwichai and Buathong (2017) and 20.58% among office workers in Bangkok (Ekpanyaskul *et al.*, 2005). Godish (1994) reported the prevalence of SBS should be less than 20%. This means that staff in both hotels did not have a major problem from SBS. A chi-square test was carried out to assess the frequency of SBS occurrence between the hotels and no significant association was discovered (Sig. = 0.92). Further studies could focus on the combined staff in both hotels.

Table 1. The percentage of symptoms related to sick building symptoms

Symptoms*	Hotel A	Hotel B
Conjunctivitis	61.3	56.7
Throat dryness	77.3	35.7
Nasal congestion	78.7	56.7
Sneezing	77.3	51.5
Wheezing	53.3	22.8
Chest tightness	60.0	29.2
Dyspnea	49.3	17.5
Headache	74.7	52.0
Dizziness	69.3	42.1
Fatigue	93.3	41.5
Depression	52.0	19.9
Stress	58.7	26.9
Nausea	68.0	32.2
Skin dryness	53.3	22.8
Eye pain	57.3	32.2
General malaise	81.3	42.7

* One can choose more than 1 symptom

**Figure 2. Occurrence of sick building syndrome in hotel staff**

Tests of Association Between the Factors and SBS Occurrence

Each of the factors was investigated for association with the occurrence of SBS. The chi-square and the likelihood ratio tests were applied to further assess the association between the factors and the occurrence of SBS. The results of this study indicate that the following factors influenced the occurrence of SBS in a significant way: gender, smoking of tobacco, presence of animals, and dry air. These analyses showed a statistically significant association between demographic and health

factors, and physical environmental factors and the occurrence of SBS. None of the workplace factors and psychosocial factors was found to have a statistically significant relationship with the occurrence of SBS. Further details are listed in Table 2.

Most studies have found that individual factors, psychosocial factors, and workplace factors are associated with SBS (Wichitwetchakar *et al.*, 2014; Romyen, 2014). The findings in our study showed only physical environmental factors and individual factors as significant factors related to SBS. No significant relationship was observed between workplace factors or psychosocial factors and the occurrence of SBS, possibly because of the low occurrence of sick building symptoms in this study.

Factors related to SBS Occurrence

In this study, the impact of each independent variable on the SBS occurrence was investigated. Since the occurrence of SBS (presence or absence) was the dependent variable in this study, the prediction of this dichotomy was based on binary logistic regression. The binary logistic regression was carried out to investigate whether the risk factor model with 4 predictors could significantly match the observed occurrence of

Table 2. Test of association between the occurrence of SBS and each of the factors

Factor	chi-square test		likelihood ratio test	
	Value	Sig.	Value	Sig.
Demographic and Health Factors				
Gender	3.878*	0.049	4.301*	0.038
Age	0.540	0.763	0.551	0.759
Education	1.285	0.526	1.245	0.537
Smoking status	7.263*	0.026	11.880*	0.003
Medical history	0.774	0.379	1.469	0.226
Passive smoking	0.055	0.814	0.055	0.814
Presence of animals	5.454*	0.020	4.183*	0.041
Workplace factors				
Working experience	13.031	0.445	16.840	0.207
Having air-conditioner	0.829	0.661	0.793	0.673
Use of printers	5.592	0.133	4.585	0.205
Use of photocopiers	1.096	0.778	1.077	0.783
Aromatic chemicals	3.053	0.384	2.590	0.459
Environmental factors				
Lighting	0.769	0.943	1.112	0.892
Chemical indoor	3.103	0.212	3.773	0.152
Air pollutants	0.665	0.415	0.718	0.397
Working environment	5.431	0.143	5.669	0.129
Temperature too high	0.113	0.945	0.110	0.947
Temperature too low	2.090	0.352	1.993	0.369
Fluctuating temperatures	0.225	0.893	0.215	0.898
Dry air	6.826*	0.033	5.638*	0.046
Psychosocial stress				
Job satisfaction	0.138	0.987	0.211	0.976
Stress of work on time	1.682	0.431	1.593	0.451
Stress of hard work	0.910	0.643	0.930	0.628
Stress of working hastily	1.279	0.528	1.275	0.529
Symptom of Stress	1.245	0.536	1.250	0.535
Other job	0.798	0.372	0.801	0.371

* is significant at Sig. <0.05

SBS. The variables considered were: gender (male or female), smoking of tobacco (yes or never), presence of animals (yes or never), and dry air (less than 10 or 10-20 or above 20 days/month).

When all the predictor variables were considered together, they significantly predicted whether a member of staff would suffer from SBS (chi-square = 37.021, Sig. = 0.000). Logistic regression analysis showed statistically significant associations starting with females, smoking, and presence of animals to the occurrence of SBS. The variables included in the logistic regression equation are displayed in Table 3. In the final model, the factors influencing SBS among hotel staff showed the female gender was the highest major risk

factor (OR = 20.52, Sig. = 0.002, 95%CI = 2.91-144.92) followed by smoking (OR = 10.67, sig. = 0.006, 95%CI = 1.94-58.61) and the presence of animals (OR = 8.09, sig. = 0.000, 95% CI = 2.52-26.01). According to the OR, being a female was the dominant risk factor associated with SBS occurrence. In general, females tend to have a lower disease resistance than males. Moreover, Nagelkerke's R^2 of 0.454 indicated a medium relationship between predictors and a predicted variable. Previous studies (Brasche *et al.*, 2001; Ekpanyaskul *et al.*, 2005; Jafari *et al.*, 2015) have suggested a more frequent occurrence of SBS in females than in males. Our study also found a similar association between gender and the risk of SBS. In addition, the presence

Table 3. Logistic regression model to predict occurrence of SBS

Variables	Regression coefficient (β)	Sig.	OR (95% CI)
Smoking	2.367	0.006*	10.67 (1.94-58.61)
Female gender	3.022	0.002*	20.52 (2.91-144.92)
Dry air (less than 10)	-2.272	0.068	0.10 (0.009-1.18)
Dry air (10 – 20)	1.536	0.051	4.65 (0.99-21.63)
Presence of animals	2.092	0.000*	8.09 (2.52-26.01)
Constant	-11.002	0.000*	
Nagelkerke R ²	0.454		
Observation (n)	246		

* CI is the confidence interval; OR is the odds ratio

of animals was an independent influencing factor for the occurrence of SBS, whereas most prior studies have considered having cats at home as significant to the prevalence of SBS (Romyen, 2014). Similar studies (Brasche *et al.*, 2001; Abdel-Hamid *et al.*, 2013) found that smoking was a significant risk factor for gender-related symptoms of SBS. The awareness of these risks among hotel staff could be raised.

Conclusions

Most members of staff in each hotel were less than 39 years old and many held a bachelor's degree. Most of them were non-smokers, had less than 4 years of work experience, and worked 6 days per week. The prevalence of SBS among the staff in both hotels is slightly low. The factors related to SBS were gender, smoking habits, frequency of dry weather, and presence of animals. This study also indicates that smoking females surrounded by animals had an elevated risk of suffering from SBS. The limitation of this study was the small sample size of the hotels' staff. The association of SBS with indoor air quality in the buildings was lacking. The results of this study will be used to support further studies on SBS occurrence at different workplaces and may be useful for effective planning and policies regarding hotel staff. Further research could be conducted to investigate biological environmental

factors, such as bacteria or fungi, and chemical factors such as carbon monoxide and ozone formaldehyde.

Acknowledgment

The authors of this article would like to thank Prince of Songkla University, Surat Thani Campus, for funding support; and hotel staff in Surat Thani for participating in the survey for this study. The authors would like to thank Anakewit Boonkasame for his valuable suggestions for the manuscript.

References

- Abdel-Hamid, M. A., Hakim, S. A., Elokda, E. E., and Mostafa, N. S. (2013). Prevalence and risk factors of sick building syndrome among office workers. *Journal of the Egyptian Public Health*, 88:109-114.
- Brasche, S., Bullinger, M., Morfeld, M., Gebhardt, H. J., and Bischof, W. (2001). Why do women suffer from sick building syndrome more often than men? - subjective higher sensitivity versus objective causes. *Indoor Air*, 11(4):217-222.
- Chirico, F., Ferrari, G., Taino, G., Oddone, E., Giorgi, I., and Imbriani, M. (2017). Prevalence and risk factors for sick building syndrome among Italian correctional officers: A pilot study. *Journal of Health and Social Sciences*, 2(1):31-46.
- Ekpanyaskul, C. (2005). Sick building syndrome. *Chulalongkorn Medical Journal*, 49(2):91-100. (in Thai)
- Ekpanyaskul, C., Jiamjarasrangsi, W., and Kesornthong, S. (2005). Prevalence, associated factors and impact of sick building syndrome among office workers in Bangkok. *J. Health Sci.*, 14(3):453-463. (in Thai)

- Godish, T. (1994). *Sick Buildings: Definition, Diagnosis and Mitigation*. CRC Press, Boca Raton, FL, USA, 416p.
- Gou, Z. and Lau, Y. (2012). Sick building syndrome in open-plan offices. *J. Fac. Manage.*, 10(4):256-265.
- Jafari, M.J. (2015). Association of sick building syndrome with indoor air parameters. *Tanaffos*, 14(1):55-62.
- Joshi, S.M. (2008). The sick building syndrome. *Indian J. Occup. Environ. Med.*, 12(2):61-64.
- Magnavita, N. (2014). Psychosocial factors in indoor work-related symptoms. Application of the MM040/IAQ questionnaire. *Med. Lav.*, 105(4): 269-281.
- Norhidayah, A., Kuang, L.C., Azhar, M.K., and Nurulwahida, S. (2013). Indoor air quality & sick building syndrome in three selected buildings. *Procedia Engineer.*, 53:93-98.
- Prasomwong, M., Ho, W., Boonchua, T., Kongcharoen, J., and Onmek, N. (2018). Indoor air quality in hotel buildings and sick building syndrome of hotel staffs, Surat Thani Province. *J. Sci. Technol., Ubon Ratchathani University*, 20(3):64-73.
- Ritwichai, A., and Buathong, N. (2017). Sick building syndrome and stress among office workers. *Chulalongkorn Med. J.*, 61(4):525 - 538. (in Thai)
- Romyen, D. (2014). Correlation of environmental factors and other factors related to sick building syndrome among nursing staffs of a university hospital, [MSc. Thesis]. School of Environmental Management, Prince of Songkla University, Thailand, 126p. (in Thai)
- Wichitwetchakar, M., Sutummasa, S., and Sivadechathep, J. (2014). The prevalence and relationship of associated factors with sick building syndrome among office workers: A case study of an electronic component factory, Pathum Thani Province. *Proceedings of the 4th Sukhothai Thammathirat Open University Graduate Research Conference*; November 26- 27, 2014; Pakkret, Nonthaburi, Thailand, P-HS 013. (in Thai)
- Wongvijitsuk, S. and Cheamjai, C. (2010). Indoor air total dust, respirable dust, total bacteria, total fungi in close rooms & sick building syndrome levels of student lecturers & officer in university. *Thailand J. Health Promo. Environ. Health*, 33(4):114-128. (in Thai)
- Zamani, M.E., Jalaludin, J., and Shaharom, N. (2013). Indoor air quality and prevalence of sick building syndrome among office workers in two different offices in Selangor. *American J. Appl. Sci.*, 10(10): 1,140-1,147.