

Original Paper

# Sick Building Syndrome in Nurses of Intensive Care Units and Its Associated Factors



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## ABSTRACT

**Introduction:** Sick Building Syndrome (SBS) is a set of undesirable physical and psychological conditions whose symptoms appear when entering the building and disappear after leaving it. The most well-known symptoms of SBS include problems of nervous and respiratory systems and skin. Since nurses spend many hours in the hospital and enclosed spaces, they are exposed to many factors related to the SBS, which can affect their health and the quality of patient care.

**Objective:** This study aimed to investigate SBS and its related factors in nurses working in special care units of hospitals.

**Materials and Methods:** This is a cross-sectional study in 2016 on 144 working nurses of special care units at educational and treatment centers in Rasht City, Iran. They were randomly selected proportional to the number of nurses working in each special care unit. For evaluating SBS symptoms and indoor air quality, the "Miljömedicin 040 Questionnaire" (English version A) was used. The collected data from the questionnaire were analyzed using the Chi-squared and Independent t-tests.

**Results:** About 47.2% of nurses complained of SBS. The most common symptoms of this syndrome were headache, fatigue, heavy-headed feeling, concentration difficulty, and nausea/dizziness. According to the Chi-squared test results, there was a significant correlation between SBS and variables of air movement, fluctuating room temperature, stuffy bad air, dry air, too much light, light reflection, dust and dirt in the workplace, and contact with static electricity ( $P < 0.05$ ).

**Conclusion:** There is a high prevalence of SBS among (nearly half of) the study nurses and it has a relationship with factors such as air movement, fluctuating room temperature, stuffy bad air, dry air, too much light, light reflection, dust and dirt in the workplace, and contact with static electricity. It is recommended that workplace cleanliness, the ventilation system quality, and standard lighting level in special care units be improved. Also, it is very important the nurses working in special care units know the factors associated with SBS.

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## Highlights

- Almost half of the nurses in special care units complained of Sick Building Syndrome (SBS).
- The nervous system symptoms of SBS were more common than respiratory, mucous membrane, and skin problems.
- Headache, fatigue, and feeling heavy-headed were the most common symptoms of the nervous system.
- Unpleasant odor, stuffy lousy air, and noise were the most disturbing physical factors in special care units.
- More than half of the physical factors in special care units were correlated with SBS.

## Plain Language Summary

Symptoms and complaints attributed to Sick Building Syndrome (SBS) have become one of the health concerns of nurses in hospitals. Nurses working in special care units spend many hours in enclosed spaces that expose them to many harmful factors. However, there was not much information about the prevalence of SBS and its related factors among these nurses. In this study, 144 nurses of special care units at hospitals located in Rasht City, were examined in terms of SBS symptoms and physical factors of the workplace. Based on the results, almost half of them complained of SBS. According to their report, the headache was the most common SBS symptom, and unpleasant odor in the workplace was the most disturbing physical factor. More than half of the physical factors in special care units were correlated with the SBS. This indicates the importance of optimizing the physical conditions of special care units which may reduce the SBS symptoms of nurses in these units.

## Introduction

Since the people spend a lot of their lives within closed spaces or inside buildings, proper conditions for indoor air are very important [1]. The indoor air pollution due to microbial, chemical, and physical contaminants is recognized as a serious health problem [2, 3]. Sick Building Syndrome (SBS) is a situation in which people are working in a building experience unpleasant physical and psychological conditions. It appears that SBS is linked to the time spent in the building. The symptoms of this syndrome are related to the work environment, as they appear when entering the building or shortly afterward and disappear after leaving the building [4].

Problems with indoor air include non-specific symptoms whose reasons are unknown; however, its most recognizable symptoms include those irritating the nervous system, respiratory system, or skin such as headache, dizziness, nausea, lightheadedness, poor concentration, eye/nose/throat irritation, dry coughs, sneezing, skin inflammation and itching [5]. Of the internal factors associated with SBS are the physical ones, particularly indoor air quality such as humidity, ventilation, and room temperature [6, 7].

The sources of air pollution in buildings can include paints of the walls and in other interior surfaces, heating and cooling system, air conditioning system, office equipment (e.g. computers), fungi and mildew growing in damp indoor environments, the entry of air contaminated with carbon monoxide gas, smoke from outside the building, and cleaners for internal surfaces [8, 9].

Regarding the effect of the working environment on employees' efficiency and health, there are a few work environments whose conditions are as hard as those in hospital settings. Hospitals as a provider of educational and therapeutic services are affected by the sources of pollution (equipment and staff activities) which can hurt the health and well-being of employees. They need a calm and friendly environment to provide optimal care for patients [10]. Hence, scholars consider the evaluation of nurses' workplace conditions. Some studies on SBS indicate that hospital staff is exposed to SBS-related risk factors such as detergents, disinfectants, chemical drugs, physical factors (e.g. noise, temperature, humidity, lighting, ventilation), and biological factors [11, 12].

Considering that nurses spend their most valuable time in hospital buildings, examining the health status of their work environment, especially breathing air

quality is essential [5]. Ghaneyan et al. reported the high prevalence of SBS in the Intensive Care Unit (ICU) nurses. According to them, ICU nurses who spend many hours in the hospital and enclosed spaces, are exposed to SBS-related risk factors such as physical, chemical, biological, and psychosocial ones.

Nursing care in these units has specific conditions because of the numerous and complex health problems of hospitalized patients [1]. These patients need nursing assistance to achieve their therapeutic goals. To make this assistance effective, it is important to pay attention to the health and quality of nurses' work environment and to keep this group healthy. Therefore, given the importance of nursing tasks, it is necessary to consider the work environment of nurses as the largest group working in hospitals [13].

Considering a few studies conducted on SBS and its related factors in nurses, this study aimed to investigate SBS in nurses working in special care units and finding its related risk factors. It is hoped that by identifying the occupational hazards for nurses in the workplace, a step is taken towards promoting occupational health and eventually nurses' health and efficacy.

## Materials and Methods

This is a cross-sectional study conducted on the nurses of special care units (Cardiac care unit, Intensive Care Unit, neonatal Intensive Care Unit, pediatric Intensive Care Unit) of educational treatment centers in Rasht City, Iran in 2016. The sample size was determined 144 nurses based on the results of Ghaneyan et al. [1] study which showed an SBS prevalence of 60% for ICU nurses and considering 95% CI and power of 0.8. According to the number of nurses present in each unit, 56% of them were entered into the study. The inclusion criteria were having an associate degree or higher in nursing, at least one-year work experience in special care units, and lack of diseases such as migraine, sinusitis, allergies or acute and chronic respiratory diseases (According to the nurses' report).

To collect the data, the Persian version of "Miljömedicin 040 Questionnaire" for SBS and indoor air quality assessment was employed which both were already used in the study of Ghaneyan et al. [1]. It has three parts. The first part surveys individual characteristics such as age, sex, marital status, clinical work experience, working shift, education, organizational status, work hours during the week, and work experience in the current unit. The second part assesses the physical condition of

the workplace such as air movement, too high or too low temperature, fluctuating room temperature, stuffy bad air, unpleasant odor, static electricity in contact with surfaces, noise, too dim or too bright light, light reflection, dust, and dirt in the working environment. The third part evaluates the symptoms of SBS (fatigue, feeling heavy-headed, headache, nausea/dizziness, difficulty in concentrating, itching or burning of the eyes, irritated/stuffy/runny nose, hoarse dry throat, cough, dry or flushed facial skin, scaling/itching scalp or ears, dry hands, and itchy red skin).

Questions in the second and third parts were rated on a 3-point Likert-type scale (always, sometimes, never). The scores are calculated for those having at least half of the symptoms by answering "always" or "sometimes" and provided that their symptoms are related to the work environment. To determine the content validity of this questionnaire, after using the opinions of 11 faculty members of Guilan University of Medical Sciences (GUMS), the Content Validity Index (CVI) and Content Validity Ratio (CVR) were calculated. The results showed the high validity of questions. For determining the reliability of the questionnaire, it was tested on 19 nurses working in special care units of one of the educational treatment centers. The results confirmed the internal consistency of the tool by calculating the Cronbach  $\alpha$  as 0.70.

After approval by the Research Ethics Committee of Guilan University of Medical Sciences (Code: IR.GUMS.REC.1394.280), the researcher visited the study units for 4 months and collected data after explaining the research objectives, how to complete the questionnaire, optional participation in the study, the confidentiality of the information and obtaining written consent. All questionnaires were completed by the subjects, and there were no dropouts. The collected data were analyzed using the Chi-squared and Independent t-tests in SPSS V. 23.

## Results

According to the results, out of 144 studied nurses working in special care units of seven educational treatment centers in Rasht City, 7 were male (4.9%) and 137 females (95.1%). Their Mean $\pm$ SD age, clinical work experience, and work experience in the current unit were respectively 33.87 $\pm$ 6.08, 10.01 $\pm$ 5.81, and 5.33 $\pm$ 6.76 years. The prevalence of SBS in samples was 47.2%, where it was 48.2% (n=66) in females and 28.6% (n=2) in males. However, this difference was not significant. Regarding the working shifts, two nurses were in the

**Table 1.** Frequency distribution of SBS concerning individual characteristics (n=144)

Variables	N (%)		Sig.*
	Without SBS	With SBS	
Gender	Female	71(51.8)	0.31
	Male	5(71.4)	
Marital status	Single	25(55.6)	0.56
	Married	50(51)	
	Widowed	0	
	Divorced	1(100)	
Education	Associate	0	0.12
	Bachelor	69(51.1)	
	Master and higher	7(77.8)	
Work shift	Fixed night	2(50)	0.38
	Fixed morning	14(66.7)	
	Rotating	60(50.4)	
Organizational status	Head nurse	6(66.7)	0.05
	Staff nurse	10(83.3)	
	Nurse	60(48.8)	

\* The Chi-squared test.

fixed night shift, 7 in the fixed morning shift and 59 in rotating shift complained of SBS, and there was no significant correlation between SBS and working shift. Regarding the work position, 3 head nurses, 2 staff nurses, and 63 working nurses complained of SBS, and there was a significant correlation between their position and SBS (P=0.05) (Table 1).

The Mean±SD working hour per week of nurses with SBS was 43.8±8.37 h, but no significant association was found between a weekly working hour and SBS (Table 2). The frequency percentages of neurological symptoms of headache, fatigue, feeling heavy-headed, difficulty in concentrating, and nausea/dizziness were 84.7%, 82.6%, 79.2%, 57%, and 43.8%, respectively. The frequency percentages for respiratory symptoms

**Table 2.** The Mean±SD of individual characteristics concerning SBS prevalence

Variables	Mean±SD		Sig.*
	Without SBS **	With SBS	
Age (y)	33.86±6.08	33.88±6.14	0.98
Hours at work during the week (y)	45.64±27.19	43.8±8.37	0.59
Clinical work experience (y)	10.22±6.08	9.77±5.52	0.64
Work experience in the current unit (y)	5.65±4.18	6.49±4.47	0.24

\* The Independent t-test; \*\* Sick Building Syndrome

**Table 3.** Nurses' views of physical factors concerning SBS

Physical Factors		N (%)		Sig.*
		Without SBS	With SBS **	
Air movement	Always	1(25)	3(75)	0.01
	Sometimes	14(29.8)	33(70.2)	
	Never	51(54.8)	42(45.2)	
Contact with static electricity	Always	1(20)	4(80)	0.006
	Sometimes	12(27.9)	31(72.1)	
	Never	53(55.2)	43(44.8)	
Dust and dirt	Always	10(32.3)	21(67.7)	0.04
	Sometimes	32(43.2)	42(56.8)	
	Never	24(61.5)	15(38.5)	
Fluctuating room temperature	Always	7(35)	13(65)	0.03
	Sometimes	37(41.1)	53(58.9)	
	Never	22(64.7)	12(35.3)	
Stuffy bad air	Always	13(25)	39(75)	0.001
	Sometimes	41(53.2)	36(46.8)	
	Never	12(80)	3(20)	
Dry air	Always	5(15.2)	28(84.8)	0.001
	Sometimes	36(50.7)	35(49.3)	
	Never	25(62.5)	15(37.5)	

\* The Chi-squared test; \*\* Sick Building Syndrome

of hoarse dry throat and cough were 53.5% and 52.1%, respectively. Moreover, for mucous irritations and skin problems of dry hands and itching red skin, itching or burning of the eyes, dry or flushed facial skin, irritated/stuffy/runny nose, and scaling/itching scalp or ears, the reported frequency percentages were 73.6%, 52.8%, 51.4%, 45.8%, and 33.5%, respectively. The nurses reported these symptoms as “always” or “sometimes”.

The subjects experienced unpleasant odor (91%), stuffy bad air (89.6%) and noise (86.8%) as the most disturbing physical factors in the workplace (by marking “always” or “sometimes” in the questionnaire). The factors of air movement (P=0.01), varying room temperature (P=0.03), stuffy bad air (P=0.001), dry air (P=0.001), contact with

static electricity (P=0.006), and dust and dirt (P=0.004) had a significant correlation with SBS (Table 3).

In this study, “chronic fatigue” had a significant correlation with fluctuating room temperature, too low temperature, dry air, and too dim light. Also, “feeling heavy-headed” had a significant correlation with air movement, too high or too low temperature, fluctuating room temperature, stuffy bad air, and dry air of the workplace. “Headache” had a significant correlation with stuffy bad air, unpleasant odor, dust and dirt, and noise of the workplace. Also, “nausea/dizziness” had a significant correlation with stuffy bad air and too dim or too bright light of the workplace. “Difficulty in concentrating” was significantly correlated with stuffy bad air, dry air, and contact with static electricity in the workplace. “Itching or burning of the

eyes” was significantly correlated with stuffy bad air and dry air in the workplace.

“Irritated stuffy and runny nose” was significantly correlated with air movement, too high or too low temperature, fluctuating room temperature, stuffy bad air, dry air, contact with static electricity, noise, too much light, and dust and dirt in the workplace. Also, “hoarse dry throat” was significantly correlated with too low temperature, fluctuating room temperature, stuffy bad air, dry air, contact with static electricity, and dust and dirt in the workplace.

“Cough” was significantly associated with too low temperature and fluctuating room temperature of the workplace. “Dry or flushed facial skin” was significantly associated with air movement, too high or too low temperature, stuffy bad air, dry air, unpleasant odor, contact with static electricity, noise, too bright light, and dust and dirt in the workplace. “Scaling/itching scalp or ears” was significantly associated with air movement, too high or too low temperature, fluctuating room temperature, dry air, contact with static electricity, and dust and dirt in the workplace. Finally, “dry hands and itching red skin” had a significant correlation with stuffy bad air and dry air ( $P < 0.05$ ).

## Discussion

In this study, most samples with SBS were female and married, having a bachelor degree and working in a fixed night shift and had a nurse position. Almost half of the nurses (47.2%) reported SBS symptoms. In some studies, this rate ranged from 35.7% to 86.3% [1, 4, 14, 15]. This difference in results can be due to differences in the workplace and study samples. Among SBS symptoms, “fatigue,” “headache,” and “dry hands and itching red skin” were the most frequent symptoms which are consistent with results of other studies [1, 4, 8, 14, 16, 17, 18].

Among the physical factors of the workplace, “unpleasant odor,” “stuffy bad air,” and “noise,” were the most abundant physical factors experienced “always” or “sometimes” in the workplace by nurses. These factors also have been reported in many studies as the most disturbing physical factors [4, 8, 17, 18]. Considering the application of cooler, split, window, and lack of standard ventilation for Intensive Care Unit in the present study, nurses working in this sector are more likely to be exposed to the above mentioned physical factors.

Based on the results of this study, SBS is related to physical factors in the workplace such as air movement,

stuffy bad air, fluctuating room temperature, dry air, contact with static electricity, too much light and reflection, dust, and dirt. In this regard, our study results are consistent with some similar studies [1, 5, 11]. Most of them investigated temperature, non-ventilation, and poor indoor air quality.

These issues are essential because inappropriate physical conditions of the workplace such as temperature, humidity, air flow, noise, the kind of activity, and uniform affect employees’ performance and their error tolerance. They can cause fatigue, irritability and reduce physical and mental capacity especially in nurses who are affected by various environmental factors and were supposed to provide comfort and care for their patients [19, 20].

Overall, only 4.5% of samples in this study reported the physical conditions of their workplace as appropriate. It is likely that dissatisfaction with the physical conditions of the workplace is due to factors such as job satisfaction and work stress, because nursing career, especially in ICUs, often entails responsibilities and facing stressful situations. Nurses encounter life-threatening diseases; difficult tasks; complex, inadequate, or poorly functioning equipment; and patients’ demands, which can result in fatigue, loneliness, anger, reduced workforce, and eventually dissatisfaction with the workplace.

The special care unit in a hospital is one of the sectors with the highest stress levels which can affect nurses’ perceptions of the physical conditions of the workplace. This issue, in addition to the deficiencies in the physical environment of units, may contribute to the incidence of SBS symptoms. Therefore, it is important to recognize and modify these factors in special care units.

One of the limitations of this study was the nurses’ conditions when answering the questions and the possibility of error in recalling information which may affect their response. Considering the limited number of studies on SBS in a hospital setting, it is necessary to conduct a thorough assessment of the work environment including psychological and biological factors and job satisfaction. Therefore, it is recommended that a joint team of community mental health nurses and environmental and occupational health professionals identify the factors affecting the SBS in a comprehensive and precise manner. Moreover, since the present study was conducted in special care units, more studies on SBS and its related factors are suggested to be held in other wards.



## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (Code: IR.GUMS.REC.1394.280). The researcher visited the study units for 4 months and collected data after explaining the research objectives, how to complete the questionnaire, optional participation in the study, the confidentiality of the information and obtaining written consent. All questionnaires were completed by the subjects, and there were no dropouts.

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### Authors' contributions

Conceptualization: Sare Jafakesh, Leila Mirhadian, Afsaneh Pasha; Investigation: Sare Jafakesh; Data analysis: Sare Jafakesh, Leila Mirhadian, Afsaneh Pasha, Zahra Atrkar Roshan; Writing the article: All authors; and Data collection and Sampling: Mohammad Javad Gol Hosseini, Sare Jafakesh.

### Conflict of interest

The authors declared no conflict of interest.

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