Archives of Occupational Health | Volume 3 | Issue 4 | October 2019 | 422-9.

Original

Prevalence of Sick Building Syndrome among Employees of Shahid Beheshti Hospital in Kashan

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Abstract

Background: The sick building syndrome (SBS) is known as an unhealthy condition of occupants of a building, caused by environmental factors such as small space, poor ventilation, and different pollutants in the building. Symptoms of SBS include anxiety, respiratory, dermal, and sensory problems which start by entering a building or slightly after that, and disappear after leaving the building. The aim of this study was to determine the frequency of SBS in the employees of Shahid Beheshti hospital of Kashan. **Methods:** In a descriptive, cross-sectional study conducted, a sample of 279 randomly-selected employees of Shahid Beheshti hospital in Kashan working during 2016-2017, were involved. The study was performed on four groups of doctors, nurses, servants and employees. To collect the data; a questionnaire was used. It consisted of two parts: demographic data and questions of SBS questionnaire of World Health Organization. The collected data were analyzed using SPSS; and statistical tests such as Chi square and Fisher's exact test were performed and logistic regression were used for multivariate analysis. **Results:** The prevalence rate of SBS in general, in women and in men was estimated 50.81%, 55.3% and 44.7%, respectively. Symptoms of indisposition (47.3%), skin dryness (41.5%) and headaches (38.9%) had the highest frequency. Studying SBS symptoms in different job groups showed that skin dryness and dry and sore throat in physicians were significantly less than those in the other groups ($p<0.05$). In logistic regression analysis, the only factor influencing SBS was the staff height ($p=0.02$). **Conclusion:** Considering the high prevalence of the symptoms of building syndrome in all of the four groups, paying more attention to improving the working environment, such as the efficiency of the air conditioner system and increasing the entry of fresh air into the departments, increasing the quality of work life would be of utmost importance which would result in motivating and increasing the productivity in the work environment.

Keywords: Sick Building Syndrome; Hospital; Employees

Introduction

Global energy crisis has led the way to build new residential and office buildings with smaller space and less exchanged air since 1937. The use of new equipment and furniture such as computers caused new pollutants to emerge in the buildings. On the other hand, and due to closed environments, density of human pollutants such as carbon dioxide, and carbon monoxide were increased. Consequently, employees or occupants complained about the existed condition. These healthy problems and new symptoms were known as Sick Building Syndrome (SBS). [1,2]

Citation: Zamani-Badi H, Sarsangi V, Hannani M, Akbari H, Mazaheri Tehrani A. **Prevalence of Sick Building Syndrome among Employees of Shahid Beheshti Hospital in Kashan.** Archives of Occupational Health. 2019; 3(4): 422-9.
Article History: Received: 12 May 2019; Rivised: 18 June 2019; Accepted: 7 July 2019

[DOI: 10.18502/aoh.v3i4.1551]

Sick Building Syndrome (SBS) is considered as a mental and physical unpleasant mood syndrome that the people working at a building will experience. It seems that the unpleasant moods are linked to the time of being in the building when usually no specific cause can be identified.[3,4] Studies have shown several reasons related to Sick Building Syndrome such as: insufficient ventilation, lightening, noise, chemical and biological pollutants, office equipment, disinfectants, detergents, and personal factors (such as work stress, race, sex, age, and gender). [5-7]

Symptoms of this disease are classified into two groups including respiratory and central nervous system.[4] Neurotoxic signs associate with headache, fatigue, loss of concentration, memory decrease, nausea along with vomiting; while respiratory signs associate with shortness of breath, nose, throat and eye irritation, dry, itchy coughs, and other respiratory disorders. Dermal rash, dermal dryness, itching, and changes in senses of smell and vision are also considered as other important symptoms of SBS.[8, 9] These conditions may happen in different environments including hospitals, residential buildings, offices, and dormitories.[10] The characteristic of the symptoms is related to both group of workplace and the time period of exposure which starts by entering a building or a slightly after that and disappears after leaving the building. To identify this syndrome, history of at least one year attendance in these environments and the existence of two symptoms during one month are necessary.[11]

The frequency of this syndrome is reported differently in several studies. Generally, about 13% of health problems which have happened in buildings and have been reported to NIOSH are related to Sick Building Syndrome.[12] According to WHO report, the frequency of this disease in new buildings is estimated to be 30%.[13] Almost 30% of American employees are exposed to poor air conditions and air pollutants in working places.[14] In an epidemiologic study done in Singapore, 19.6% of the employees had the symptoms of Sick Building Syndrome.[15] The effects of Sick Building Syndrome in women are more serious than men. In a study carried out in a European country, the prevalence of SBS in women was 44.3% while in men was 26.2%.[16] In a study conducted by Asadi et al. on the staff of Mashhad University of Medical Sciences, 23.3% of employees had Sick Building Syndrome generally. It mentioned that 21.8%, 10.3%, 5.2%, 6.8%, and 6.8% of the employees had anxiety, irritation, respiratory, and dermal symptoms and disorders in five senses, respectively.[15] In Zarandi et al. study which was performed in Shahrak Ekbatan of Tehran, the rate of syndrome was 56.4%.[9] Studying the prevalence of the symptoms in 58.8% of the employees of the Housing Ministry was fulfilled in Sadeghniat et al. The study showed that the highest prevalence of symptoms among employees was fatigue with 57.3 percent in the workplace during the last three months.[17]

SBS is known as the major cause of absence at work, reduction of productivity and efficiency. Considering the fact that most of the efficient time of the employees is spent in the buildings; investigating their health status and their respiratory condition is of utmost importance. It has been observed that, the performance efficiency of employees will be more than 40% by improving the workplace condition and providing supportive actions for the employees working in the buildings. Creating ideal conditions, can increase the working efficiency and can decrease the rate of the absence from workplace.[18] The Sick Building Syndrome has not been studied among the employees of Shahid Beheshti hospital of Kashan University of Medical Sciences until the present time. Regarding the human and material costs of SBS and its effect on work efficiency of the personnel, it is essential to study the factors linked to SBS. This research was performed to investigate the prevalence of SBS in the employees of Shahid Beheshti hospital at Kashan University of Medical Sciences.

Methods

Study Design and Participants

This descriptive, cross-sectional study was conducted among the employees of Shahid Beheshti hospital in Kashan. The total sample size was determined to be 279 according to this equation $n = \frac{\left(z_{1-\frac{\alpha}{2}}\right)^2 \times p \times q}{d^2}$, (considering 95% confidence, $z_{1-\frac{\alpha}{2}}$ is equal to 1.96, p value, as the prevalence regarding to WHO, was estimated 0.3, q=1-p=0.7 , d=0.05. The sample size is proportional to the number of the personnel in each of the units of the hospital. After receiving the list of educational and personnel units of the hospital, samples of each unit were selected randomly. The number of samples in each of the units is depicted in table 1. At first, personnel list was achieved from each educational unit of the hospital and then number of the samples of each unit were obtained using the table of random numbers.

[DOI: 10.18502/aoh.v3i4.1551]

Table1. The number of samples of each unit of Shahid Beheshti hospital

Row	units	Number of personnel	number of samples	Row	units	Number of personnel	Number of samples
1	ICU	50	13	15	Cat lab	13	3
2	CCU	27	7	16	Surgery room	68	17
3	Women surgery	20	5	17	Pathology lab	48	12
4	Childbed and infant bedridden	57	15	18	Medical documents	16	4
5	Infectious bedridden	19	5	19	Finances- assistance	32	8
6	Hospitalized children	22	6	20	Installation	30	8
7	Pregnant women	15	4	21	office services	210	53
8	Emergency accident	32	8	22	Administrative affair- management	24	6
9	Internal emergency	49	12	23	Health and nutrition	5	1
10	Radiology-Physiotherapy	43	11	24	Guarding- preservation-vehicles	37	9
11	Chemotherapy	4	1	25	Telecommunications	10	3
12	Clinic-Pharmacy	31	8	26	Men surgery	46	12
13	Academic board of educational group	68	17	27	Non- academic board of educational group	46	12
14	Internal	81	19	28	-		

These individuals were simply selected randomly. Inclusion criteria were considered to be working in Beheshti hospital of Kashan and having at least one year of work experience and exclusion criteria from the study were considered as having acute and active chronic disease like catarrh and asthma, which have similar symptoms to SBS. In order to collect data, a two-part questionnaire was used.

Instruments

The first part of the questionnaire includes demographic characteristics like age, gender, years of work experience and job group of employees. The second part of the questionnaire examined SBS using "assessment of symptoms of Sick Building Syndrome" which has been presented by World Health Organization. Khajevandi et al.[19] proved the reliability and validity of this questionnaire. Counted validity index of this questionnaire was reported to be 0.78. In addition, internal consistency reliability of the questionnaire was evaluated appropriately (Cronbach's alpha coefficient was equal to 0.75).[19] This questionnaire (assessment of symptoms of Sick Building Syndrome) is composed of 3 parts. The first part contains questions used to assess the prevalence of the symptoms of SBS in the 19 cases. The second part measured having musculoskeletal and mental disorders by using 13 questions and the third part studied the workplace condition. Answers to the questions consisted of 4 comparing items (Never, sometimes, rarely, and always).

Procedures

After referral to the hospital and the considered workplaces, the questionnaire was given to the sample individuals and it was thoroughly explained how to fill the questionnaire. It is noteworthy that only those who enter the building encounter the symptoms and with egress of building, the symptoms have improved, will be considered as SBS. To detect this syndrome, it is necessary to be present in the environment at least for 1 year and the existence of two marks for 1 month. Interfering factor of this study was the underlying diseases which were examined in questionnaire such as Asthma diseases, Eczema, breast side and fever that were removed from this study.

Ethical Considerations

This study was approved by the Ethics Committee of Research Deputy of Kashan University of Medical Sciences. Written informed consent was obtained from all participants at the beginning of the study. All participants were informed about the voluntary nature of the participation and were assured about the confidentiality of their personal information.

Data analysis

Statistical analysis was used by SPSS ver. 16 software and $p<0.05$ was considered as significant. For statistical analysis, chi-square and Independent T tests were used for comparison. Also, the binary logistic regression model using the Backward technique and the WALD statistic was used for multivariate analysis.

Results

Out of 279 distributed questionnaires, 262 questionnaires were totally completed and returned (response rate was 81.11%). Out of the 262 questioned individuals, 151 people (57.6%) were women. Mean of age and years of working in

[DOI: 10.18502/aoh.v3i4.1551]

the workplace of the studied individuals was 32.97(7.99) and 5.94(5.77), respectively, and 31 (11.8%) individuals were physicians, 123 (46.9%) were nurses and paramedics, 52 (19.8%) of the individuals were service members and 56 (21.4%) of the individuals were office workers. The prevalence rate of SBS in the studied population was 50.8% and illness (47.3%), skin dryness (41.6%) and headache (38.9%), which had the highest frequency among SBS symptoms. SBS prevalence rate in women was (55.3%) and in men was (44.7%) Table 2.

The frequency of sneezing in women (23.2%) was significantly more than men (9%) (P<0.05). Also, the frequency of skin dryness, skin itching, illness, nausea and headache was significantly more in women (P<0.05) table 3.

Table2. Frequency of SBS symptoms in the employees of Shahid Beheshti hospital in Kashan

Clinical signs	Always N (%)	Sometimes N (%)	Rarely N (%)	Never (%)
Sneezing	4 (1.5)	41 (15.6)	19 (7.3)	198 (75.6)
Dry or sore throat	6 (2.3)	44 (16.8)	18 (6.9)	194 (74)
Skin dryness	44 (16.8)	65 (24.8)	20 (7.6)	133 (50.8)
Skin itching	16 (6.1)	54 (20.6)	28 (10.7)	164 (62.6)
Redness and acne	9 (3.4)	32 (12.2)	22 (8.4)	199 (76)
Sore eyes	13 (5)	46 (17.6)	27 (10.3)	176 (67.2)
Red-eye	11 (4.2)	44 (16.8)	31 (11.8)	176 (67.2)
Itchy eyes	9 (3.4)	39 (14.9)	30 (11.5)	184 (70.2)
Itchy nose	5 (1.9)	32 (12.2)	22 (8.4)	203 (77.5)
Nasal irritation	6 (2.3)	36 (13.7)	26 (9.9)	194 (74)
Adenoid	4 (1.5)	26 (9.9)	20 (7.6)	212 (80.9)
Shortness of breath	4 (1.5)	31 (11.8)	22 (8.4)	205 (78.2)
Chest Wheezing	3 (1.1)	12 (4.6)	11 (4.2)	236 (90.1)
Dry cough	1 (0.4)	23 (8.8)	17 (6.5)	221 (84.4)
Cough with sputum	5 (1.9)	13 (5)	11 (4.2)	233 (88.9)
Dizziness	9 (3.4)	43 (16.4)	40 (15.3)	170 (64.9)
Headache	14 (5.3)	88 (33.6)	50 (19.1)	110 (42)
Nausea	6 (2.3)	26 (9.9)	23 (8.8)	207 (79)
Illness	32 (12.2)	92 (35.1)	36 (13.0)	102 (36.9)

Table3. Comparison of SBS symptoms in terms of gender, age and experience in the employees of Shahid Beheshti hospital in Kashan

Clinical symptoms	Sex			Age			Experience		
	women N=151	men N=111	P-value	<39	>40	P-value	<9	10>	*P*-value*
Sneezing	35(23.2)	10(9)	0.003	36(16.7)	9(19.6)	0.666	36(17)	9(18)	0.864
Dry or sore throat	33(21.9)	17(15.3)	0.205	39(18.1)	11(23.9)	0.359	43(20.3)	7(14)	0.309
Skin dryness	81(53.6)	28(25.2)	0.000	94(43.5)	15(32.6)	0.173	90(42.5)	19(38)	0.566
Skin itching	48(31.8)	22(19.8)	0.034	62(28.7)	8(17.4)	0.115	61(28.8)	9(18)	0.121
Skin redness and rash	28(18.5)	13(11.7)	0.169	37(17.1)	4(8.7)	0.153	33(15.6)	8(16)	0.939
Eye pain	40(26.5)	19(17.1)	0.099	51(23.6)	8(17.4)	0.359	48(22.6)	11(22)	0.922
Eye redness	36(23.8)	19(17.1)	0.220	46(21.3)	9(19.6)	0.794	47(22.2)	8(16)	0.335
Eye itching	29(19.2)	19(17.1)	0.747	36(16.7)	12(26.1)	0.134	39(18.4)	9(18)	0.948
Nasal itching	24(15.9)	13(11.7)	0.374	29(13.4)	8(17.4)	0.483	30(14.2)	7(14)	0.978
Nasal irritation	25(16.6)	17(15.3)	0.865	34(15.7)	8(17.4)	0.782	35(16.5)	7(14)	0.664
adenoid	17(11.3)	13(11.7)	0.458	22(10.2)	8(17.4)	0.163	24(11.3)	6(12)	0.892
Shortness of breath	24(15.9)	11(9.9)	0.199	28(13)	7(15.2)	0.683	30(14.2)	5(10)	0.438
Chest whizzing	10(6.6)	5(4.5)	0.594	12(5.6)	3(6.5)	0.732	15(7.1)	0(0)	0.010
Dry cough	16(10.6)	8(7.2)	0393	19(8.8)	5(10.9)	0.685	19(9)	5(10)	0.788
Cough with sputum	11(7.3)	7(6.3)	0.810	14(6.5)	4(8.7)	0.532	17(8)	1(2)	0.211
Dizziness	32(21.2)	20(18)	0.536	43(19.9)	9(19.6)	0.958	44(20.8)	8(16)	0.448
Headache	69(45.7)	33(29.7)	0.010	84(38.9)	18(39.1)	0.976	82(38.7)	20(40)	0.863
Nausea	27(17.9)	5(4.5)	0.001	28(13)	4(8.7)	0.422	28(13.2)	4(8)	0.312
Illness	80(53)	44(39.6)	0.034	106(49.1)	18(39.1)	0.220	99(46.7)	25(50)	0.674
Total number	151	111	---	216	46	---	212	50	---

**P*-value<0.05 is significant

[DOI: 10.18502/aoh.v3i4.1551]

Among the symptoms of the stimulation of skeletal-muscular and mental disorders, it was observed that the frequency of backache in the employees with work experience less than 5 years was 70.7%, 5-14 years was 71.3% and more than 15 years was 61.9%. According to the results, there was no significant relation between backache and work experience (P>0.05). Also, in other cases of stimulation of musculoskeletal disorders, no significant relation was observed with work experience (P>0.05).

Among the mental symptoms, it was found that the frequency of being bad-tempered and the irritability in employees younger than 34 years old was 52.2%, 35-44 years old was 29% and older than 45 years old was 45.5%. There was a significant difference between the frequencies of being bad-tempered and irritability among different age groups (P<0.05). Furthermore, a significant difference existed between the frequency of depression, reduction of sleep and concentration in different age groups (P<0.05).

The frequency rate of backache in men and women was 61.3% and 76.8% which indicates a significant relation between backache and gender (P<0.05). In other cases related to stimulation of musculoskeletal disorders, a significant difference was observed between neck pain and shoulder pain (P<0.05). The prevalence rate of anxiety and distress was 45.9% and 52.3% in men and women, respectively, which had no significant difference (P>0.05). However, in other cases related to psychological symptoms, a significant relation was seen between being bad-tempered and irritability, depression and fatigue (P<0.05). Table 4 shows the frequency of SBS in different job groups. In all job groups, headache and illness had the highest frequency. Studying SBS symptoms in different job groups showed that skin dryness and dry and sore throat in physicians were significantly less than those in the other groups (P<0.05) but significant difference among other symptoms in different groups were not obsereved (P>0.05).

There were a significant relation between skin dryness and itching, dry and sore throat, redness and rash of skin with the air condition of the workplace (temperature and humidity) (P<0.05). Furthermore, significant relation was between shortness of breath, headache, dizziness and nausea with unpleasant smell (P<0.05). Headache had a significant relation with noise and low brightness (P<0.05). The results of this study will be sent to hospital manager in order to eliminate or lower the problems produced by SBS. The results of multivariate analysis using multiple logistic regression model showed that the only factors that were effective on SBS were height (P=0.02), smoking (P=0.049), sex (P=0.369), when weight (P=0.167) had no effect on SBS Table 5.

Table 4. The comparison of SBS in the different occupational groups

Clinical symptoms	Occupational groups N (%)				*P*-Value*
	Doctor	Nurse	Servant	Employee	
Sneezing	5(16.1)	34(27.6)	15(28.8)	9(16.1)	0.209
Dry or sore throat	2(6.5)	39(31.7)	12(23.1)	15(26.8)	0.037
Skin dryness	12(38.7)	73(59.3)	26(50)	18(32.1)	0.005
Skin itching	7(22.6)	56(45.5)	17(32.7)	18(32.1)	0.057
Skin redness and rash	6(19.4)	35(28.5)	10(19.2)	11(19.6)	0.4
Eye pain	5(16.1)	40(32.5)	18(34.6)	22(39.3)	0.167
Eye redness	7(22.6)	39(31.7)	20(38.5)	20(35.7)	0.474
Eye itching	8(25.8)	38(30.9)	13(25)	19(33.9)	0.721
Nasal itching	7(22.6)	28(22.8)	11(21.2)	13(23.2)	0.995
Nasal irritation	12(38.7)	30(24.4)	14(26.9)	12(21.4)	0.334
Adenoid	4(12.9)	23(18.7)	10(19.2)	12(21.4)	0.809
Shortness of breath	6(19.4)	28(22.8)	11(21.2)	12(21.4)	0.979
Chest whizzing	1(3.2)	10(8.1)	8(15.4)	7(12.5)	0.246
Dry cough	5(16.1)	21(17.1)	9(17.3)	7(12.5)	0.878
Cough with sputum	2(6.5)	15(12.2)	7(13.5)	5(8.9)	0.707
Dizziness	5(16.1)	50(40.7)	19(36.5)	18(32.1)	0.078
Headache	18(58.1)	79(64.2)	27(51.9)	28(50)	0.239
Nausea	7(22.6)	29(23.6)	8(15.4)	11(19.6)	0.662
Illness	21(67.7)	76(61.8)	32(61.5)	31(55.4)	0.71

*P-value<0.05 is significant

[DOI: 10.18502/aoh.v3i4.1551]

Table 5. Multiple logistic model coefficients of SBS based on demographic and job variables

Variables	Beta	S.E. of Beta	Wald score	df	Sig.	Exp(B)
Sex	.325	.362	.806	1	.369	1.384
Height	-.054	.023	5.452	1	.020	.947
Weight	.021	.015	1.906	1	.167	1.021
Smoking	3.453	1.822	3.593	1	.058	31.610

Discussion

This study showed that 121 people (46.2 percent) of the personnel of Shahid Beheshti hospital of Kashan have suffered from SBS. According to the obtained results, most symptoms were illness, headache, and skin dryness which have some differences among various studies. In WHO report, the highest frequency of symptoms was mental fatigue.[20] In Nordstrom study, the highest mentioned symptoms were weakness, throat and eye dryness and headache.[21] In Runeson study, headache, tiredness and nausea were the most prevalent symptoms.[22] Reports of different symptoms in various studies totally were justified regarding the difference in the various buildings and the variety of formation factors. Different working conditions in different buildings with different heating and cooling systems can cause different symptoms. The findings of this study show that the frequency of Sick Building Syndrome was significantly higher in women. Moreover, in study conducted by Magnavita et al. reported that the frequency of Sick Building Syndrome in women is more than those in men.[23] However, in Runeson et al. study, the frequency had no significant difference among two genders.

The high frequency of SBS in women can be different due to the risks of biological heredity, through genes and hormones, differences in the impact of risk factors that women encountered in working conditions, leisure time, and lifestyle. Besides, job stresses and role definition in official environment in health profile of women and men can be highlighted the role among working women. In the study of Landerberg, the results showed that discomfort and health problems in all age categories of women were more than those in men.[24] Asadi et al. conducted a study on employees of Mashhad University of Medical Sciences and observed that 23.2 percent of employees have SBS. Prevalence percent was so lower than other studies. In this study, there was not a significant relation between stimulation of musculoskeletal disorders and mental symptoms with working years and frequency of Sick Building Syndrome which has a significant relationship in Nordstorm et al. study .[21] As observed in study results, there were significant relations between the symptoms of musculoskeletal disorders, backache, neck pain and shoulder pain with gender. In addition, among psychological symptoms, being bad-tempered and irritability, depression and fatigue were seen to have significant relation.

According to the frequency percentage of work environment conditions, in different sections of the hospital, the highest frequency was related to noise, very hot air, and unpleasant odors, similarly in a study carried out in Italy in which stuffy air, unpleasant odors, and noise were also the most important causes of the symptoms.[25] The case studied building in this study is a closed building type and has a central air conditioning system. Central and closed air conditioning system is considered as the most important cause of Sick Building Syndrome. Moreover, this incorrect ventilation system pushes the air in small amounts which causes inefficient and insufficient stream of air and can lead to complaining of employees because of suffocation, air tightness and unpleasant smells.[17] The results of evaluating the questionnaires showed that 88.3% of questioned individuals complained about noise in their work environment, even though sound pressure level in a hospital is not as much that causes hearing loss, but can cause loss of concentration and fatigue. Furthermore, there were high dissatisfaction due to low lighting and unpleasant smells in the working environment.

Conclusions

Eventually, the important thing about Sick Building Syndrome is that these symptoms cause a series of human and functional complications in work environment. For examples, leaving the workplace and decreasing efficiency are undesirable results of the functional complications. In addition, the dissatisfaction with indoor air quality and environmental factors can be caused by the factors such as

[DOI: 10.18502/aoh.v3i4.1551]

lack of job satisfaction, stress, and job relationships. Therefore, well-designed buildings taking into consideration the physical comfort factors (light, temperature…) and psychological standards can decrease the prevalence of Sick Building Syndrome. Finally, it is recommended that doctors recognize the symptoms of this discomfort in differential diagnosis of other diseases, such as asthma, sensitivity, and mental health problems. Building engineers are also required to be familiar with the causes of this situation in order to design better buildings. Limitations of this study include the lack of measurement of physical conditions (sound, lighting, temperature, etc.) with precise tools, their relationship with SBS symptoms, and the impossibility of checking the degree of ventilation and bioavailability in the air in different parts of the hospital. It should be noted that in the future studies it is possible to examine this issue.

Acknowledgement

This study is a part of research project and is supported by grant 93151 from kashan University of Medical Sciences. We thank the research center of Kashan University of Medical Sciences for their valuable financial and social support in performing this study in a research plan.

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