Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2023;12(1):87-93

The affecting factors and prevalence rate of sick building syndrome in healthcare workers

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Received 16 December 2022; Accepted 19 January 2023
Available online 25.01.2023 with doi: 10.5455/medscience.2022.12.272

Abstract

Sick building syndrome (SBS) is defined as symptoms that occur while living or working in a certain building but disappear after moving away from the environment. In this study, we aimed to determine the effects of indoor air pollutants on the health of employees, the prevalence of SBS in healthcare workers at the university hospital, its relationship with environmental and personal factors and the respiratory system. A questionnaire was applied to 951 healthcare workers who agreed to participate in the study. Having at least one general, one mucosal and one skin symptom every week in the last 3 months was accepted as SBS. Temperature, CO and CO_2 levels and relative humidity were measured in different areas of the hospital. The prevalence of SBS was 62.1%. There was a statistically significant relationship between SBS and having a chronic disease (p<0.0001), continuous drug use (p=0.005) and the evaluation of the environment as warm (p=0.042). Having a chronic disease (OR=0.426; 95% CI, 0.228–0.797), the environment often being too warm (OR 0.218; 95% CI, 0.084–0.567) or occasionally too bright (OR=0.300; 95% CI, 0.158–0571) and diagnosed by a doctor due to symptoms (OR=3.209; 95% CI, 1.529–6.731) was found to be significant in forward variable selection method and binary logistic regression analysis. In our study, a relationship was found between physical factors such as temperature, humidity and CO_2 level of the environment and personal factors such as stress, chronic disease and SBS. SBS can be prevented by control at the source as well as by administrative and engineering interventions among the employees.

Keywords: Sick building syndrome, hospital, healthcare worker, indoor air pollution

Introduction

In industrialised countries, people spend over 90% of their lives in closed environments and more than half of the employees spend their time in office environments [1]. Sick building syndrome (SBS) is defined as a building occupant manifests at least one symptom of SBS, the onset of two or more symptoms at least twice, and rapid resolution of symptoms following moving away from the workstation or building [2]. Itching, dry skin or eye, nasal congestion or discharge, congestion in the sinus, dry or itchy throat, cough, stiffness of the chest, dyspnea, wheezing, increase in asthma symptoms, fatigue, difficulty in concentrating, headache, dizziness, myalgia and smell or taste disturbances are common indications [3]. Indoor air pollutants can be

CITATION
Otlu Karadag M, Ecin SM, Turkkan S, et al. The affecting factors and prevalence rate of sick building syndrome in healthcare workers. Med Science. 2023;12(1):87-93

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DOI: 10.5455/medscience.2022.12.272

classified as toxic or irritant chemicals, allergens and infectious agents and include carbon monoxide (CO), tobacco smoke and cleaning agents [3]. Passive cigarette smoke, smoke and other allergens, volatile organic compounds, particulate matter and gases, cleaning or personal care products and combustion products resulting from cooking or heating are important indoor air pollutants [3]. Viruses, fungi and rarely bacteria are cited as infectious agents [3]. Common cold and flu viruses are the routine infectious agents, but the coronavirus has been the most common infectious agent in recent years [3]. Tuberculosis is very common among healthcare workers, and an infectious agent that is rarely considered is legionella [3]. Physical factors affecting indoor climatic conditions are temperature, humidity, airflow velocity, lighting and noise. To ensure good environmental quality, the temperature should be in the range of 19°C–23°C, relative humidity should be 40%–60% and airflow velocity should be 0.1 m/sec according to American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHR AE) [4].

Studies on SBS are increasing in the world. As a result of these studies, it has been determined that the symptoms in people may occur in relation to the buildings they work or live in. Although there are studies on indoor air pollution and its effects in Turkey, there is not much research to determine SBS and its health effects.

In this study, we aimed to determine the prevalence of SBS in healthcare workers in a university hospital, its relationship with environmental and personal factors and its effects on the respiratory system. This investigation was necessary because indoor air pollutants have an important effect on the health of employees and indirectly on productivity.

Material and Methods

The university hospital has 16 floors and a total bed capacity of 1.368, including 301 intensive care beds and 39 operating theatres. The outside of the building is heat insulated and has high reflective windows and a barrier curtain wall. There is no window that opens towards the outside. Heating in all indoor areas and hygienic air conditioning in operating rooms (cooling and ventilation air handling units) are provided by air conditioners consisting of cooling groups and aspirators. The operating room, intensive care units, infectious diseases department and radiology department receive 100% fresh air (outside air), and other departements receive mixed air (50% inside and 50% outside air). No carpets are used in areas where the floor is covered with polyvinyl chloride, and wet floors are covered with ceramics. Water, 1/10 diluted bleach and detergent are used for cleaning the building, and a mopping system is used for floor cleaning. This is a cross-sectional study. This study had been carried out between 2011-2012 and data were collected between September 2010 and May 2011. Sixty-two questions were posed to determine the socio-demographic data of the individuals and the symptoms, and some characteristics related to SBS. Having at least one general, one mucosal and one skin symptom every week in the last 3 months was defined as SBS [2].

A questionnaire was applied to 951 (38%) of the 2500 people working in the university hospital who agreed to participate in the study.

People who were determined to have rhinitis, pharyngitis, sinusitis and asthma were evaluated for the presence of SBS. General symptoms: Weakness of vision, shortness of breath, feeling of tightness in the chest, flushing, sleepiness, tiredness, abdominal pain, nausea, vomiting, fatigue, restlessness, headache, dizziness, difficulty sleeping at night and generalized muscle and joint pain. Mucosal symptoms: Burning–stinging eyes, tearing, redness, dry throat, dry cough, wheezing, sore throat-tenderness, cracked lips, excessive thirst, runny nose-bleeding, nasal congestion, unpleasant smell sensation and unpleasant taste sensation. Dermal symptoms: Dry skin, redness and itching. The survey was conducted using the translated version of the questionnaire about SBS of London Hazards Center, Interchanges Studios [5] and adapted to Turkish by Efeoğlu (2006) [6].

A hand-held Fluke 975 AirmeterTM Tester, a five-sensor internal-type air quality diagnostic device, was used in the evaluation. Temperature, dew point and wet bulb temperature were measured in Celsius (C) or Fahrenheit (F); relative humidity (% RH), CO levels in parts per million (ppm) and carbon dioxide (CO_2) levels in ppm were also estimated. Pulse oximetry was used to measure peripheral blood oxygen saturation and heart rate [7,8]. Carbon monoxide (CO), CO_2 and relative humidity were measured in 36 areas in total, including one operating room, 7 intensive care units, 11 services, 10 outpatient clinics and 7 other places (kitchen, warehouse, air conditioning room, etc.). Room temperature level: normal 20–24ºC, relative humidity level: normal 30%–50%, CO level: lower limit value according to ASHRAE 62-2004 - 9 ppm as normal, CO2 level: ≤700 ppm accepted as normal [3].

Statistical Analysis

The data were calculated using the SPSS 17.0 statistics programme. The compliance of the variables in the study to the normal distribution was examined using the Kolmogorov–Smirnov test. For the definition of numerical variables, the median value, the smallest and the largest range of values were used. Categorical variables were defined as numbers and percentages. The Mann–Whitney U test was used for comparisons between two groups in terms of numerical variables. In terms of categorical variables, Pearson's Chi-square and Fisher's exact tests were used. Factors affecting SBS were evaluated using the forward variable selection method and binary logistic regression analysis. For indoor space measurements, those suitable for normal distribution were compared with one-way analysis of variance and those not suitable for normal distribution were compared with the Kruskal–Wallis H test. Levene test was used for the homogeneity control of variances. When the one-way analysis of variance result was important, multiple comparisons were made by the Türkiye's Test, and when the result of the Kruskal–Wallis H test was significant, multiple comparisons were made by the

 DOI: 10.5455/medscience.2022.12.272

Conover Test. Forward variable selection method and binary logistic regression analysis was used to assess relationship between SBS patients and other independent variables. A value of $p < 0.05$ was considered statistically significant. Clinical ethics committee approval was obtained from the university hospital ethics committee (Protocol number: 2010/48). Informed Consent was taken from the participants.

Results

Participants' characteristics

A questionnaire was applied to 951 healthcare workers (38%) in the university hospital who agreed to participate in the study. The median age of the participants was 30 years (19–65). Regarding the gender distribution of the participants, there were 515 (54.2%) men and 436 (45.8%) women. When their marital status was examined, 631 (66.4%) were married, 306 (32.2%) were single, 11 (1.2%) were in the 'others' group and 3 (0.3%) did not state their marital status. When the education level of the participants was evaluated, it was determined that two (0.2%) were illiterate, 7 (0.7%) were primary school graduates, 280 (29.4%) were high school graduates and 555 (58.4%) were university graduates. While 61% (n=578) of the participants stated that they did not smoke, 39% (n=370) were smokers. The average daily smoking load was determined as 10 cigarettes/day (1–40/day), while the mean duration of smoking was 12 years. When the distribution of tasks of the participants was assessed, the number of faculty members was 25 (2.6%), the number of research assistants was 99 (10.4%), the number of specialist doctors was 8 (0.8%), the total number of physicians was 132 (13.8%), the number of nurses was 286 (30.1%), the number of assistant health personnel was 120 (12.6%), the number of cleaning personnel was 142 (14.9%), the number of security personnel was 53 (5.6%), the number of administrative (office) personnel was 108 (11.4%), the number of the technical staff was 54 (5.7%) and the number of the kitchen staff was 52 (5.5%). The median of the total working time of the participants in the previous indoor working places and the hospital building was 6 (1–38) years. The employees were divided into three groups according to the duration of work: <5 years, 5–10 years and ≥10 years. The proportion of those working for ≤5 years was 38% (361), those working for 5–10 years was 26.3% (n=250) and those working ≥10 years was 35% (n=333). When the daily working hours in the closed environment were examined, the median working time was found to be 8 (1–40) hours, the proportion of those working ≤8 hours were 62% (n=590) and those working >8 hours were 37.5% (n=354). The relationship between the demographic data of the employees, working conditions and the presence of SBS is given in Table 1.

Furthermore, 186 individuals (19.5%) who participated in the questionnaire were found to have a chronic disease, and the most common chronic diseases were hypertension, thyroid dysfunction, and asthma. It was noted that 11.7% (n=112) of the participants were using a drug continuously. It was further observed that 14.7% (n=140) of the participants had a previous diagnosis of allergic rhinitis, 16.7% (n=159) had a diagnosis of chronic pharyngitis and 3% (n=29) had a diagnosis of asthma. Besides, 18 (32.1%) of the 29 employees with a diagnosis of asthma stated that they were diagnosed with the disease before starting to work in this building, while only 11 (37.9%) were diagnosed after starting to work in the building. Moreover, 8 (27.6%) of the patients diagnosed with asthma stated that the severity of the condition increased in the hospital, and 13 (44.8%) stated that the severity did not change. At the time of the study, active tuberculosis was found in two people working in the chest diseases clinic.

Table 1. Relationship between employees' demographic data, working conditions and sick building syndrome

Features		SBS N(%)	p*
Gender	Female	334(56.5)	0.061
	Male	257(24)	
Marital status	Married	387(40.8)	0.737
	Single	196(20.7)	
Education Status	No	1(0.1)	0.024
	Primary education	62(6.5)	
	High school	178(18.7)	
	University	349(62.3)	
Job	Teaching asistant	15(1.6)	0.105
	Research assistant	65(6.8)	
	Specialist	5(0.5)	
	Nurse	174(18.3)	
	Technical personnel	37(3.9)	
	Assistant health personnel	83(8.7)	
	Cleaning staff	79(8.3)	
	Administrative staff	71(7.5)	
	Security	38(49	
	Kitchen staff	24(2.5)	
Smoking	Yes	235 (24.8)	0.493
	No	353 (37.2)	
Stress	No	11(1.9)	< 0.0001
	Less	67(11.3)	
	Medium	211(35.7)	
	Much	156(26.4)	
	Too much	146(24.7)	
Use of computer	Yes	321(54.7)	0.293
	No	266(45.3)	
Noise level	No	49(8.3)	0.625
	Less	129(21.9)	
	Medium	286(48.6)	
	Much	125(21.2)	
Chronic illness	Yes	79(8.3)	0.293
	No	512(53.8)	
Drug use	Yes	56(5.9)	0.005
	No	534(56.3)	
Total working time	≤25	97(16.4)	0.896
	25-30	205(34.7)	
	≥ 31-40	202(34.2)	
	≥ 41	86(14.6)	
Daily working time	≤5 yıl	295(50.4)	0.286
	5-10 yıl	159(27.2)	
	≥10 yıl	131(22.4)	
	≤8 hour/day	369(62.8)	0.835

* Pearson chi-square and Fisher's exact chi-square ** p <0.05 value is statistically significant SBS: Sick Building Syndrome

 DOI: 10.5455/medscience.2022.12.272

Table 2. Workers' symptoms every week during their work in the hospital for the last 3 months

		Rarely	Often	Continuous	Symptoms decrease or disappear away from work?		Symptoms relieved on days away from work or on holidays		
Symptoms	**No N(%)**	**Once a week N(%)**	**At least 2-4 times a week N(%)**	**5 times a week N(%)**	**No N(%)**	**Yes N(%)**	**No N(%)**	**Yes N(%)**	**%**
Burning eyes	448(47.6)	238(25.3)	199(21.1)	56(6)	84(17.1)	408(82.9)	104(21.2)	385(78.6)	52.4
Watery eyes	500(53.2)	223(23.7)	170(18.1)	47(5)	84(19.5)	347(80.5)	102(23.8)	325(75.9)	46.8
Redness in the eyes	562(59.5)	177(18.7)	160(16.9)	46(4.9)	65(17.4)	309(82.6)	79(21.4)	290(78.6)	40.5
Dry throat	440(46.4)	210(22.1)	192(20.3)	106(11.2)	84(16.9)	412(82.9)	95(19.3)	397(80.7)	53.6
Cough	609(64.4)	181(19.1)	111(11.7)	45(4.8)	97(29.3)	234(70.7)	106(32.3)	222(67.7)	35.6
Wheezing	762(80.5)	111(11.7)	49(5.2)	25(2.6)	71(39.7)	108(60.3)	80(44.4)	100(55.6)	19.5
Sore throat-tenderness	599(63.3)	206(21.8)	103(10.9)	39(4)	115(34)	223(66)	125(37.1)	121(62.)	36.8
Cracked lips	527(55.6)	198(20.9)	146(15.4)	77(8.1)	140(34.1)	271(65.9)	154(37.7)	255(62.3)	44.4
Runny nose	606(63.9)	197(20.8)	105(11.1)	40(4.2)	161(48.2)	173(51.8)	17(52)	159(48)	36.1
Nose bleeding	878(92.7)	48(5.1)	16(1.7)	5(0.5)	30(42.9)	40(57.1)	30(42.9)	40(57.1)	7.3
Stuffy nose	562(59.5)	206(21.8)	120(12.7)	57(6)	99(26.6)	273(73.4)	109(29.4)	262(70.6)	40.6
Unpleasant smell sensation	594(62.7)	174(19.9)	119(13.6)	60(6.8)	49(14.2)	295(85.8)	63(18.5)	278(81.5)	37.2
Unpleasant taste sensation	599(63.3)	216(22.8)	92(9.7)	40(4.2)	158(46.9)	179(53.1)	169(50.6)	164(49.1)	36.8
Poor vision	704(74.4)	142(15)	69(7.3)	31(3.3)	108(46.8)	123(53.2)	112(48.9)	117(51.1)	25.6
Shortness of breath	757(79.9)	125(13.2)	45(4.8)	20(2.1)	65(35.5)	118(64.5)	111(50.2)	110(49.8)	20.1
Chest tightness	715(75.5)	173(18.3)	46(4.8)	13(1.4)	103(46.2)	120(53.8)	111(50.2)	110(49.8)	24.6
Flushes	675(71.3)	160(16.9)	82(8.7)	30(3.1)	94(35.9)	168(64.1)	105(40.2)	156(59.8)	28.7
Sleepiness	532(56.2)	228(24.1)	125(13.2)	61(6.5)	90(22.3)	313(77.7)	99(24.9)	299(75.1)	43.8
Fatigue-exhaustion	312(32.9)	219(23.1)	255(26.9)	163(17.1)	156(25)	468(75)	166(26.8)	453(73.2)	67.1
Stomachache	780(82.3)	111(11.7)	38(4)	19(2)	63(38.4)	101(61.6)	70(42.9)	93(57.1)	17.8
Nausea	757(79.9)	119(12.5)	47(5)	25(2.6)	75(40.3)	111(59.7)	82(44.3)	103(55.7)	20.1
Vomiting	889(93.8)	40(4.2)	8(0.8)	11(1.2)	21(34.4)	40(65.6)	25(41.7)	35(58.3)	6.2
Uneasiness	565(59.6)	209(22)	107(11.3)	67(7.1)	81(21.8)	290(78)	95(25.7)	274(74.3)	40.4
Headache	384(40.5)	298(31.4)	193(20.4)	73(7.7)	94(17)	458(83)	102(18.6)	446(81.4)	59.5
Dizziness	750(79.3)	118(12.5)	57(6)	21(2.2)	55(28.5)	138(71.5)	62(32)	132(68)	20.8
Muscle-Joint Pain	486(51.2)	202(21.3)	159(16.8)	102(10.7)	144(32.1)	305(67.9)	155(34.9)	289(65.1)	48.8
Dry skin	574(60.5)	135(14.3)	130(13.7)	109(11.5)	92(25.3)	272(74.7)	104(28.7)	258(71.3)	39.4
Skin rash	765(81)	94(9.9)	52(5.5)	34(3.6)	37(21)	139(79)	45(26.2)	127(73.8)	19.1
Itching	684(72.2)	140(14.7)	69(7.3)	55(5.8)	71(27.3)	189(72.7)	75(29.1)	183(70.9)	27.9

Table 3. Logistic regression analysis of factors affecting sick building syndrome

Features	B	Standard deviation	OR (95% CI)	p*
Chronic illness	-0.854	0.319	0.426 (0.228- 0.797)	0.008
Diagnosing by symptoms	-1.203	0.328	0.300 (0.158-0.571)	0.000
Working environment is too hot	-1.523	0.487	0.218 (0.084- 0.567)	0.002
Working environment is occasionally too bright	1.166	0.378	3.209 (1.529- 6.731)	0.002

* $p<0.05$ value is statistically significant OR: Odds ratio SBS: Sick Building Syndrome

DOI: 10.5455/medscience.2022.12.272

In the study, 244 (25.7%) of the 951 people were excluded from the study in terms of SBS as they had at least one of the previous diagnoses of asthma, chronic pharyngitis and chronic rhinitis. The remaining 707 people with at least one symptom of each of the general, mucosal and skin symptoms were considered to have SBS. SBS was detected in 62.1% (n=591) of the participants who did not have any previous disease.

Workers symptoms

Employees' symptoms were questioned every week during their work in the hospital for the past 3 months, and 505 people answered this questionnaire. The most common SBS symptoms were fatigue-exhaustion (67.1%) and headache (59.5%) and the high rate of mucosal symptoms such as burning and stinging in the eyes (52.4%), dry throat (53.6%), cracked lips (44.4%) and nasal obstruction (40.6%). The numbers and percentages of the symptoms each week during the study are given in Table 2.

Environmental conditions

When the stress level in the working environment was evaluated, the number of participants who stated that there was no stress was 28 (3%), while 99 people (10.7%) rated it as low, 344 people (37.3%) rated it as moderate, 247 people (26%) rated it as high and 204 people (22%) rated it as too high. The rate of those working with computers was 510 (53.9%), and the rate of those who did not use a computer was 436 (46.1%). When the hours of computer use were examined, the average duration of computer use was found to be 4 hours (1–12 hours). When the noise level in the environment was evaluated, 75 people (7.9%) stated it as noiseless, 198 people (20.9%) found the working environment less noisy, 474 people (50.1%) found the environment to be moderately noisy and 200 people (21.1%) considered the environment too noisy.

As a result of the 36 evaluations, it was found that the limit value of CO2 in 69.4% (n = 25) of the working environments was above the limit value of 700 ppm. When the limit value of CO was taken as 9 ppm, the limit value was not exceeded in any of the working environments. When the room temperature was checked, 77.7% of the values were not within the normal limits of 20–24ºC. Only the air conditioning room and kitchen storage had working environments <20ºC, and in 72.2% of the working environments, the ambient temperature was found to be >24ºC. In 22.2% of the evaluated working environments, the relative humidity level was within the normal limits. The relative humidity level in 77.8% of the working environments was below the limit value of 30%.

Relationship between SBS and parameters

The median peripheral blood oxygen saturation value of those with SBS was 97.2 (92–99), while the median saturation value of those without SBS was 97.3 (91–99). The relationship between peripheral blood oxygen values and SBS was not statistically significant (p=0.213). The relationship between having SBS and often considering the working environment to be too warm was found to be statistically significant (p=0.042). The relationship between the presence of SBS and evaluating the environment as dry, damp, dim, very cold and low air intake was not found to be statistically significant (p=0.422, 0.289, 0.223, 0.226, 0.223).

When assessing whether the participants had SBS using forward variable selection method and binary logistic regression analysis, the presence of chronic disease (OR=0.426; 95% CI, 0.228–0.797), the environment often being too warm (OR=0.218; 95% CI, 0.084–0.567) or occasionally very bright (OR=0.300; 95% CI, 0.158–0.571) and the fact that they diagnosed a doctor because of their symptoms (OR=3.209; 95% CI, 1.529–6.731) were found to be impressive factors. The fit of the logistic regression model was checked with the Hosmer–Lemeshow test (Table 3).

Discussion

Our study evaluated the prevalence of SBS symptoms among healthcare workers. Many studies have found that SBS symptoms are more common in women than in men [9-10]. And these studies revealed that women have more health-seeking behavior than men when it comes to perceiving and reporting health problems [9-12]. On the other hand, in a study conducted by Dhungana et al. in Nepal, no difference was found between the genders13. Although SBS was seen more frequently among women in our study, no statistically significant difference was found. The differences found might also be due to an actual gender difference in the physical work environment or the rate of male participants (54.2. %) was high.

Although the exact prevalence of SBS is not known owing to the lack of definitive diagnostic tests, it was found in a study conducted in Singapore in 1998 that 19.6% of the participants had SBS symptoms. In the study carried out in Ankara, Turkey, the rate of SBS was determined as 31.9%, it was determined that 60% of the symptoms occurred due to environmental factors in the workplace [2,14]. Furthermore, it was noted that 60% of the problems arising from air quality were related to ventilation, and in a meta-analysis, it was found that SBS symptoms were higher in buildings with artificial ventilation than in those with natural ventilation [15-7].Our study is more specific because it investigated the SBS rate in the hospital building, and the rate was found to be 62.1%. According to many investigations, the reason for the high rate may be that the ventilation is artificially made, the air conditioning system is old, the age of the building is >15 years, frequent renovations are made, and the fact that physical factors such as temperature, humidity and CO_2 ratios inside the building differ significantly from their normal values.

In many similar studies conducted in Egypt, Kenya and Singapore, the most common symptom was evaluated as fatigue [2,18,19]. We found that the most common SBS symptoms were fatigue-exhaustion (67.1%) and headache (59.5%) and were evaluated in accordance with the literature.

The indirect indicator that indoor ventilation is sufficient is the CO_2 level. CO_2 does not directly cause symptoms, but it is considered as a parameter of insufficient ventilation 20. As a result of 36 evaluations made in our study, CO_2 levels in 69.4% of the working environments were found to be above the limit value. With the use of a CO_2 controlled ventilation system, lowering the elevated CO_2 level will increase the perceived air quality and reduce headache and fatigue symptoms. In a study conducted by Wargocki et al., it was shown that CO_2 is associated with reduced work performance and health effects in offices [21,22]. High CO_2 level is associated with high SBS symptoms and can be considered as an indicator of insufficient ventilation.

In a study of healthcare workers in Slovenia showed that the most frequent risk factors for SBS to be poor air quality, an inappropriate level of relative humidity, and inappropriate room temperature [23]. Additionally, when the ambient relative humidity and temperature are inappropriate, it increases the frequency of irritative symptoms of SBS such as dry eyes, skin and upper airway manifestations [11,14,24]. We found that the relative humidity level in 77.8% of the environments was below the limit value of 30%, and in 72.2% of the environments, it was found to be >24°C and occasionally very bright. In our study, the high rate of mucosal symptoms such as burning and stinging in the eyes (52.4%), dry throat (53.6%), cracked lips (44.4%) and nasal obstruction (40.6%) can be explained by the low humidity, high ambient temperature, and the bright environment.

Work stress is among the reasons that cause SBS. High job expectations, low job control and low support from colleagues exacerbate the symptoms [11,12]. In a study conducted in Vietnam, SBS symptoms were found to be higher in nurses, and in our study, when hospital workers were examined according to their duties, the stress levels of nurses were found to be higher than other occupational groups (62%). Moreover, the relationship between stress levels and SBS was found to be statistically significant, which is in line with the literature [25].

According to the WHO report published in 2009, 2.7% of the global disease burden occurs due to indoor air pollution and it is seen at a higher rate in infants, the elderly and those with chronic diseases [26]. In our study, it is significant that the affected individuals consult a doctor and get a diagnosis due to the presence of chronic diseases and symptoms, which is consistent with the literature.

The presence of atopy and asthma increases the incidence of SBS. More than 20% of asthma in adults is from exacerbated asthma at work [21,27]. In our study, 27.6% of the participants with asthma stated that their complaints were worsened during work in the hospital building. In addition, active tuberculosis was detected in two people working in the chest diseases clinic during the study period. Tuberculosis outbreaks have been reported in the literature, especially among healthcare workers [3]. When the professional groups were evaluated according to the clinics they worked in, it was found that doctors, nurses and assistant staff working in chest clinics were 6.97, 7.86 and 7.70 times more at risk, respectively, when compared with their colleagues working in other clinics [28]. It is important that our study was performed before the pandemic because we think that COVID-19 would highly affect the SBS data.

Our study is an important investigation conducted with a high number of participants in Turkey. The work examined the frequency of SBS in healthcare workers and the factors affecting it and demonstrated the relationship between SBS and buildings without natural ventilation. The limitation of the research is that the causal relationship could not be fully established since it is a cross-sectional study, and environmental factors, such as noise and illumination, and stress level measurements were based on personal statements and could have caused bias, and it is a single-centred study, it could not be generalized.

Conclusion

SBS has emerged as an occupational disease with an increasing momentum among the office workers worldwide [14,29]. Depending on this situation, it causes a decrease in work performance and productivity and increases absenteeism [2,30]. This problem can be alleviated or eliminated by administrative and engineering practices and control at the source.

For this reason, studies involving the frequency of SBS among healthcare workers in Turkey, its relationship with environmental and personal factors and its effects on the respiratory system are very important. In our study, a relationship was found between SBS and physical factors such as temperature, humidity and CO_2 and personal factors such as stress and chronic disease. Therefore, there is a need for more studies in which environmental measurements are made and control studies are added after taking personal, administrative and engineering measures in areas where deficiencies are detected.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
Approval for this retrospective cohort study was obtained from the local ethics committee of our hospital (Decision No: 125 Date:01.07.2020) and informed consent was obtained from the patients.

Acknowlegments
The manuscript hasn't been submitted or published anywhere.

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