ORIGINAL ARTICLE
IN OCCUPATIONAL MEDICINE

Prevalence and risk factors for Sick Building Syndrome among Italian correctional officers: A pilot study

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Abstract

Introduction: Over the past two decades, numerous studies on indoor air and the Sick Building Syndrome (SBS) have been conducted, mostly in office environments. However, there is little knowledge about SBS in police officers. This study was aimed to fill this gap.
Methods: A cross-sectional questionnaire survey was conducted in 2016 at the Triveneto Penitentiary Center, Northern Italy. Chi-square was used to test the difference of prevalence between office workers (OWs) and correctional officers (COs) of personal characteristics, cases of SBS, and general and mucocutaneous symptoms associated with SBS. A binary logistic regression was used to identify among individual, environmental, and psychosocial characteristics, factors associated with correctional officers' Sick Building Syndrome.
Results: Chi-squared analyses revealed that there were statistically significant differences in the estimated prevalence of SBS general symptoms (χ^2 (1) = 12.22, P < .05), SBS mucocutaneous symptoms (χ^2 (1) = 9.04, P < .05), and cases of SBS (χ^2 (1) = 4.39, P <.05) between COs and OWs. COs reported that their health had been affected by the passive smoking (ß = 2.34, P < .05) and unpleasant odour (ß = 2.51, P < .05) as environmental risk factors; work-family conflict (ß = 2.14, P < .05), psychological and physical isolation (ß = 2.07, P < .05), and negative public image (ß = 2.06, P < .05) as psychosocial risk factors. Finally, atopy (ß = 2.02, P < .05) and to be current smoker (ß = 2.02, P < .05) were statistically significant behavioral predictors of SBS among correctional officers.
Discussion: Our survey showed that symptoms compatible with the sick building syndrome are common in correctional officers and that psychosocial work climate and exposure to passive smoking could have a strong influence on the prevalence of both general and mucocutaneous symptoms associated with SBS. A health policy for passive tobacco smoking within prisons, and for work-related stress management among COs could improve occupational wellness and decrease potential SBS symptoms among COs.

KEY WORDS: Sick Building Syndrome; environmental tobacco smoke; correctional facilities; psychosocial risk factors.

Riassunto

Introduzione: Nel corso degli ultimi due decenni sono stati effettuati numerosi studi sulla qualità dell'aria indoor e sulla Sick Building Syndrome (SBS) soprattutto negli uffici. Tuttavia, c'è poca conoscenza sulla SBS nelle guardie carcerarie. Questa ricerca è stata realizzata per colmare tale mancanza.
Metodi: Uno studio trasversale con l'uso di un questionario è stato condotto nel 2016 nelle strutture detentive del Triveneto, nel Nord Italia. Il Test del Chi-quadrato è stato utilizzato per testare le differenze tra impiegati civili e guardie carcerare relativamente alle caratteristiche individuali, ai casi di SBS ed ai sintomi generali e muco-cutanei associati alla SBS. Una regressione logistica binaria è stata effettuata per individuare le caratteristiche individuali, ambientali e psicosociali associate ai casi di SBS riscontrati nelle guardie carcerarie.
Risultati: Il Test del Chi-quadrato ha rivelato differenze statisticamente significative tra guardie carcerarie ed impiegati civili per quanto riguarda la prevalenza dei sintomi generali (χ^2 (1) = 12.22, P < .05) e muco-cutanei (χ^2 (1) = 9.04, P < .05) di SBS e la prevalenza dei casi di SBS (χ^2 (1) = 4.39, P <.05). Sono stati correlati ai casi di SBS evidenziati nelle guardie carcerarie il fumo passivo (ß = 2.34, P < .05) e l'odore spiacevole (ß = 2.51, P < .05) come fattori di rischio ambientale, il conflitto lavoro-famiglia (ß = 2.14, P < .05), l'isolamento fisico e psicologico (ß = 2.07, P < .05) e l'immagine negativa da parte della società (ß = 2.06, P < .05) come fattori di rischio psicosociali. Infine, l'atopia (ß = 2.02, P < .05) e lo stato di fumatore (ß = 2.02, P < .05) sono stati individuati come predittori statisticamente significativi della SBS tra le guardie carcerarie.
Discussione: Il nostro studio ha evidenziato che i sintomi compatibili con la SBS sono comuni nelle guardie carcerarie e che il clima lavorativo psicosociale e l'esposizione al fumo passivo potrebbero avere una forte influenza sulla prevalenza dei sintomi generali e mucocutanei associati alla SBS. Una politica sanitaria contro il fumo di sigaretta passivo nelle carceri e la gestione dello stress lavoro-correlato tra le guardie carcerarie potrebbe portare ad un miglioramento del benessere lavorativo e diminuire il potenziale dei sintomi di SBS per questa categoria di lavoratori.

TAKE-HOME MESSAGE

Symptoms of Sick Building Syndrome in Italian correctional officers could be attributed to psychosocial risk factors and exposure to passive smoking. A health policy against tobacco smoking within prisons, and for work-related stress management could improve occupational wellness for this category of workers.

Competing interests - none declared.

Cite this article as - Chirico F, Ferrari G, Taino G, Oddone E, Giorgi I, Imbriani M. Prevalence and risk factors for Sick Building Syndrome among Italian correctional officers: A pilot study. J Health Soc Sci. 2017;2(1):31-46

DOI 10.19204/2017/prvl3

Received: 22/12/2016 Accepted: 22/01/2017 Published: 15/03/2017

Sick Building Syndrome (SBS) is a widespread problem, which has been reported with increasing frequency since the 1970s [1]. This phenomenon describes a range of symptoms thought to be linked to spending time in a certain building, most often a workplace [2]. Sick Building Syndrome is not a recognized illness and there is no universally-accepted definition of 'Sick Building Syndrome' [3]. According to the American Environmental Protection Agency (EPA), the term 'Sick Building Syndrome' (SBS) is 'used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified' [4]. In contrast, the term 'Building Related Illness' (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. SBS was defined by the World Health Organization (WHO) as 'an excess of work-related irritations of the skin and mucous membranes and other symptoms, including headache, fatigue, and difficulty concentrating, reported by workers in modern office buildings' [5]. Physicians usually divide these symptoms into five groups: (1) irritation of eye, nose, and throat; (2) neurasthenic symptoms (headaches, dizziness, fatigue, confusion and nausea); (3) skin irritation; (4) hypersensitivity reactions (non-asthmatic with asthma-like symptoms); and (5) unpleasant odor and taste sensations [6]. SBS usually -affecting more than 25% of a building occupants- is often diagnosed based on the exclusion of other identifiable illness, because no specific cause of SBS can be identified [7]. The most cited causes of SBS are inadequate ventilation, chemical contaminants from indoor and outdoor sources, and biological contaminants [4]. Individual characteristics such as female sex and personal history of allergy, and behavior like smoking have been also associated with some specific symptoms of SBS. However, many studies showed that such psychosocial factors as work overload, high time pressure, lack of control and social support, poor interpersonal relationship, role ambiguity, and role conflict can exasperate the symptoms attributed to indoor air problems at work [8–15]. The most cited organizational factors that may modify its onset and severity are high demand, low control, and low support [10, 16]. According to the three-dimensional model of demand-control-support (DCS), low social support combined with either passive or strained job situation were associated with higher levels of SBS [17]. Policing is one of the most stressful occupations [18] and working in a prison as a correctional officer (CO) is a stressful job [19]. According to a recent systematic review, the five categories of organizational stressors among correctional officers are: (a) stressors intrinsic to the job; (b) role in the organization; (c) rewards at work; (d) supervisory relationships at work; and (e) the organizational structure and climate. The organizational structure and climate were demonstrated to have the most consistent relationship with CO's job stress and burnout [20]. In addition, prisons as institutions are emotional work environments. In their everyday work, correctional officers (COs) must manage prisoners' varying emotional states, while controlling their own emotional display and concurrently managing their emotional strain. CO work involves professionally encountering all kinds of prisoners, no matter how resistant they are or how repellent the crimes committed [21]. Therefore, COs are also exposed to traumatic events represented by such incidents as suicides, murders, riots, hostage takings and assaults. Indeed, workplace violence for this category of workers was not considered unusual among Italian COs [22]. In a survey performed in some prisons of three Regions (Veneto, Trentino Alto Adige and Friuli Venezia Giulia) of Northern Italy designed in cooperation with Italian Department of Justice to identify risk factors, and to promote occupational health levels among Italian COs, Ferrari showed that work-family conflict ('living away from home'), a marked psychological and physical isolation, and a negative image of correctional officers held by the community and correctional officers' perception of their

own occupational prestige, were the most cited psychosocial risk factors in this work environment [23, 24]. SBS was studied among regular computer users [25] and in densely populated offices [26], and some studies have measured the effect of tobacco bans on secondhand smoke (SHS) exposure in prisons. Moreover, it is well-known that environmental tobacco smoke exposure can contribute to the development of SBS symptoms [27]. However, little is known about prevalence and risk factors for sick building syndrome among correctional officers. The present study aimed to fill this gap. We tested 3 hypotheses: (1) correctional officers report SBS symptoms more often than do civil servants employed as office workers in the same prison buildings, (2) certain psychosocial risk factors affect SBS symptomatology in correctional officers, and (3) SBS symptoms are more often reported by smoker and atopic correctional officers.

METHODS

Setting of the Study

This study was conducted at the Triveneto Penitentiary Center in the regions of Trentino Alto-Adige, Friuli Venezia Giulia and Veneto (Northern Italy). In Italy, the Penitentiary system is unique, but it is structured in regional branches. The Italian prisons are managed by the Department of Penitentiary (DAP), which operates under the Ministry of Justice. The Triveneto Penitentiary Center includes different buildings and all of them are managed by the head of the Regional Department of Penitentiary. Every prison has the Director or Warden who is at the top of the entire hierarchy. The prison police is responsible for the inner security, while educators and social assistants (employed by the Ministry of Justice), and volunteers are responsible for whatever concerns social issues and re-education of prisoners. Psychologists are in some cases employed by the Ministry of Justice while in others by the National Health Service. Physicians and healthcare assistants are employed by the National Health Service. Moreover, there are civil servants employed by the Ministry of Justice as administrative support staff. In Italy there are 206 prison buildings and 16 of them are located in Triveneto. Some of buildings are located in historical buildings (old fortresses or monasteries) and some others in more recent buildings [28].

Study design

We designed the study in accordance with the Helsinki declaration, and it was approved by the Italian Ministry of Justice. Both qualitative (psychological interview and physical examinations) and quantitative (questionnaire survey) methods were used. The questionnaires collected self-reported information on the subjects' basic socio-demographic data, SBS symptoms and their perceived psychosocial risk factors. The face-to-face interviews and physical examination were conducted by well-trained interviewers who were composed of psychological and medical staff trained by the principal investigator. The data come from an independent research project promoted by Italian Society for Psychotherapy and Social Development (SIPISS) in cooperation with the Ministry of Justice within a strategic framework for health-promoting prisons in Italy [23, 24].

Building characteristics

All of the locations that we have chosen were offices and common facilities provided by centralized air conditioning systems. All workplaces prohibited smoking inside the premises. We had data on indoor microclimate conditions (air temperature and humidity) and total dust exposure in air-conditioned buildings checked periodically by licensed firms according to the Italian occupational health and safety regulation (D. Lgs n.81/08) and Italian legislation on energy efficiency (DPR n.74/2013) [29, 30]. According to official reports, microclimate conditions and total dust concentrations were within permitted limits (air temperature range, 20°C – 22° C; relative air humidity range, 40%-60%; total dust concentrations, < 10mg/m^3 in all air-conditioned buildings).

Study subjects

This is a cross-sectional study, involving both office workers and correctional officers from three Italian regions, named Trentino Alto Adige, Friuli Venezia Giulia and Veneto. We invited employers from 8 prison buildings to participate and all of the prisons studied were air-conditioned buildings. Each employee interested in participating was informed about the study protocol and signed a consent form. Brief (10- to 15-minute) questionnaires were administered to participants by a trained group of 3 medical doctors and 5 psychologists between January and February 2016. Overall, 161 workers completed and returned the questionnaires (Response rate = 87%). The final sample consisted of 76 correctional officers and 85 office workers.

Questionnaire

The administered questionnaire included questions on working conditions, perceived work stress, and health-related lifestyle factors, as well as SBS symptoms.

Assessment of SBS and work environment

Questions on indoor air quality and symptoms associated with SBS were derived from the basic MM Questionnaire (MM 040 NA), a validated self-administered questionnaire designed for epidemiologic assessment of indoor air problems, which has been translated into many foreign languages and is used as a routine instrument in Finland [31]. The questionnaire translated into Italian by Magnavita was used in this study [32, 33]. Problems in the work environment (for example, draught, dry and stuffy air, etc; altogether 12 items) were recalled from the past three months (1, yes, often, every week; 2, yes, sometimes; 3, no, never). Following the format utilized by Magnavita (2014) for estimating the existence and prevalence of SBS, participants were asked to indicate the extent to which they experienced 18 symptoms over the 3-month period preceding the cross-sectional survey, during working hours only, and whether these symptoms were resolved or improved after leaving the building overnight or during the weekend. We considered the following symptoms: fatigue; feeling heavy-headed; headache; nausea/dizziness; difficulty concentrating; itching, burning, or irritation of the eyes; irritated, stuffy, or runny nose; hoarse, dry throat; cough; dry or flushed facial skin; scaling/itching of the scalp or ears; dry, itching, or red-skinned hands; visual impairment; tinnitus; hearing impairment; musculoskeletal disorders in neck and arms; low back pain; and paresthesia of the hands or legs. For analysis, symptoms were categorized into three groups: general SBS symptoms (fatigue; feeling heavy-headed; headache; nausea/dizziness; difficulty concentrating), mucocutaneous SBS symptoms (eye, respiratory and skin symptoms) and musculoskeletal disorders. The response choices were 'often, because of my working here', 'often', 'sometimes', and 'never'. Therefore, two scores were obtained: (a) if symptoms were experienced 'often, because of my working here', they were considered present, and if 'often', 'sometimes', and 'never' they were considered absent; (b) a summary score was obtained by adding the scores for each symptoms related to indoor air (0-18 points). Subject who tested positive for at least one general symptom and at least one mucocutaneous symptom were designed SBS cases for this study.

Socio-demographic and work-related variables

Queries for personal information included age (≤ 29 year, 30 to 39 year, 40 to 49 year, or ≥ 50 year), gender, working years (≤ 9 year, 10 to 19 year, or ≥ 20 year), position (office worker or correctional officer) education (higher, degree or others), marital status (single, married, or divorced), history of allergy (no, yes), smoking habits (current smoker, non-smoker, or ex-smoker), participation in sports activity per week (none, sometimes, every day) [12]. The psychosocial work environment was investigated using the MM040 with some questions regarding interest in one's work ('Do you regard your work as interesting and stimulating ?'), work overload ('Do you have too much work to do ?'), control over one's work

('Do you have any opportunity to influence your working conditions?'), support from colleagues ('Do you fellow workers help you with problems you may have in your work?') [31–33]. We also included single-item scales to investigate on distress over interpersonal (human) relations at work, [12] social support by superiors [34], rewards at work, work-family conflict, ambiguity role in the organization, emotional labour with prisoners, violence from prisoners, perception of psychological/physical isolation, and negative public image [22, 24]. There were four alternative response categories to the questions: (1) yes, often; (2) yes, sometimes; (3) no, seldom; or (4) no, never.

Statistical analysis

Chi-square was used to test the difference between office workers and correctional officers in the prevalence of personal characteristics, cases of SBS, and general and mucocutaneous symptoms associated with SBS. Then, we performed a binary logistic regression with the SBS diagnosis (SBS- cases vs. non SBS cases) as the dependent variable and individual, environmental, and psychosocial risk factors as predictive variables, according three distinct models. Data analysis was performed by SPSS software. The statistical significance was set to $p < 0.05$.

RESULTS

Regarding the job characteristics of the study subjects, 53% (n = 85, M = 63, F = 23) were office workers (OW), 47% (n = 76, M = 64, F = 12) were correctional officers (COs); 39.8% (n = 65) of the subjects had been working for over 20 years, 42.3% (n = 69) had been working for 10 to 19 years, and 17.7% (n = 29) had been working for less than 9 years. With regards to the socio-demographic profile of the participants, of the office workers, 25.2% were graduated with an associate/bachelor's degree, 78.1% were married, 11.4% were current smoker, 25.3% did exercise regularly, and 3.5% were affected by atopy. Of the correctional officers, only 10.5% were graduated with an associate/bachelor's degree; 38.1% were married, while 23.6% were current smoker, 14.4% were affected by atopy and only 5.2% did exercise regularly. Chi-squared analyses revealed that there were significant differences between these two groups in terms of age (χ^2 (3) = 16.86, P <.05), educational background (χ^2 (2) = 15.03, P <.05), marital status (χ^2 (2) = 27.22, P <.05), history of allergy (χ^2 (1) = 4.81, P <.05), smoking habits (χ^2 (2) = 10.07, P <.05), sports activity (χ^2 (2) = 23.09, P <.05). There were not significant differences in terms of sex and length of service (Table 1). Tables 2 and 3 show the prevalence of SBS outcomes variables. Significant difference was found in the estimated prevalence of SBS general symptoms such as fatigue, feeling heavy-headed, headache, nausea/dizziness; difficulty concentrating (χ^2 (1) = 12.22, P < .05) and SBS mucocutaneous symptoms such as eye, respiratory and skin symptoms (χ^2 (1) = 9.04, P < .05). As a consequence, the difference between office workers and correctional officers was also statistically significant in the prevalence of SBS cases (χ^2 (1) = 4.39, P <.05). However, there was no statistically significant difference in the prevalence of other symptoms such as visual impairment, tinnitus, hearing impairment, musculoskeletal disorders in neck and arms, low back pain, and paresthesia of the hands or legs.

Table 1. Personal factors of workers employed in 8 prison buildings of Triveneto, Italy (*n* = 161)

Personal Factors	All (%, n)	Office Workers (%, n)	Correctional Officers (%, n)	χ^2 **	p- value
Gender					
Male	77.9 (127)	72.4 (63)	84.2 (64)		.090
Female	21.7 (35)	26.4 (23)	15.7 (12)		
Age group					
≤ 29 year	8.5 (14)	9.2 (8)	7.8 (6)	$\chi^2 = 16.86$ df = 3	< .05*
30-39 year	21.4 (35)	20.6 (18)	22.3 (17)		
40-49 year	47.2 (77)	35.6 (31)	60.5 (46)		
≥ 50 year	22.7 (37)	34.4 (30)	9.2 (7)		
Working years					
≤ 9 year	17.7 (29)	17.2 (15)	18.4 (14)		.107
10-19 year	42.3 (69)	35.6 (31)	50 (38)		
≥ 20 year	39.8 (65)	47.1 (41)	31.5 (24)		
Education					
Higher School	56.4 (92)	60.9 (53)	51.3 (39)	$\chi^2 = 15.03$ df = 2	< .05*
Degree	18.4 (30)	25.2 (22)	10.5 (8)		
Junior High School	25.1 (41)	13.7 (12)	38.6 (29)		
Marital status					
Single	21.4 (35)	10.3 (9)	34.2 (26)	$\chi^2 = 27.22$ df = 2	< .05*
Married	59.5 (97)	78.1 (68)	38.1 (29)		
Divorced	19 (31)	11.4 (10)	27.6 (21)		
History of allergy					
'Yes'	8.5 (14)	3.5 (3)	14.4 (11)	$\chi^2 = 4.81$ df = 1	< .05*
'Not'	89.5 (147)	96.5 (82)	85.5 (65)		
Smoking habits					
Current smoker	17.1 (28)	11.4 (10)	23.6 (18)	$\chi^2 = 10.07$ df = 2	< .05*
Non-smoker	66.2 (108)	64.3 (56)	68.4 (52)		
Ex-smoker	16.5 (27)	24.1 (21)	7.8 (6)		
Sports activity					
None	46 (75)	29.9 (26)	64.4 (49)	$\chi^2 = 23.00$ df = 2	< .05*
Sometimes	38 (62)	44.3 (39)	30.2 (23)		
Very often/Every day	15.9 (26)	25.3 (22)	5.2 (4)		

**Chi-square test. *P < .05

Table 2. Prevalence of SBS symptoms in office workers (n = 85) and correctional officers (n = 76).

Symptoms	All (%, n)	Office workers (%, n)	Correctional Officers (%, n)	χ^2 **	p- value
SBS General symptoms	43.3 (72)	30 (27)	59.2 (45)	$\chi^2 = 12.22$ df = 1	< .05*
SBS mucocutaneous symptoms	41.5 (69)	30 (27)	55.2 (42)	$\chi^2 = 9.04$ df = 1	< .05*
Non-SBS symptoms	52.4 (87)	56.6 (51)	47.3 (36)		0.23

**Chi-square test. *P < .05

Table 3. Comparison of the prevalence of Sick Building Syndrome (SBS) between office workers (n = 85) and correctional officers (n = 76).

Type of occupations	Prevalence of SBS N = 160 (100%)		χ^2 **	p- value
	Yes	No		
Office workers	13	77	$\chi^2 = 4.39$ df = 1	< .05*
Correctional Officers	21	55		

**Chi-square test. *P < .05

Table 4. Results of the logistic regression analysis with environmental parameters predicting cases of SBS among COs (n = 76).

					CI 95 % CI for Odds Ratio	
Environmental Predictors	*B*	*Wald*	*P**	*Odds ratio*	*Lower*	*Upper*
Draught	.26	.05	.826	1.30	.11	13.51
Temperature too high	.07	.00	.951	1.07	.12	9.51
Temperature varies	-1.74	2.25	.134	.18	.02	9.51
Temperature too low	1.07	.96	.327	2.91	.34	24.63
Stuffy air	-21.45	.00	.999	.00	.00	+ Infinity
Dry air	1.12	1.32	.251	3.08	.45	21.03
Dust or Dirt	1.25	1.82	.177	3.49	.57	21.46
Static electricity	.01	.00	.996	1.01	.06	18.09
Passive smoking	2.34	3.98	.046*	10.37	1.04	103.15
Noise	-.00	.00	1.000	1.00	.09	11.18
Illumination problems	-22.51	.00	.998	0.00	0.00	+ Infinity
Unpleasant odour	2.51	4.02	.045*	12.33	1.06	143.96

CI = Confidence Interval. *P < .05

Finally, COs reported that their health had been affected by the passive smoking (ß = 2,34, Wald = 10,37, P < .05) and unpleasant odour (ß = 2.51, Wald = 12.33, P < 0.05) as environmental risk factors (Table 4), work-family conflict (ß = 2.14, Wald = 8.51, P < .05), psychological and physical isolation (ß = 2.07, Wald = 7.95, P < .05) and negative public image (ß = 2.06, Wald = 7.85, P < .05) as psychosocial risk factors (Table 5). Finally, atopy (ß = 2.02, Wald = 7.54, P < .05) and to be current smoker (ß = 2.02 Wald = 7.62, P < .05) were significantly behavioral predictors of SBS (Table 6).

Table 5. Results of the logistic regression analysis with psychosocial parameters predicting cases of SBS among COs (*n* = 76).

					CI 95 % CI for Odds Ratio	
Psychosocial Predictors	*B*	*Wald*	*P**	*Odds ratio*	*Lower*	*Upper*
Low interest in work	.04	.00	.979	1.04	.08	13.93
Work overload	-.52	.15	.697	.60	.04	8.08
Low control over work	1.28	1.30	.254	3.60	.40	32.46
Low support from colleagues	-.62	.08	.780	.54	.01	41.35
Relationship conflicts	-.74	.21	.646	.47	.02	11.43
Low support from superiors	-1.32	.85	.357	.27	.02	4.42
Low rewards at work	-1.27	.16	.686	.28	.00	130.94
Work-family conflict	2.14	4.32	.038*	8.51	1.13	64.12
Role ambiguity	-1.14	.39	.553	.32	.01	11.49
High emotional labour with prisoners	1.68	1.11	.292	5.34	.24	120.50
Violence from prisoners	.39	.05	.830	1.47	.04	50.42
Psychological and physical isolation	2.07	4.32	.038*	7.95	1.12	56.26
Negative social image	2.06	4.21	.040*	7.85	1.10	56.08

CI = Confidence Interval. *P < .05

Table 6. Results of the logistic regression analysis with individual parameters predicting SBS cases among COs (*n* = 76).

					CI 95 % CI for Odds Ratio	
Individual Predictors	*B*	*Wald*	*P**	*Odds ratio*	*Lower*	*Upper*
Education level	-.14	.05	.011*	.28	.10	.75
Marital status	-.05	.01	.913	.95	.39	2.34
History of allergy ('Yes')	2.02	4.75	.029*	7.54	1.23	46.43
Current smoker	2.03	5.82	.016*	7.62	1.46	39.67
Sports activity	-.14	.05	.831	.87	.24	3.13

CI = Confidence Interval. *P < .05

DISCUSSION

Over the past two decades, numerous studies on indoor air and the sick building syndrome (SBS) have been conducted, mostly in office environments [25, 26, 31, 35, 36]. To our knowledge, this paper is the first to investigate SBS in correctional officers. In our study, response rate among all participants was high (87%), as well as the prevalence of cases of SBS among correctional officers (27.6%). However, this finding could be limited by the small sample size of correctional officers (n = 76), and by the convenience sampling, as correctional buildings were selected because of their convenient accessibility and proximity to our research center. In addition, even though the possibility of a health-based selection of employees is mainly associated with industrial exposures, it might occur in non-industrial indoor environments as well [36]. In our study, we identified general (n = 45, 59.2%) and mucocutaneous (n = 42, 55.2%) symptoms associated with SBS, and cases (n = 21, 27.6%) of SBS occurred in correctional officers that were working in eight different correctional buildings, which at the time of the study were not considered 'sick buildings' and were all served by a central air conditioning system. The sample of our study was composed by two groups of employees with different tasks and worksites; on one hand, the COs were responsible for supervising and guarding prisoners in cells, and within common, workplaces and recreational areas; on the other hand, office workers were employed in video display terminal (VDT) work, and were responsible for organizing all of the administrative activities that facilitate the smooth running of the correctional facilities, within workplaces located separately from inmates. With regard to overall sample of participants, we showed a high prevalence of cases of SBS (n = 34, 21.1%), but they belong to different buildings. In many cases, SBS affects the entire building, but in other locations, it affects only certain parts of the building. This finding was consistent with a lot of research showing that air conditioned buildings are related to an increased prevalence of SBS [39–44]. However, SBS is a diagnosis established for buildings and not individuals. In our study, we did not associate cases with buildings. This is a limitation of our study. However, our purpose is that to examine in depth the air quality of these correctional buildings by indoor environmental quality measurements in a next phase of research, considering symptoms of SBS not only depending on types of working, but also on types of correctional buildings. Furthermore, our 'SBS case' definition could have inadvertently excluded some sensitive subjects, because there is no universally-accepted definition of 'Sick Building Syndrome', and occupational physicians use different criteria to diagnose SBS. Indeed, it is well-known that the diagnostic use of SBS could suffer from serious weaknesses because the term SBS should not be used as a diagnosis applied to individual persons [38]. However, aim of this pilot study was to study the prevalence of symptoms associated with SBS among COs, analyzing their relationship with self-reported environmental and psychosocial risk factors. Firstly, the Chi square test showed a statistically significant difference between COs and office workers in the prevalence of cases of SBS, and general and mucocutaneous symptoms associated with SBS. Conversely, our research did not reveal significant differences between COs and office workers in the prevalence of neck and arms musculoskeletal disorders, low back pain, hand or leg paresthesia, tinnitus, hearing impairment and, unexpectedly, also visual impairment. These findings are discordant with past research indicating 'more use of computers' as a risk factor related to increased prevalence of SBS [12, 45]. In literature, sick building syndrome was found to be significantly associated with specific personal and environmental exposure factors. prevalence of symptoms of SBS among COs. More specifically, we found a strong relationship between cases of SBS and passive smoking ($P < .05$), and unpleasant odour ($P < .05$) as environmental risk factors, and atopy ($P < .05$) and smoking ($P < .05$) as individual characteristics. In this way, our study has corroborated that smoking can exert a

significant influence on symptoms of SBS, which agrees with earlier studies in office workers [46], school personnel [47], and hospital workers [37]. Moreover, we showed that prevalence of symptoms of SBS is high in subjects affected by allergy, in agreement with previous epidemiological investigations in office workers [46], in hospital workers [37], and in the general population [48]. Our study highlighted that exposure to environmental tobacco-smoke (ETS) is a widespread problem within correctional facilities [49]. Exposure to second-hand smoke has been studied in some correctional centers from United Kingdom [50], Unites States [51] and other countries [52] in order to ascertain whether the recent indoor smoking ban laws in correctional facilities worldwide were successfully implemented and whether the indoor air quality was improved as a result. In Italy, as in many other countries that introduced smoke-free policies, legislation requiring all enclosed work and public places to become smoke-free came into force in 2003. The Italian legislation did not provide exemptions for prisons [53]. However, prisons remain an exception to this perhaps because they fall into the category of workplace for staff and 'home' for inmates. For this reason, partial smoking bans were designed to restrict smoking to particular places within a prison, usually, but not always, the cells, designated smoking areas or outside areas. These restrictions attempt to alleviate the civil rights issues around banning tobacco use in an environment where individuals are unable to leave the premises in order to smoke [28, 54]. In our study, we adopted a questionnaire named MM-40 that is the most widely used tool for SBS. It also includes items concerning the psychosocial risk factors drawn from the Karasek's job stress model. Firstly, MM-40 was developed by Andesson et al. in Sweden [31, 55]. In a second time, this tool was introduced in Italy by Maroni [56]; then, it was translated and validated by Magnavita who employed this measurement instrument in a large survey to investigate offices and healthcare workplaces [32, 33, 57]. The MM040 is a useful questionnaire for studying the occupants' experiences on quality of the indoor air as well as symptoms attributed to the work environment. It's also possible to collect information about previous and current allergic diseases, and the smoking habits of the employees. Regarding the psychosocial risk factors, the questionnaire includes three items concerning the workload ('job demand'), the possibilities to control one's work situation ('job control'), and the support by co-workers ('social support'). However, MM-40 lacks items on other relevant aspects of the psychosocial work environment such as role ambiguity or role conflict, organizational culture and function, supervision, and so on. For this reason, using logistic regression analysis, we have included in our study all of the psychosocial risk factors that were most cited in literature as potential work-related stressors among COs. The psychosocial risk factors that we included were role ambiguity and role conflict in the organization, work-family conflict, rewards at work, supervisory relationships at work, organizational structure and climate, marked psychological and physical isolation, emotional demands, and negative public image [20, 23, 24]. An important finding of this study is that there was a highly significant association between SBS cases and work-family conflict ($P < .05$), psychological and physical isolation ($P < .05$) and negative public image ($P < .05$). Today, it is well-known the role of the work-related psychosocial stressors on the sick building syndrome. In accordance with several studies, our research confirmed the role of the work-related psychosocial risk factors as significant and independent determinants of sick building syndrome. Particularly, this association was found for some psychosocial risk factors that one of authors of this paper observed in a preliminary research of this study that was previously carried out in the same correctional buildings [23, 58, 59]. However, according to other studies, mental strain and work-related stress could be a modifying factor between environmental factors and symptoms, increasing an individual's vulnerability to physical, chemi-

cal, and biological hazards of the work environment. Specifically, stress itself can result in physiological and physical responses and health complications, which resemble the symptoms related to indoor air problems [46, 60, 61]. According to Mendelson et al, higher levels of stress could be found in SBS environments, because stress may result from SBS, may contribute to SBS-related symptoms, or it may play a dual role, increasing both the symptoms and the source of stress [62]. Indeed, the SBS symptoms are often mild and do not appear to cause any lasting damage. To those suffering, however, they are not trivial and can cause considerable distress. In severe cases, they can affect attitudes to work and may represent a significant cost to business in the form of reduced staff efficiency; increased absenteeism and staff turnover; extended breaks and reduced overtime; lost time complaining and dealing with complaints [63]. In the bio-psychosocial model by Spurgeon et al [64], SBS is considered a multifactorial health problem with 3 interactive paths for the SBS symptoms: somatic (atopy, mucosal hyperreactivity), psychosocial (stress, personality, behavior, and sociological factors), and environmental (physical, biological, and chemical hazards) [65]. However, a common mental model of the indoor air was not achieved; therefore, psychosocial explanations for SBS could be only diagnosed by exclusion, when no other environmental causes can be satisfactory [61, 66]. Finally, consistently with literature on this topic, limitations of this research were the geographical localization of our study in the area of North-East Italy, which somewhat limits the generalization of study results to all the employees in Italy, the lack of analysis of physical environmental conditions of correctional buildings, an uneven gender representation of study participants, and the cross-sectional design of the study that precludes the drawing of any definitive conclusions about the cause-effect relationship between the complaints of sick building syndrome and the observed harmful psychosocial factors for the correctional officers [67]. Indeed, self-reporting of symptoms and certain exposure could lead to biased observations of association. This is because the recognition and reporting of building-related health complaints is influenced not just by the ambient environment, but also by the individual's perception of his or her environment [16, 68]. For instance, a low job satisfaction could make the individual not only more susceptible to other risk factors in the environment but also more aware, and critical of different aspects of the surroundings [17, 69]. In conclusion, our survey showed that symptoms compatible with the sick building syndrome are common in correctional officers and that psychosocial work climate and exposure to passive smoking could have a strong influence on the prevalence of both general and mucocutaneous symptoms associated with SBS. For this reason, it is need a complex and multifactorial approach to the problem involving symptomatic treatment, environmental control, good ergonomic design, and stress management [46]. In general, workplace health promotion is pivotal for creating healthy workplaces [70]. Therefore, a policy for cutting tobacco smoking to a minimum among prisoners and specific workplace health promotion programs for smoking prevention and cessation and for stress management among COs could improve occupational wellness and decrease potential SBS symptoms among COs [71].

Acknowledgments

This research was supported by Italian Society of Integrative Psychotherapy for Social Development (SIPISS), and Triveneto Penitentiary Center, Italy. We thank our colleagues Arianna Girard and Valentina Penati, psychologists, from SIPISS and Enrico Sbriglia, Superintendent of TriVeneto Penitentiary Center, for their assistance and support during the course of this research.

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