

## Predicting the Sick Building Syndrome (SBS) occurrence among Pharmacist assistant in Banjarmasin South Kalimantan

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### Abstrak

**Latar belakang:** Banjarmasin memiliki jumlah apotek terbanyak di wilayah Kalimantan Selatan. Salahsatu jenis pekerjaan yang ada di apotek adalah asisten apoteker. Dengan tipikal pekerjaan asisten apoteker yang indoor dan memiliki resiko yang tinggi terhadap paparan zat kimia, asisten apoteker cenderung mengalami kejadian Sick Building Syndrom (SBS). Penelitian ini bertujuan untuk mengidentifikasi faktor determinan yang paling berpengaruh terhadap kejadian SBS pada asisten apoteker yang bekerja di apotek wilayah kerja Kota Banjarmasin

**Metode:** Penelitian ini merupakan penelitian crosssectional dengan metode observasional analitik. Lokasi penelitian dilakukan pada 13 lokasi apotek yang berada di wilayah kerja Kota Banjarmasin dengan 73 orang asisten apoteker yang memenuhi kriteria inklusi sebagai respondennya. Variabel bebas dari penelitian ini adalah variabel karakteristik responden dengan sub variabel jenis kelamin, usia, kondisi psikososial dan masa kerja, variabel aspek perilaku dengan sub variabel pengetahuan, sikap dan praktik asisten apoteker terhadap SBS, serta variabel faktor lingkungan pekerja meliputi kepadatan ruang, suhu, kelembaban, kecepatan aliran udara serta pencahayaan ruangan, sedangkan kejadian SBS menjadi variabel terikat.

**Hasil:** Sebanyak 29 responden (39.7%) responden mengalami kejadian SBS dengan sebesar 68.3% kejadian SBS dipengaruhi oleh faktor psikososial responden (OR 26,479), masa kerja (OR 9,882), tindakan yang memicu SBS oleh responden (OR 13,859) serta kondisi pencahayaan yang tidak sesuai standar (OR 8,912).

**Kesimpulan:** Lingkungan kerja seperti pencahayaan ruangan yang kurang, pengaturan jam kerja serta ketersediaan fasilitas istirahat merupakan faktor determinan yang berpengaruh pada kejadian SBS.

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**Kata kunci:** Sick Building Syndrom, asisten apoteker

### Abstract

**Background:** Banjarmasin has the highest number of pharmacies among the other area in South Kalimantan. One of the main types of work in stores is a pharmacist's assistant. With their typical indoor job activities and the higher risk of chemical exposures, assistant pharmacist tends to experience the sick building syndrome occurrence. This research aims to identify the primary determinant on the SBS event among pharmacy assistant working at pharmacies in Banjarmasin.

**Methods:** This is a cross-sectional research with analytical observation method. The research location takes place in 13 pharmacies in the city of Banjarmasin with 73 pharmacy assistants that meet the inclusion criteria serve as respondents. The study analyzes several variables such as SBS occurrence, respondents characteristics, working conditions including room density, temperature, humidity, air velocity and indoor lighting.

**Results:** There are 29 respondents (39.7%) having an SBS occurrence with a significant correlation between the SBS occurrences with respondents psycho-social condition (OR 26,479), years of service (OR, 9.882), indoor lighting condition (OR 8,912) and respondents behaviors related to SBS occurrences (OR 13,859).

**Conclusion:** Working environments such as inadequate indoor lighting, working hours arrangement and rest facilities are the determinants of SBS. (*Health Science Journal of Indonesia 2017;8(2):118-23*)

**Keywords:** sick building syndrome, pharmacy assistants

In the past twenty years, a lot of closed-multi story building have been built with their air circulation depending entirely on artificial systems, such as Air Conditioner (AC). The condition will lead to pollution caused by AC system ventilation, so it will affect the indoor air quality as well as decreasing of oxygen level.<sup>1</sup>

According to the National Population Agency, 2.7 million people were estimated died from air pollution worldwide; 2.2 million among of them are caused by indoor air pollution. In fact, 70-80% time is spent by humans for indoor activity. Consistently, (EPA) categorized the indoor pollution as the top five of environmental risks for public health.<sup>2</sup>

It has known that many materials are leading to poor indoor air quality. The problem is complex since human use modern and sophisticated equipments. If the equipment is not properly maintained, it will become the indoor air pollution source and may cause health problems such as SBS.<sup>3</sup>

Sick Building Syndrome (SBS) or also called as Tight Building Syndrome or Building Related Illness / Building Related Occupant Complaints Syndrome is a situation in which building residents complained about health problems and acute comfort. These are related to time spent in a building (usually  $\geq 8$  hours), but the symptoms are not unique, and there are no cause to be identified.<sup>4</sup>

Research on Forensic Laboratories and Ballistic Test Laboratory in Indonesian National Police laboratory showed that there were some shreds of evidence that chemicals can cause a risk for SBS in the laboratory personnel. This finding was supported by the previous observation results stating that the staff was working in lab mostly worked without using a mask that lead to the increase of SBS risk.<sup>5</sup>

Based on South Kalimantan Provincial Health Office, it has been recorded that until the end of 2014, most of South Kalimantan pharmacies can be found in Banjarmasin and tends to have various variations on their services. Compared to other regions, the pharmacies in Banjarmasin working area have higher work intensity, especially on pharmacist assistants with drugs processing. This condition also supported by more physicians in Banjarmasin region than other.

Most of the pharmacy buildings in Banjarmasin uses Air Conditioner (AC) as the air regulation system in their employee room, especially pharmacist

assistant. Most of the pharmacy assistant work face to face with the diverse variety of chemicals in the form of drug dosage form for  $\pm 8$  hours/day from Monday to Sunday with only a couple of times for day-off in each month.

The pharmacist assistants have a higher risk of SBS due to their exposure on various chemicals acting as Volatil organic compounds (VOCs).<sup>6</sup> Also, the characteristics and behavior of a pharmacist assistant may affect on SBS occurrence, such as gender and age changing on person's endurance, as well by the use of Personal Protective Equipment (PPE) such as masks, gloves and lab coats which can minimize the contaminants exposure on pharmacist assistants.

This study aims to determine the determinant of SBS occurrence including characteristics, behavioral and environmental factors of pharmacist assistant as well as to predict the SBS occurrence by pharmacist assistants working in Banjarmasin working region.

## METHODS

This is a quantitative research with cross-sectional design and using analytic observational. The population in this study consisted of 325 assistant pharmacist who worked in 123 pharmacies in the city of Banjarmasin. Based on inclusion and exclusion criterias, 73 pharmacist's assistants were obtained as respondent. Checklist, questionnaire and observation sheet were used to identify the SBS cases, respondent's characteristics and respondent physical environment, while the lux meter was used to measure lighting conditions. The respondent characteristics, room density, temperature, humidity, air velocity, and indoor lighting condition were independent variables, while the occurrence of SBS was the dependent variable. The Chi Square test was conducted to determine the significant relationship between SBS occurrence and contributing factors to the arisen symptoms, while the logistic regression was used to determine the relationship between variables. Multivariate analysis was carried out in four stages, i.e., multivariate models candidate selection, multivariate modeling, the interaction test and final modeling.

## RESULTS

One of factors causing the emergence of SBS was the indoor air pollution<sup>3</sup> in which it was closely related to the room space density.<sup>7</sup> The pharmacist

working space varied between 9m<sup>2</sup> to 20 m<sup>2</sup> with 6.92 m<sup>2</sup> / person average density. Based on the ≥ 6 m<sup>2</sup> / person standard workspace density,<sup>8</sup> among 13 area observed, five of them were classified as an abnormal densities rooms and did not meet the minimum standards of space density requirement.

Based on working environment and industrial light intensity standards, working space required at least: 100 lux of light intensity,<sup>9</sup> 150 lux for drugstore<sup>10</sup> and 200 lux on the drug storage chamber.<sup>11</sup> The pharmacist assistants workspace lighting intensity range between 82.5 - 145.8 lux with an average of 107.15 lux. The results show that 8 of 13 rooms measured were categorized as a workspace with abnormal lighting conditions.

Related to SBS symptoms, 29 respondents experienced at least three symptoms and disappeared when they out of their office (see table 1). The symptoms included at least five common symptoms lead to the SBS. The symptoms included mucous membrane irritation (eye, nose, and throat), neurotoxic symptoms (dizziness, fatigue, emotional and concentrating difficulty), asthma-like symptoms (chest tightness, breathing difficulty), skin complaints (dry skin and skin irritation) and gastrointestinal symptoms such as diarrhea.<sup>12</sup>

Table 1. SBS symptoms among pharmacist assistant

No	Main symptoms	Σ	SBS			
			positive		negative	
			n	%	n	%
1	At least three symptoms and disappear when out of the room	29	29	39.72	0	0.00
2	At least three symptoms and does not disappear when out of the room	13	0	0.00	13	16.45
3	At least two symptoms	18	0	0.00	18	24.65
4	Only one symptom	4	0	0.00	4	5.48
5	Without symptom	9	0	0.00	9	12.32
<b>Total</b>		<b>73</b>	<b>29</b>	<b>39.73</b>	<b>44</b>	<b>60.27</b>

Table 2 showed that from the 29 assistant pharmacists who suffered SBS, 68.97% of them were a woman, with unfavourable psychosocial condition (82.76%). All were in the working ages category, with 48.28% of them having a one-year working period (risky years) and being indifferent to the SBS risks (75.86%). While 75.86% perform highly risk behaviors that can lead into an SBS symptoms, worked in a standard working space density (65.92%) even though with abnormal lighting condition (51.72 %).

Five of the nine variables that were analyzed showed a significant association with the SBS occurrence on pharmacist’s assistant in Banjarmasin ( $p < 0.05$ ) ie psychosocial condition ( $p\text{-value} = 0.000$ ), respondents year of services ( $p\text{-value} = 0.011$ ), respondent knowledge related SBS ( $p\text{-value} = 0.025$ ), respondents attitude of respondents against the risk of SBS ( $p\text{-value} = 0.002$ ) and SBS risky behaviors performed by respondents ( $p\text{-value} = 0.000$ ).

Table 2. Percentage of positive SBS by pharmacist’s assistant characteristics

No	Respondent characteristics		Positive SBSe		p-value
	n		n	%	
1	Sex	Man	9	31.03	0,454
		Woman	20	68.97	
2	Psychosocial condition	Poor	24	82.76	0,000
		Good	5	17.24	
3	Working age (15-65 y.o)	Within the range	29	100	0,147
		Outside the range	0	0	
4	Year of services	Less risky	15	51.72	0,011
		Risky	14	48,28	
5	Knowledge	Poor	14	48.28	0,025
		Good	15	51.72	
6	Attitude	Well concerned	22	75.86	0,002
		Poor concerned	7	24.14	
7	Behaviors	Highly risk	22	75.86	0,000
		Less risky	7	24.14	
8	Space density	Normal	19	65.52	0,491
		Abnormal	10	34.48	
9	Lightning condition	Normal	14	48.28	0,072
		Abnormal	15	51.72	

In analyzing the most influential determination factors, multivariate analysis with logistic regression was performed. It was done to see which independent variables that have the most significant effect on the emergence of SBS complaints in pharmacies within the Banjarmasin working area.

Multivariate analysis with predictive factors conducted to obtain the best model in determining the SBS occurrence determinants. With this modelling, all the candidate’s variables were tested. The best models will be considered at the  $P\text{-value} < 0.05$ . A hierarchical model selection was carried by including all qualified independent variables candidate into the model, then the variables with  $P\text{-value} > 0.05$  were excluded from the model one by one. From the data analysis result shown in Table 3, among nine variables analyzed, there were only four variables remain included.

Table 3. Modelling of SBS determinant factors

No	Variables	Model					
		1	2	3	4	5	6
1	Sex	0.121	0.087	0.104	0.076	0.276	-
2	Psycho-social	0.000	0.000	0.000	0.000	0.000	0.000
3	Ages	0.999	-	-	-	-	-
4	Year of services	0.016	0.011	0,012	0.009	0.010	0.010
5	Knowledge	0.125	0.090	0.102	0.066	-	-
6	Attitude	0.360	0.587	-	-	-	-
7	Behavior	0.033	0.026	0.017	0.019	0.003	0.002
8	Space density	0.507	0.463	0.487	-	-	-
9	Lighting	0.036	0.038	0.042	0.036	0.018	0.016

Table 3 also shows that the psychosocial variables, year of service, behaviors and lighting have a P value (P wald) of <0.05. This indicates that those variables have a significant relationship with the occurrence of sick building syndrome. As for the other variables were excluded for having a P value (P wald) more than 0.05. Multivariate analysis for psychosocial variables, year of service, behaviors and lighting can be seen in Table 6.

Table 4. The occurrence of SBS multivariate analysis among respondents

No	Variable	B	P wald	Odd Ratio (OR)	95% CI
1	Psychosocial	3.276	0.000	13.811	4.704 – 149.048
2	Year of service	2.291	0.010	6.655	1.734 – 56.320
3	Behaviors	2.629	0.002	9.473	2.598 – 73.923
4	Lighting	2.187	0.016	5.847	1.513 – 52.481

-2 log likelihood = 46.739

Neglkerke R square = 0.683

Table 4 indicated that the highest OR value was the psychosocial, with 13.811 showing the greatest influence of all, followed by behaviors (OR value= 9.473), year of service (OR value= 6.655), and the last one was lighting (OR value= 5.847). With the psychosocial's OR value reach 13.811, it can be interpreted that the lower of the pharmacist's assistant psychosocial condition, than the chance of SBS increased likely 13.811 times higher compared with the pharmacist's assistant who had a good psychosocial condition. Employee psychosocial conditions was closely related to poor work environment, such as low social support at work, low supervisor social support, low job control, low social support at work, low skill discretion, low co-workers social support, and low supervisor social support and could be easily associated with the presence of SBS symptoms.<sup>13</sup>

As for the year of service variable, it can be concluded that if an assistant pharmacist has more than one year of duty, then the chances of SBS against them increased by 6655 times compared with the pharmacist's assistant with the year of service less than one year.

With the 9.473 of OR value for behaviors, it can be interpreted that the more a pharmacist's assistant demonstrated risky behaviors against SBS, that slightly increase the chances of SBS cases by 9.473 times compared with the pharmacist's assistant who performed less risky activities. Some of the behaviors that were suspected to play a role in the SBS incident were the excessive usage of synthetic room fragrances,<sup>14</sup> passive smoking,<sup>8</sup> non-compliance with the Personal Protective Equipment (PPE) regulation and the habit of using chemical sanitizers and disinfectant.<sup>15</sup>

And for lighting variable, with OR of 5.847, it can be interpreted that if the lighting condition in pharmacist's assistant working area were getting worsen, then it would be likely to increase the SBS occurrence up to 5,847 times higher than pharmacist's assistant who is working in good lighting condition environment.

The analysis also showed a determinant coefficient (R-square) value by 0.683, which means that the regression model obtained could explain 68.3% of the dependent variable variation of SBS occurrence at pharmacies in Banjarmasin working area. Thus the psychosocial condition, year of service, behaviors and lighting variables were able to explain the SBS occurrence by 68.3%, while 31.7% was explained by other variables.

## DISCUSSIONS

The significant correlation between SBS occurrence with psychosocial conditions was shown in a variety of SBS's typical health problems caused by stress rather than by the building condition. The existence of workplace automation and computer technology can improve work efficiency, but with these circumstances, workers were demanded to maximize their performance. Workers must enhance their ability and can cope with the heavier workload. Also, various complaints of SBS also influenced by factors outside environment, such as personal problems, work and psychologically considered to affect one's sensitivity to SBS.<sup>4,16</sup> Excessive stress or dissatisfaction, poor interpersonal relationships and poor communication are also often seen to be associated with SBS.<sup>14</sup>

Ages influence on the immune system so as the older the age of the individual then the correspondingly reduced personal stamina. Younger age also played a role in causing the SBS symptoms and complaints. The possible causes that could happen because when the age reached the working and productive period, usually employees were expected to show their optimal performance, so their stamina can be decreased.<sup>4</sup>

Few factors were suspected for the insignificant relationship between the age of the respondent to the SBS occurrences. Among them were unnormal data distribution and respondents who did not include in the working age criteria were mostly at the age of 64 years above years, so the rise symptoms are degenerative disease symptoms and excluded from SBS criteria.

Out of the 29 respondents who experienced SBS, 48.28% of them were included in the risk category of years of service and demonstrated a significant relationship. Such condition mainly due to the duration of individual working activities in the room were assumed could lead to chronic health problems. The longer the person working length, the more numerous and varied health concerns experienced. The extended period of indoor working activities is believed to affect the different exposure level against indoor pollutants.<sup>17</sup>

Previous research has explained that workers with ten years of service or more had a greater risk of the SBS occurrence,<sup>18</sup> as a result of work-climate acclimatization the workers experienced by themselves.<sup>19</sup> But at the case with the pharmacist assistant pharmacist in Banjarmasin, with the year of service relatively short (> 1 year) they had the same risk of developing the magnitude of SBS. This might happen due to the pharmacist assistant's type of work that is closely related to drugs and other chemicals that can be a source of indoor air pollution.<sup>5</sup>

Related to attitudes, the correlation between the respondents' attitudes towards SBS risk with the occurrence of SBS by the Rais *et al.* research (2009) which stated that attitude has a significant relationship with the employee's behaviors on SBS risk activities.<sup>20</sup> The attitude itself was a reaction or closed response from the individual to the object or stimulus. Manifestations of such attitudes simply can not be seen directly, but can only be interpreted in advance of the covert behavior. Such behavior will be known through the actions committed by a person.

Among 29 respondents who experienced the SBS events, 22 of them demonstrate risky actions against SBS occurrence. The analysis also showed a significant correlation ( $p < 0.005$ ) between the respondents acts with the SBS event experienced by them. Some of the behaviors that may play a role in the SBS occurrence include smoking, unwell maintained air-conditioning facilities as well as the habits of using sanitizer and disinfectant.<sup>21</sup>

In Table 2 shows that 51.72% of the total 29 respondents exposed to SBS were working in a room with normal lighting levels (intensity <100 or > 200 lux), while 48.28% others operating in the normal light work environment. Based on the results of chi-square tests ( $\alpha = 0.05$ ) p-value of 0.072 ( $p > 0.05$ ) was obtained, this means that there is no significant correlation between the respondent's environment lighting condition with Sick Building Syndrome (SBS) occurrence in pharmacy assistants in the city of Banjarmasin.

One of the factors that could potentially lead to the insignificant correlation between the lighting conditions with SBS occurrence is because the lighting mostly influenced by the artificial light with constant intensity over time to time due to a closed room. The condition also can make individual's sense of vision becomes accustomed adapted to such lighting condition in such an extended period. However, this study has limitations due to the exclusion of specific variables of pharmacist's assistant job characteristics, such as chemicals exposure on the drugs compounding activity.

In conclusion, this study concluded that the respondents who had experienced Sick Building Syndrome symptoms had a significant association between psychosocial variables, the length of service, knowledge, attitudes and actions. Respondent's psychosocial condition, years of service, respondents behaviors and working area lighting condition were variables that influenced the occurrence of SBS.

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