The Relationships of Temperature and Humidity in Air-Conditioned Room to the Occurrences of Sick Building Syndrome

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Abstract

High rates of *Sick Building Syndrome* in other countries where pollution levels are far lower than Indonesia, it is suspected that *Sick Building Syndrome* in Indonesia is already worrying and that pollution levels are very high. This syndrome can cause respiratory infections and can worsen people with asthma and allergies due to dirty air. The main objective of this study is to analyze the relationship of temperature and humidity in air-conditioned rooms to the emergence of *Sick Building Syndrome* in UPT PSMB-LT Surabaya. This research is a descriptive study using an observational and approach *cross-sectional*. The population in this study were all employees who worked at UPT PSMB-LT Surabaya, as many as 35 people, using *Non-Probability Sampling* namely *techniques, total sampling*. Data collection is done by interview and observation. Data will be processed and presented in the form of frequency tabulation and described using a contingency coefficient test. The results of this study indicate that the measured air temperature meets the standards except for the physics laboratory room and the air humidity measured mostly does not meet the standards except the leadership room, treasurer room, quality assurance room, physics laboratory room and cation room. Symptoms of *Sick Building Syndrome* most commonly complain of symptoms on the skin. There is a moderate relationship between the incidence of *Sick Building Syndrome* and age. Suggestions for companies are to pay attention to the temperature of the air inside and outside the room as well as the humidity of the air, SBS complaints need to be aware of early on, use a lotion before entering an air-conditioned room.

Keywords: physical quality of the air, air-conditioned rooms, *Sick Building Syndrome*

Introduction

The development of population and the world economy is driving rapid urbanization from rural to urban areas, almost every major city in the world stands tall buildings soaring into the sky which is a result of limited land for settlements, offices and centres of economic activity.

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Tall buildings are built with closed structures and are equipped with air circulation and artificial cooling systems to create comfortable working environment conditions. The outside air entering the building's ventilation system will be reduced to even zero, only recirculating air is used for breathing. This causes poor *indoor air quality* (IAQ) and many free radicals originate from cigarette smoke, ozone from copiers and *printers*, furniture, paints and cleaning materials [1].

The United States Agency or the *Occupational Safety and Health National Institute for Occupational Safety and Health* (NIOSH) conducted a study of 446 buildings in the United States and found that there were six main sources of air pollution in the building. The six main sources of air pollution are the causes of

air pollution in buildings due to pollution from tools and or materials inside the building (17%), pollution entering from outside the building (11%), pollution from building materials and office equipment (3%), microbial pollution (5%), inadequate ventilation (52%), and 12% from unknown sources [2].

The physical quality of the air such as air temperature and humidity are important things to consider. Research in air-conditioned rooms shows air temperature and humidity significantly influence *Sick Building Syndrome*. The study was a study of [3] which showed that there was a significant relationship between temperature (OR = 3.363) and humidity (OR = 2.923) with the incidence of *Sick Building Syndrome*.

Sick Building Syndrome (SBS) has been known since 1970. Occupational medicine in 1980 introduced the concept of SBS as a health problem due to the work environment related to air pollution, IAQ and poor ventilation of office buildings. *World Health the Organization* (WHO) reported in 1984 that 30% of new buildings around the world complained to workers linked to IAQ [4]. Regionally, low and middle-income countries in Southeast Asia and the West Pacific had the highest levels of air pollution in 2012, with a total of 3.3 million deaths related to indoor air pollution and 2.6 million deaths related to outdoor air pollution 5.

The high rate of morbidity *Sick Building Syndrome* (SBS)in other countries whose pollution levels are much lower than Indonesia raises the suspicion that *Sick Building Syndrome* (SBS) in Indonesia has also been alarming, especially in Surabaya where pollution rates are very high. UPT PSMB-LT Surabaya is deemed necessary to be investigated because its location is located in an area with quite high pollution levels and the use of a system *Air Conditioning* that has the potential to cause *Sick Building Syndrome* (SBS).

The number of activities in the building can increase the number of pollutants in the room. In closed buildings that use air conditioners or air conditioners, the design of air conditioners that are used to regulate room temperature continuously can remove some of the pollutant material, but the air circulation only revolves around the same place and added to the presence of pollutants in the same air. This can lead to *Sick Building Syndrome* (SBS). This syndrome can cause respiratory infections and can worsen people with asthma and allergies due to dirty air. Therefore, an occupational health effort is needed so that no more employees are complaining about the symptoms of *Sick Building Syndrome* (SBS). One effort that can be done is to get to know and know SBS complaints early which is common in offices with the use of AC.

This study aims to analyze the relationship of air temperature in air-conditioned rooms to the emergence of *Sick Building Syndrome* in UPT PSMB-LT Surabaya.

Methods

type of research is a descriptive study with a study design *cross-sectional*. The population is all employees who work at UPT PSMB-LT Surabaya as many as 35 people. The sampling method is done by using the technique, *Non-Probability Sampling* which is a total sampling of 35 people.

The research variables include the independent variable (free) in the form of physical quality of air in the room which includes air temperature and the dependent variable (bound) in the form of complaints *Sick Building Syndrome* that is felt by employees due to air exposure while in the air-conditioned room during working hours.

Data collection techniques include primary and secondary data collection using data collection instruments in the form of observation sheets and questionnaires. Primary data collection is done by field observations, interviews and the results of measurements of air temperature, while secondary data is obtained from data that is already in the office.

Results

Relationship of Physical Air Quality toe vents *Sick Building Syndrome*

Relationship of Air Temperature events The *Sick Building Syndrome* following is a cross-tabulation data of *Sick Building Syndrome in* terms of air temperature in UPT PSMB-LT Surabaya. The table explains the relationship between air temperature and the incidence of *Sick Building Syndrome.*

Table 1: Relationship between Air Temperature and the Occurrence of *Sick Building Syndrome*

Temperature	SBS				Total	
	Yes		No			
	n	%	n	%	n	%
18-28˚C	15	44.1	19	55.9	34	100.0
<18˚C or> 28˚C	1	100, 0	0	0.0	1	100.0
Total	16	45.7	19	54.3	35	100.0

Based on the cross-tabulation above it can be seen that respondents who experienced SBS at 18-28˚C air temperature were 15 people (44.1 %) of the total respondents who worked in the room with the temperature as many as 34 people, while the respondents who experienced SBS at air temperature <18˚C or> 28˚C as many as 1 people (100.0%) of the total respondents who worked in the room with the temperature is 1 person.

Based on the test results using a contingency coefficient, the associational value is 0.184. When viewed from the level of relationship, the value of the association is 0.184 in the range of values from 0.00 to 0.25, which means it has a weak relationship level. This shows that there is no relationship between air temperature and the incidence of *Sick Building Syndrome*.

Relationship of Air Humidity toe vent The *Sick Building Syndrome*

following is a cross-tabulation data of *Sick Building Syndrome in* terms of air humidity in UPT PSMB-LT Surabaya. The table explains the relationship between humidity and the incidence of *Sick Building Syndrome.*

Table 2: Relationship of Air Humidity to The Occurrences of *Sick Building Syndrome*

Air Humidity	SBS				Total	
	Yes		No			
	n	%	n	%	n	%
40-60%	7	63.6	4	36.4	11	100.0
<40% or> 60%	9	37.5	15	62.5	24	100.0
Total	16	45, 7	19	54.3	35	100.0

Based on the cross-tabulation above it can be seen that respondents who experienced SBS in air humidity 40-60% were 7 people (63.6%) of the total respondents who worked in a room with that temperature as many as 11 people, while respondents who experienced SBS in humidity <40% or> 60% were 9 people (37.5%) of the total respondents who worked in the room with the temperature as many as 24 people.

Based on the results of testing using the contingency coefficient, the associational value is 0.237. When viewed from the level of relationship, the association

value of 0.237 is in the range of values from 0.00 to 0.25, which means it has a weak relationship level. This shows that there is no relationship between air humidity with the incidence of *Sick Building Syndrome*.

Discussion

Relationship between Physical Air Quality and occurrence of *Sick Building Syndrome*

The temperature that is too high or too low can affect one's concentration and workability. Too high a temperature causes a person to lose fluids faster and in extreme conditions can cause a *heat stroke*. Conversely at low temperatures force a person to work harder to maintain body temperature remains in normal conditions. In extreme conditions temperatures that are too cold can cause *frostbites*. In both above conditions either the temperature is too high or too low the body can feel fatigued faster than normal and experience a variety of symptoms including SBS symptoms [4]. According to the Standards of Quality following [6], the temperature in the workspace is 18-28˚C.

Based on the results of the study note that most respondents who experienced SBS at temperatures 18-28˚C, as many as 15 people (44.1%). The results of temperature measurements show that most of the temperature rooms still meet the standards, only that there are rooms that exceed the standard temperature that is considered comfortable for the working atmosphere, namely the physics laboratory room with a temperature of 29.4 ° C.

Analysis of these two variables uses a contingency coefficient and the associated value is 0.184. When viewed from the level of relationship, the value of the association is 0.184 in the range of values from 0.00 to 0.25, which means it has a weak relationship level. This shows that there is no relationship between air temperature and the incidence of *Sick Building Syndrome*. These results are in line with research conducted by [7] and [8] that the temperature in the work environment is not a trigger for SBS complaints. This can occur because the temperature is still within normal limits for the work environment for employees. Because with these temperatures, body temperature does not waste too much energy to adapt to the surrounding environment. This is what might cause in this study, the temperature has no relationship with SBS.

Relationship of Air Humidity to occurrence *Sick Building Syndrome*

Relatively low air humidity of less than 20% can cause dryness of the membrane mucous membranes, whereas high humidity will increase the growth of microorganisms [9]. According to the Standards of Quality following [6], the humidity in the workspace is 40-60%.

Based on the results of the study note that the majority of respondents who experienced SBS in humidity <40% or> 60%, as many as 9 people (37.5%). Meanwhile, the results of humidity measurements show that most of the humidity rooms do not meet the standards, there are 7 rooms with humidity not meeting the standards of the total rooms that are as many as 12 rooms. Humidity in 7 rooms has exceeded the existing standard that is more than 60% to increase the growth of microorganisms following the opinion [10] that lower humidity of 70% can cause dryness of the mucous membrane while high humidity can increase the growth of microorganisms.

According to [9], room air humidity is one of the factors that influence room temperature so that if humidity is high, the air temperature will drop, conversely if humidity is low, the air temperature will rise. This can affect the health of the occupants of the room, so it needs attention.

Analysis of these two variables uses a contingency coefficient and the associated value is 0.237. When viewed from the level of relationship, the association value of 0.237 is in the range of values from 0.00 to 0.25, which means it has a weak relationship level. This shows that there is no relationship between air humidity with the incidence of *Sick Building Syndrome*. These results are in line with research conducted by [7] and [8] that humidity in the work environment is not a trigger for SBS complaints. This can occur because there are still other factors that influence the onset of SBS symptoms, for example, the quality of air chemistry and air microbiology.

Conclusion

The results of physical air quality measurements include air temperature and humidity. Most of the measured temperatures have met the standard, except

for the physics laboratory room where the temperature exceeds the specified standard of 29.4 ° C. The measured air humidity mostly does not meet the standard with the number of rooms where the humidity does not meet the standard that is 7 rooms out of a total of 12 rooms, except the leadership room, treasurer room, quality assurance room, physics laboratory room and cation room that have met the standard.

The symptoms of *Sick Building Syndrome* most complained are symptoms on the skin of 21 people (21.7%), respondents experiencing SBS as many as 16 people (45.7%).

From the results of testing using the contingency coefficient, it is found that there is a moderate relationship between the incidence of *Sick Building Syndrome* and age, but there is a weak relationship between *Sick Building Syndrome* with gender, length of work and length of service.

From the test results using a contingency coefficient, it is found that there is a weak relationship between the incidence of *Sick Building Syndrome* and the physical quality of the air which includes the temperature and humidity of the air.

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