

# The Factors of Affect Indoor Air Quality Inpatient at Private Hospital, Pekanbaru, Indonesia

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## Abstract

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**BACKGROUND:** Air quality in inpatient rooms influenced by several factors. Room not qualified health can cause disease and can spread through equipment, the material used, food and drink, health workers, patients and visitors.

**AIM:** The purpose of this study is to know the factors that affect air quality in the inpatient room at a private hospital, Pekanbaru.

**METHODS:** The research is quantitative analytic by design cut latitude study. Samples from 120 nurses were selected overall sampling. The data do with the measurement directly, interviews and observation using a questionnaire. Data analysed by using the chi-square with significance p-value less than 0.05.

**RESULTS:** The quality of the air in inpatient rooms has met the standard. Variables are affecting air quality in inpatient rooms in the hospital significantly with p-value more than 0.05 is temperature, dust, the germ, density occupancy, sanitation room. While the moisture, standard operating procedures and behaviour is not significant.

**CONCLUSION:** The factors that significantly affect indoor air quality inpatient hospitalisation are temperature, dust, germ numbers, occupancy density, room sanitation.

## Introduction

Human activity can change chemical composition in the air structures and concentration and on the chemical substances to increase, especially if that activity is done in a room with a bad air circulation system. Air quality in space not only affected by chemical pollution but also by physical of environmental factor such as temperature and moisture [1].

Air quality in space is the air inside a building inhabited or occupied to a period of at least 1 hours by people with various health status different; Air quality in the room is the air inside a building inhabited or occupied to a period of at least 1 hours by people with various health status [2]. Well, air quality in space defined as air free from irritation, free of pollution

discomfort or health inhabitant of disruption. Room temperature and moisture also affect the comfort and health of the inhabitants [3].

One of the rooms that could potentially have a problem of indoor air pollution is the hospital. The hospital as a health service for the community must have inpatient ward qualified, health good air quality, construction and facility. In a room that did not qualify, health disease can spread via, equipment, food and drink, health workers, and visitors [4].

The Indonesian government has set the requirements of environmental health hospital in Minister for Health Decree No.1204 / MENKES / SK / X / 2004 which is air that is in should be free inside the germ pathogens by the number was no more than 500 CFU/m<sup>3</sup> air and dust levels of particulate matter less than 10 micron average with 8 hour or 24 hours does not exceed 150 µg/m<sup>3</sup> and does not contain

asbestos dust. [5]. The results study of Abdullah in public hospitals haji Makassar south Sulawesi, shows that more than 91% the number of germs and 71-87% the quality of the physical environment health was not up to the required by Indonesian decree number 1204 / MENKES / SK / X / 2004 [6].

In Pekanbaru city hospitals, this research has never been found, so researcher assumes that the topic of this research is very important to study and the researcher hopes that with this study, we can know the existing conditions of air quality in hospital that is in the hospital and so that it does not affect the health and environment of the hospital. The difference between this study and earlier studies is that there are several variables examined in this study rarely examined by previous studies, and usually, other researchers only focus on the physical environment of the hospital.

Based on the results of observations made at three private C class hospitals in the city of Pekanbaru, there were several findings, including the temperature of class 2 and 3 hot rooms. This is because the number of patients in the room does not meet the standards, the extent of the inpatient room cannot accommodate a large number of patients so that the condition of the room becomes less conducive. And natural ventilation is not available for the exchange of air circulation so that the condition has the potential to cause health problems.

Based on the background, the researcher was interested in conducting this research. The purpose of this study was to find out the factors that influence air quality in the inpatient room at a private hospital in Pekanbaru City.

## Methods

This study is a quantitative analytic with a cross-sectional design. The population is all in-patient room nurse at a private hospital in Pekanbaru. Sample in this research as many as 120 nurses who were chosen with a total of sampling. The data was undertaken in two ways: first, measuring directly inpatient rooms that are variable temperature used a thermometer, moisture used a hygrometer, dust used a Low Volume Air Sampler (LVS), The germ used a microbiology air sampler, and density dwelling uses laser distance meters. Second, with the interview and observation consisting of a variable behaviour, knowledge, standard operating procedures. Variable behaviour, consisting of 5 questions variable knowledge consisting of 9 questions, variable standard operating procedures are consisting of 4 questions. Used the validity and has tested realibilitas. Coding all data was undertaken then analysis to see characteristic nurse, the percentage the frequency

and the factors that affect air quality in the inpatient ward at Private Hospital in Pekanbaru. Data analysis use the chi-square with significance p-value less than 0,05 by SPSS 21 version.

## Results

### Characteristics of respondents

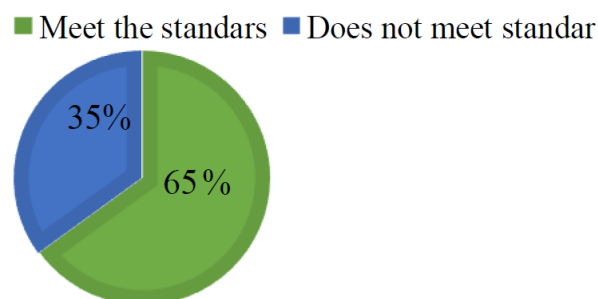
Total respondents were 120, as many as 65.9% (n = 79) was 20-30 years old, 28.3% (n = 24) was 31-40 years old and 5.8% (n = 7) 41-50 years old. Most of respondents 95 % (n = 114) were women and 5% (n = 6) of them were men. As many as 60% (n = 72) were diploma and the others 40% (n = 48) were bachelor. Most of respondents working less than 5 years 92.5% (n = 111) and only 7.5% working more than 5 years (n = 9). It's showed in the Table 1.

**Table 1: Characteristics of respondents**

No	Variable	Frequency (n= 120)	Percentage (%)
1	Age		
	20-30 years old	79	65.9
	31-40 years old	24	28.3
	41-50 years old	7	5.8
2	Sex		
	Man	6	5
	Woman	114	95
3	Education		
	Diploma	72	60
	Bachelor	48	40
4	Working Duration		
	≥ 5 years	9	7.5
	< 5 years	111	92.5

### The percentage of air quality in the inpatient ward of the hospital and to for affecting variables

Air quality in the inpatient ward hospitals that had to meet the standards as many as 65% (n = 78) and does not fit the standard 35% (n = 42). As in figure 1 below:



**Figure 1: Percentage of Indoor Inpatient Room Air Quality of Hospital**

The temperature that had been measured categorised into two if measurement result 22-24°C category, if the measurement results it less than 22°C and more than 24°C category does not meet the standard. The results of the measurement of

temperature obtained that 34.2% (n = 41) were standard and the others 65.8% (n = 79) temperatures do not meet the standard.

Moisture that had been measured categorised into two is that if the measurement results 45-60 % categorised as based on standard if the measurement result less than 45% and more than 60% was a category does not meet the standard. The measurement result moisture indicated that 39.2 % (n = 47) who meet the standards and 60.8 % (n = 73) moisture that does not meet the standard.

The dust that had been measured categorised into two is that if the measurement results in less than 150 µg/m<sup>3</sup> including meet the standard if the measurement results more than 150 µg/m<sup>3</sup> category does not meet the standard. The measurement result indicated that dust 62.5% (n = 75) who meet the standards and 37.5 % (n = 45) dust which does not meet the standard.

The germs that had been measured categorised into two is that if the measurement result 200-500 CFU/m<sup>3</sup> including meet standards, if the measurement result less than 200 CFU/m<sup>3</sup> and more than 500 CFU/m<sup>3</sup> category does not meet the standard. The measurement result obtained the germs that 56.7% (n = 68) who meet the standards and 43.3% (n = 52) the germs do not meet the standard.

The occupancy density that had been measured categorised into two is that if the measurement results 8 m<sup>2</sup> including meet the standards, if the measurement result less than 8 m<sup>2</sup> in the category does not meet the standard. The measurement result obtained the occupancy density that 55.8% (n = 67) who meet the standards and 44.2% (n = 53) the occupancy density does not meet the standard.

Respondent's standard operating procedures about air quality was calculated with the correct scores of 4 items question if the answer more than 75% were corrected then concluded in accordance category. On the other hand, if the answer, less than 75% were category not in accordance. The results showed that the percentage of the standard operating procedures that 45% (n = 54) appropriate and 55% (n = 66) standard operating procedures that are not appropriate.

Respondent's sanitation the room about air quality was calculated with the correct scores of 9 items questions if the answer more than 75% were corrected then concluded in meet standards. On the other hand, if the answer, less than 75% were category does not meet the standard. The results showed that the percentage of sanitation the room that 55% (n = 66) who meet the standards and 45% (n = 54) sanitation the room does not meet the standard.

Respondent's behaviour of air quality was calculated with the correct scores of 5 items question

if the answer more than 75% were corrected then concluded in the category of good if the answer less than 75% categorised not good. The results showed that the percentage of the behaviour that 60.8% (n = 73) of conduct good and 39.2% (n = 47) of behaviour that is less than good (Table 2).

**Table 2: The Percentage Variables Affecting Indoor Air Quality**

No	Dependent Variable	Frequency	Percentage (%)
1	Temperature		
	Does not meet standards	79	65.8
	Meet standards	41	34.2
2	Humidity		
	Does not meet standards	73	60.8
	Meet standards	47	39.2
3	Dust		
	Does not meet standards	45	37.5
	Meet standards	75	62.5
4	The germ		
	Does not meet standards	52	43.3
	Meet standards	68	56.7
5	Occupancy density		
	Does not meet standards	53	44.2
	Meet standards	67	55.8
6	Standard operating procedures		
	Not in accordance	66	55.0
	Accordance	54	45.0
7	Sanitation the room		
	Does not meet standards	54	45.0
	Meet standards	66	55.0
8	Behavior		
	Not good	47	39.2
	Good	73	60.8

**Factors affect air quality in inpatient rooms at the hospital**

Table 3 show variables are affecting air quality in inpatient rooms at the hospital. The research results indicated that variables affecting the air quality in inpatient rooms at the hospital, that is: the significant temperature, dust, the germs, occupancy density, sanitation the room like a table below:

**Table 3: Factors that affect air quality in inpatient rooms at the hospital**

Factors	Air quality in inpatient rooms at the hospital				
	Does not meet standards	Meet standards	Total	P value	POR (95% CI)
Temperature					
-Does not meet standards	58 (73.4%)	21 (26.6%)	79 (100%)	0.007	2.900 (1.316-6.390)
-Meet standards	20 (48.8%)	21 (51.2%)	41 (100%)		
Humidity					
-Does not meet standards	52 (71.2%)	21 (28.8%)	73 (100%)	0.074	2.000 (0.929-4.304)
-Meet standards	26 (55.3%)	21 (44.7%)	47 (100%)		
Dust					
-Does not meet standards	39 (86.7%)	6 (13.3%)	45 (100%)	0.001	6.000 (2.271-15.853)
-Meet standards	39 (52.0%)	36 (48.0%)	75 (100%)		
The germ					
-Does not meet standards	44 (84.6%)	8 (15.4%)	52 (100%)	0.001	5.500 (2.257-13.403)
-Meet standards	34 (50.0%)	34 (50.0%)	68 (100%)		
Occupancy density					
-Does not meet standards	44 (83.0%)	9 (17.0%)	53 (100%)	0.001	4.745 (2.003-11.239)
-Meet standards	34 (50.7%)	33 (49.3%)	67 (100%)		
Standard operating procedures					
-Not in accordance	40 (60.6%)	26 (39.4%)	66 (100%)	0.265	0.648 (0.301-1.392)
-Accordance	38 (70.4%)	16 (29.6%)	54 (100%)		
Sanitation the room					
-Does not meet standards	43 (79.6%)	11 (20.4%)	54 (100%)	0.002	3.462 (1.525-7.860)
-Meet standards	35 (53.0%)	31 (47.0%)	66 (100%)		
Behaviour					
-Not good	33 (70.2%)	14 (29.8%)	47 (100%)	0.337	1.467 (0.670-3.210)
-Good	45 (61.6%)	28 (38.4%)	73 (100%)		

## Discussion

Nurses in hospitals are predominantly female with ages 20-30 years and working period less than 5 years with Diploma education, this is in accordance with the early history of professional nursing that began in Florence nightingale that is based on the love of a mother or females but to live and length of employment usually a nurse with age and length of employment old more experienced in do the work. This is supported by the results of the study Megawati that age and length of working very influence the performance nurses of the hospital [7].

For diploma education this is supported by the theory Notoadmodjo, that people having higher education will know higher the comparison with peoples having low education and through education a person can improve ripeness intellectual so that it can decide between acting [8].

Air quality in inpatient rooms at the hospital is adequate to suggest that air quality in the room was uncontaminated from physical harm, chemical or biological to pollute air quality. However, it does not rule out the possibility that inpatient rooms are free of diseases that cause symptoms of health problems in patients, health workers, and visitors.

The result of this research can define it as many as 79% temperature does not meet the standard is a lot of room that has been exceeding that of 24°C condition of inpatient rooms feels hot, the high temperature can be a disturbing role in regulating the way a metabolic reaction for the organism. High cold temperature frustrates the patient condition and causes inconveniences. This is in line with an average temperature of research Lisa that obtained from the measurement of in-patient hospital room Syekh Kabupaten Gowa more than 30°C that has been exceeding the value of the standard [9].

The research results show there an effect that welfare between temperature and the quality of the air as it when the temperature exceeds the standard he will affect the quality of the air in the inpatient ward, this is in accordance with the results of the study Fang state that there are significant links of temperature and moisture on air quality, the air is considered far less caused by a rise can be received by temperatures and humidity, so that it will have a negative impact [10].

The humidity just 39.2% complete the standards, to the humidity is relatively low less than 20% can cause drought mucous membrane, membrane while high humidity would increase the growth of microorganisms. This fits in with research conducted Nizar the average results of moisture measurements when researching RSUD Prof. Dr Margono Soekarjo Purwekerto as many as 68,25% did not meet the requirements of the Minister of Health Decree No.1204 / Menkes / S / X / 2004 [11].

The dust of 62.5% meets the standard; this condition requires maintenance of the room so that the dust inside the inpatient room still meets the standards. This is supported by Laila research that the concentration of dust in the air the library FB and FC still qualified while in the FA library have exceeded the limits [12].

Because the particles dust is small and does not look by the eye and to find out more than dust standard or not to be done directly measure the same as conducted by the results of this research as to when the dust has more than a standard will impact on negatively. This health research results together with the research Lisa that levels of dust on the mend did not exceed 150 mg/m<sup>3</sup>, so levels of dust the room on the study is based on standard [9].

But from the results of Mahmoud's research, it was stated that air quality in space, especially health care facilities (HCFs) was strongly influenced by outside sources, especially traffic. For the highest level of total suspended particles (TSP) and less than 10 microns (PM) in hospitals with locations where there is a lot of human activity. The level of the particulate maker (PM and TSP) is higher than the Air Quality Guidelines (AQG) so that the occupants of the room must know about the sources and effects of contaminants and ventilation systems that are in the room to reduce particulates in the room [13].

The germ, as many as 56.7% qualified standards where the spread of the germ the media involved the environment such as air and vector as an intermediary or vehicle. As the results of the study Adysaputra in space surgery RSUDP, Dr Wahidin Sudirohusodo Makasar found staphylococcus aureus germs the main cause of nosocomial infections derived from the upper part of the respiratory channel [14].

In this study, density dwelling was qualified standard as many as 55.8%, according to northern European studies that there was a correlation between increased temperature about 23°C, density inhabitant and ventilation to indoor uncomfortable. When temperature more than 28°C need to use a neutralizer such as air conditioner or fan. Results shows that there is significant influence between density dwelling and air quality in space, having the increasing number of a number of people in a room will affect air quality in space. This is supported by the study of Yousef that the quality of the environment in the room could affect the welfare and comfort residents and issues such as sick building syndrome thermal comfort to the quality of indoor air, as comfortable as visual and acoustic so that it is necessary designs of buildings by considering the parameters of welfare [15]. Same as research of Huisman that adverse effects of the physical environment very proved to be relevant to the process of healing and welfare for patient and the patient family and health workers, with the development of

healthcare facilities (HCF) approach in the design and construction executive future such as a seven-bed single to their own generation, identical room, and lighting [16].

As many as 45% standard operating procedures were not appropriate and the rules to be applied at the hospital is not optimal and it has to do with the manners nurse during inpatient care in maintaining the air quality, if not applied standard operating procedures at the hospital nurses will affect behavior. In this study the standard operating procedures is a significant relation exists with the air quality in space, this is different to the theory that behavior nurse in maintaining and preventing nosocomial infections is an important factor to prevent nosocomial infections in hospitals. According to the theory of Notoatmojo that behavior domain influenced by knowledge, attitudes and the act of, so that on this research nurse behavior is strongly influenced by the knowledge that is largely obtained through the eyes and ears. Knowledge of the realm of cognitive constituted the domain that is very important in shaping the act of someone or overt behaviour [8]. According to its research of Beiyu that behavior could affects air quality in rooms and with the good manners being measurable and knowledge can develop a system building with smart city [17].

Results it can be concluded that temperature and moisture are not adequate and variable this is significantly influenced the quality of the air in the inpatient room at the hospital, it is closely related to the can caused by the high number of temperature and moisture in the room. Dust, the germ, density dwelling, standard operating procedures, sanitation and behaviour still room standard, but it is possible that this condition free from an impairment of health due to an impact caused. Health and suggested to the management hospital to anticipate this must be cleaned every day, inpatient rooms monitoring the condition of the maintenance water conditioner regularly and periodically to be able to maintain the quality of air in a room.

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