

# Community Behavior in the Use of Energy on Inpatient Room Care Hospital in Makassar City

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## ABSTRACT

Hospital buildings have a more complex electrical energy structure than other ordinary buildings. The most extensive use of electrical energy in hospitals is the inpatient room, which operates throughout the day. This study aimed to determine the community behavior in the use of electrical energy such as lighting and air conditioning or air conditioning. This study uses a quantitative descriptive analysis with a correlational approach. The population in this study were patients and caretakers of patients at the Labuang Baji Hospital, Makassar City. The sample collection technique used accidental sampling so that 180 samples were obtained. The study results found that 86% of patients and visitors turned on the room lights more than 20 hours a day, and as many as 92% of patients and visitors used AC < 25°C. Furthermore, as many as 74% of patients feel very comfortable with AC temperatures < 25°C and 82% of patients are comfortable turning on all day. This result is in line with the correlational analysis, which states a significant effect between occupant comfort and energy savings.

**Keywords:** Convenience, Energy Saving, Hospital

## 1. INTRODUCTION

The building is one of the large users of electrical energy. The hospital building uses a significant enough source of electrical energy. This happens because it is a service demand for visitors, including room lighting, air comfort, and completeness of other facilities that are components of supporting services. In the hospital, 12 electrical installations need to be fulfilled, namely operating room, ICU, ER, health worker room, laboratory room, worship room, pharmacy room, canteen, garden, morgue room, administration room, and inpatient room [1]. Hospitals consume an incredible amount of energy, roughly twice that of public buildings worldwide. The primary energy can be used for heating, ventilation, and air conditioning [2]. This makes the hospital one of the buildings using a relatively large source of electrical energy compared to other buildings.

The use and utilization of electrical energy in buildings must be efficient according to Presidential Regulation Number 79 of 2014 concerning the National Energy Policy, which issues provisions in the form of regulations regarding energy conversion. This Regulation aims to manage electrical energy effectively and efficiently in the surrounding environment. Furthermore, Regulation of the Minister of Energy and Human Resources (ESDM) Number 31 of 2005 regulates the procedure for implementing energy-saving, which

regulates in detail the use of energy such as Air Conditioner (AC), the use of water, and excessive use of electricity in lamps which can cause light pollution. In addition, efforts can be made to save energy, one of which is the need for an energy audit. An energy audit is a technique used to calculate the amount of energy consumption in buildings and identify the saving model [3].

The users of the inpatient room facilities are one of the determining factors in the utilization of electrical energy sources. Users are expected to be aware of the impact of excessive use of electrical energy. Excessive electricity use can also produce emissions, which means that the more electricity used, the more carbon is produced. Of course, it impacts global warming because electricity is mainly generated from fossil energy [4]. An air conditioner (AC) is the largest energy source in the inpatient room, 40%, and lighting is 15% [5].

**Table 1.** Hospital Building Lighting Level

Building	Room	Great lighting (Lux)
Hospital	Inpatient Room	250
	Laboratory	500
	Surgery room	300
	Delivery room	300
	Rehabilitation Room	250

The average energy waste in households is only 10%, in private office buildings 20%, industry 25%, shops and markets 25%, and government offices 25-30% [6]. The problem of wasting electrical energy is 80% caused by human factors and 20% caused by technical factors. This is due to the excessive and inappropriate use of electricity. From these data, it can be seen that the most significant waste of electrical energy is in the public sector.

Good quality of space can be seen from the spatial arrangement, such as ventilation and windows. Improper ventilation and window arrangements will reduce the room's intensity of light. The lighting in the inpatient room can affect the patient's comfort during hospitalization, so the lighting level in the hospital building should pay attention to the lighting standards of the hospital building according to the following SNI 03-6575-2001.

**2. METHODS**

This study uses a quantitative descriptive analysis with a correlational approach. The research location is at Labuang Baji Hospital, Makassar City, with all patients and patient caretakers. The sampling technique used accidental sampling so that 180 samples were obtained. The variables in this study consisted of independent variables, namely occupant comfort and the dependent variable, or energy savings. The analytical technique used is simple regression analysis to see how much influence the independent variable has on the dependent variable.

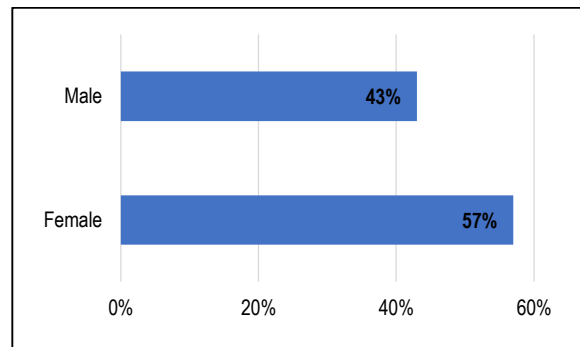
**3. RESULTS AND DISCUSSION**

**3.1. Characteristic of Respondent**

The characteristics of the respondents in this study were seen from gender, age, and education. The following are the results of the characteristics of respondents at Labuang Baji Hospital, Makassar City.

**3.1.1. Occupant Gender**

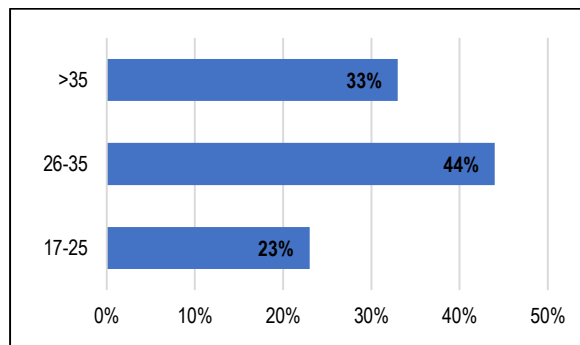
The gender characteristics of respondents are female and male. The analysis results show that the occupants who became the research respondents were dominated by women with a value of 57% while 43% by male residents. The following analysis results are presented in Figure 1.



**Figure 1.** Occupant Gender

**3.1.2. Occupant Age**

This characteristic is to see the effect of age on the use and saving of energy in hospitals. The following analysis results are presented in Figure 2.

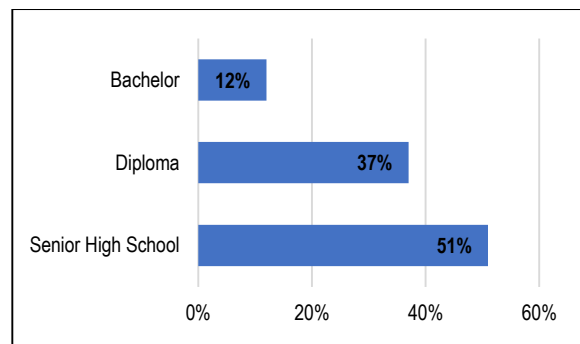


**Figure 2.** Occupant Age

The analysis results above show that the average age of the residents is in the range between 26-35 years with a value of 44%, and for the age range between 17-25 with a value of 23% and ages >35, it is 33%.

**3.1.3. Occupant Education**

Respondent's education is one of the determining factors in the use of energy efficiency. The following analysis results are presented in Figure 3.



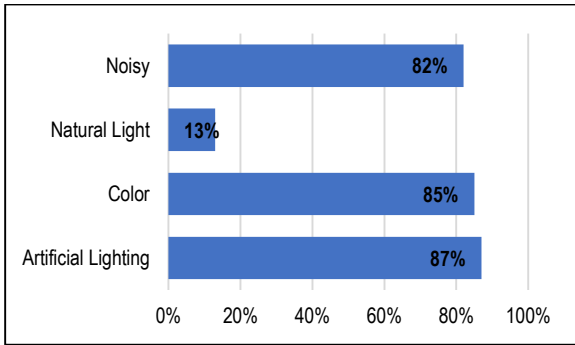
**Figure 3.** Occupant Education

Based on the analysis results above, it shows that residents' highest average level of education is in senior

high school with a value of 51%, and the lowest is 12% in Bachelors.

**3.2. Audio and Visual Comfort**

In this aspect, the researcher wants to see the occupants' comfort level in the inpatient room through audio and visual. The following is the occupants' comfort level presented in Figure 4.

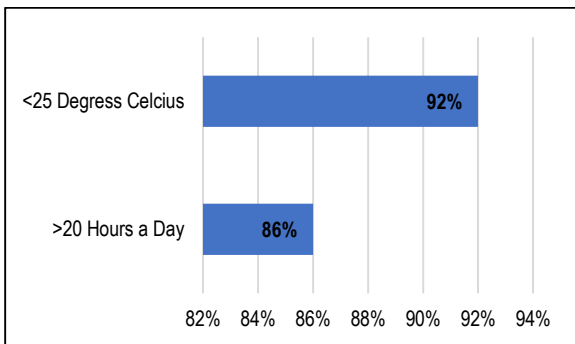


**Figure 4.** Occupant Comfort Level

Figure 4. above shows that residents feel very comfortable with artificial lighting with a value of 87%, while the lowest is in natural light with 13%. These results illustrate that residents prefer artificial light to natural light, which is much healthier.

**3.3. Energy Usage**

In this aspect, the researcher wants to see how often the occupants use energy through lighting and ventilation. The following analysis results are presented in Figure 5.



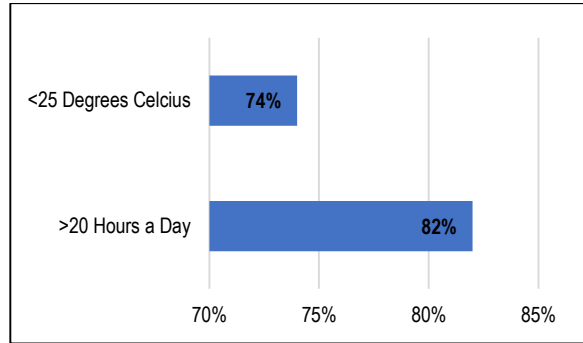
**Figure 5.** Energy Usage

The picture above shows that the occupants of the inpatient room turn on the lights more than 20 hours a day and use the air conditioner below 25°C. These results indicate that residents use excessive energy throughout the day.

**3.4. Occupant Comfort**

This aspect wants to see the comfort of the occupants in the use of energy, in this case, lighting and

air conditioning. The following analysis results are presented in Figure 6.



**Figure 6.** Occupant Comfort

Based on the analysis results above, it shows that residents feel comfortable when turning on the past all day with air conditioning below 25°C. These results indicate that residents do not like dark and hot spaces.

**3.5. Regression Test Result**

Simple linear regression testing determines whether or not the occupants' comfort affects energy use in the inpatient room. The following analysis results are presented in Table 2.

**Table 2.** Occupants Convenience Against Energy Usage

Model	Std. Coefficients	t	Sig.
(Constant)		18.390	.000
Occupant Comfort	-.186	-2.523	.012

Based on the analysis results above, the value of Sig. of 0.012 or less than 0.05, which means that occupant comfort influences energy use in the inpatient room at Labuang Baji Hospital, Makassar City. This indicates that residents are very comfortable with excessive energy use.

The results showed that residents generally use electrical energy more than 20 hours a day. This condition indicates that energy use at the research site is not environmentally friendly. Most extensive energy use, while electrical energy is vital in everyday life. The use of lights, air conditioners, and other electronic devices causes hospital buildings to consume quite much energy [7]. Energy efficiency efforts can be made with reasonable spatial arrangements. Sufficient sunlight entering the inpatient room can impact reducing the use of lights [8]. In addition, natural ventilation can be enhanced with window openings that allow natural air circulation.

Hospital standards in Indonesia require that hospital buildings must consider energy efficiency and the placement of inpatient rooms that do not cause glare or reflection effects. Space users must adjust the artificial lighting and ventilation system manually to suit their needs.

#### 4. CONCLUSION

Residents of the Labuang Baji Hospital in Makassar City habit turning on the lights for more than 20 hours a day and using air conditioning below 25°C. The results illustrate that residents feel comfortable in the treatment room when using energy as ventilation (AC) and lighting (Artificial) throughout the day. Residents' comfort against excessive energy use negatively impacts the environment, causing global warming. Therefore, it is necessary to design a hospital that aims to save energy.

Occupant perceptions and visual comfort assessments of three dynamic daylight control systems and shading strategies,” *Build. Environ.*, vol. 154, pp. 107–121, 2019.

#### REFERENCES

- [1] R. L. Kobus, R. L. Skaggs, M. Bobrow, J. Thomas, T. M. Payette, and S. A. Kliment, *Building type basics for healthcare facilities*, vol. 13. John Wiley & Sons, 2008.
- [2] H. Cho *et al.*, “Overcoming the electroluminescence efficiency limitations of perovskite light-emitting diodes,” *Science (80-. )*, vol. 350, no. 6265, pp. 1222–1225, 2015.
- [3] T. Hilorme, O. Zamazii, O. Judina, R. Korolenko, and Y. Melnikova, “Formation of risk mitigating strategies for the implementation of projects of energy saving technologies,” *Acad. Strateg. Manag. J.*, vol. 18, no. 3, pp. 1–6, 2019.
- [4] T. Y. A. Quek, W. L. A. Ee, W. Chen, and T. S. A. Ng, “Environmental impacts of transitioning to renewable electricity for Singapore and the surrounding region: A life cycle assessment,” *J. Clean. Prod.*, vol. 214, pp. 1–11, 2019.
- [5] C. Shen, K. Zhao, J. Ge, and Q. Zhou, “Analysis of building energy consumption in a hospital in the hot summer and cold winter area,” *Energy Procedia*, vol. 158, pp. 3735–3740, 2019.
- [6] L. Susanti, D. Fatrias, D. Ichwana, H. Kamil, and M. V. Putri, “A configuration system for real-time monitoring and controlling electricity consumption behavior,” in *2018 International Conference on Information Technology Systems and Innovation (ICITSI)*, 2018, pp. 442–447.
- [7] M. William, A. El-Haridi, A. Hanafy, and A. El-Sayed, “Assessing the energy efficiency and environmental impact of an egyptian hospital building,” in *IOP Conference Series: Earth and Environmental Science*, 2019, vol. 397, no. 1, p. 12006.
- [8] J. K. Day *et al.*, “Blinded by the light: