SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

This study had two objectives:

- To determine factors – personal, lighting control, or the physical environment – that contribute to how lighting is used by occupants in healthcare facilities.
- To determine if the design of lighting switches can impact the optimal use of lighting, independent of other factors.

Factors affecting optimal lighting use in shared hospital environments: A case study

Maleetipwan-Mattsson, P., Laike, T., & Johansson, M. 2015 | *Building and Environment*. Volume 96, Pages 260-269

Key Concepts/Context

The consumption of energy is high in hospitals. Artificial lighting, according to the authors, uses a sizable proportionate share of a hospital's electricity consumption. The authors refer to literature that identifies two factors influencing the use of lighting and the consequent energy consumption: the design features of a building and the behavior of the facility's occupants. In the context of lighting and its interfaces (switches), the authors allude to literature that indicates the affordances (or properties of a product that lets a user know how to use it). Two studies were carried out in a hospital in Stockholm, Sweden, to identify the affordances of light switches and other factors that contributed to how occupants in a healthcare building use lighting and whether the design of lighting interfaces can impact optimal use of lighting in shared hospital spaces. The authors conclude that both individual-based and design factors impact behavior of occupants with regard to light use.

Methods

Two empirical studies were carried out to examine the above objectives in a dining room and a dayroom located in patient wards of a hospital. Both spaces were commonly frequented by patients, staff, and visitors between 7:00 a.m. and 8:00 p.m. The two rooms had indirect access to daylight; artificial lighting was provided by six ceiling lamps in each room. Both studies were conducted with the original switches as well as after two rounds of installation of new switches of varying colors and shapes; the dining room studies involved switches of different colors and the dayroom switches of different colors and shapes. The first study involved the administration of a questionnaire to patients, visitors, and staff regarding satisfaction with lighting, perceptions of light switches, the physical environment, and individual-based factors. The second study involved examining the impact of the design of light switches on their use. To this effect, field observations and

DESIGN IMPLICATIONS

The study showed that when the color of the light switches was changed, they were more likely to be used optimally. However, when both color and shape of the light switches were changed, people were less likely to use them.

measurements were carried out. Lighting use in the two rooms was monitored by a data logger – ALMEMO® 2590-2. This equipment recorded electric current used by the lights at intervals of one minute for 30 days. Data were analyzed statistically (non-parametric correlation, chi-square tests, Mann-Whitney U-test, logistic regression, Kruskal-Wallis test). There were 42 respondents to the survey.

Findings

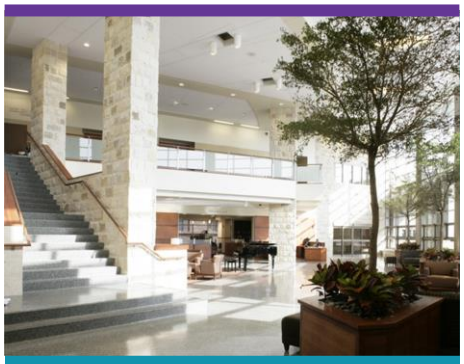
The study yielded the following findings:

Study 1:

- Although the staff participants reported different experiences of being in the two rooms compared to the patient participants, there was no significant difference in their responses.
- Respondents perceived that
    - The switches in both rooms had high affordances.
    - The physical environment was not unusual.
- Moderate, significant correlations were found between affordances and ($P<0.05$)
    - The familiarity of the physical environment
    - The perceived possibility of adjusting the lighting in the rooms
- The correlation between the physical environment and the possibility of adjusting the lighting was not significant.
- There was a strong negative correlation between satisfaction with the room's lighting and its use – the lower the satisfaction with the lighting in the room, the more inclined occupants were to adjust the lighting.
- Optimal lighting use had a moderate, significant correlation with
    - Intention to use lighting optimally ($P<0.01$)
    - General lighting-use behavior ($P<0.05$)
- Attitude (affective-related beliefs) had a strong, significant correlation with intention ($P<0.01$).
- Satisfaction with the lighting and attitude (affective-related beliefs) were statistically significant predictors of intention ($P<0.001$).

Study 2:

- About three-fourths of the recorded lighting activity (turning on or off) was performed by patients.
- Generally occupants did not adjust the lights very often. The use of switches was observed:
    - Dining room: Original: 79 times: First installation: 92 times; Second installation: 98 times
    - Day room: Original: 76 times: First installation: 27 times; Second installation: 63 times
- No correlation was found between the design of the switches and lighting use activities in either room.
- Data from the logger revealed that
    - In the dining room, use of the lamps ranged from no use to eight occasions of use, and energy consumption ranged from 0 to 6.92 kWh.
    - In the day room, use of the lamps ranged from no use to four occasions of use, and energy consumption ranged from 0 to 7.66 kWh.
- Changing the color and shape of the light switches impacted the number of occasions on which the ceiling lamps were used and the energy consumption as revealed by data logger:
    - Dining room:
        - Mean number of lighting-use occasions of the original switches was significantly less than that of the installation 2 switches ($P<0.005$).
        - Mean energy use related to the original switches was significantly less than that related to installation 1 and 2 switches (both $P<0.005$),
    - Day room:
        - Mean number of lighting-use occasions of installation 1 switches was significantly less than that of the original and installation 2 switches ($P<0.005$),
        - Mean energy use related to the installation 1 switches was significantly less than that related to original and installation 2 switches (both $P<0.005$).



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Limitations

The authors identify study 1 to have the following limitations:

- Sample size was small, as such limiting generalizability,
- Self-reported questionnaires have reliability issues,
- The data were collected for only 12 hours a day over short time period.

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