Development and Validation of a Lighting Assessment Questionnaire for Hospitals

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SUMMARY

A questionnaire was designed consisting of 7 main sections and a section entitled "Suggestions for improving brightness". The validity of the questionnaire was determined based on expert comments and the CVI index. Its reliability was assessed by completing the questionnaire by hospital staff. According to the North American Society of Lighting Engineers (IESNA) standard, illumination was evaluated and compared with the questionnaire results. The Cronbach's alpha coefficient and CVI value of the questionnaire were estimated to be 0.901 and 0.97, respectively. There was a significant positive relationship between the mean score of the questionnaire and the illuminances in the workstations (P = 0.001). 72.8% of the workstations had good lighting, and the results of the questionnaire evaluation in these stations showed good and excellent lighting conditions.

KEYWORDS

Comfort lighting, Questionnaire, Subjective assessment, Validity, Reliability

Introduction

Lighting is one of the most important environmental factors that affect visual comfort, sleep quality, occupational accidents, and musculoskeletal disorders. This study aimed to design and develop a tool for subjective assessment of lighting in hospital workplaces.

Material and Methods

This study was performed on 180 hospital staff in western Iran. First, the existing questionnaires were reviewed, and questions were designed. This questionnaire consisted of 7 main sections and a section entitled "Suggestions for improving lighting". The validity of the questionnaire was determined based on expert comments and the CVI index. Its reliability was assessed by completing the questionnaire by hospital staff. Cronbach's alpha coefficient has used to estimate the internal consistency of the questionnaire. The degree was calculated of correlation between the sections of the questionnaire separately. SPSS24 for statistical tests was used. According to the North American Society of Lighting Engineers (IESNA) standard, artificial lighting was measured by a calibrated HAGNER lux meter. The correlation was assessed between light evaluation in hospital wards and questionnaire score by Pearson correlation coefficient and ANOVA test.

Results and Discussion

The Cronbach's alpha coefficient and CVI value of the questionnaire were estimated to be 0.901 and 0.97, respectively. Table (1) shows the Cronbach's alpha for each questionnaire area.

Table 1: Results of validity of the subjective assessment questionnaire

Questionnaire areas	**Cronbach's alpha**
Quality of general artificial lighting in the workplace	0.881
Lighting quality of lights	0.758
The quality of local lighting	0.696
Natural light quality	0.974
Effects of lighting on employee performance	0.882
Visual tiredness	0.926
Safety and ergonomic effects	0.746

The minimum and maximum local illuminances were 55.67 and 980.80 lux, respectively. The minimum and maximum scores were given to the questionnaire were 30.39 and 100. None of the healthcare workers reported poor visual comfort status, 8.9% reported moderate visual comfort status, 58.9% good visual comfort status, and 32.2% had excellent visual comfort status.

72.8% of the workstations had good lighting, and the results of the questionnaire evaluation in these stations showed good and excellent lighting conditions. The results of the Pearson correlation test showed a significant positive relationship between the mean score of the lighting status obtained from the questionnaire and the illuminance measured at the workstations ($P = 0.001$, $r = 0.716$).

The result shows that the presently designed questionnaire with 29 main questions has good validity and reliability. The reliability of the questionnaire was also confirmed in a statistical sample, including the staff of a hospital. The questionnaire designed by Dianat et al. In the field of subjective assessment of lighting in hospitals had a good internal correlation with the results of this study. Objective and subjective evaluations of lighting comfort conditions performed in classrooms at a university in Italy showed that the average amount of illuminance measured was highly correlated with the visual comfort perceived by users.

The results showed that the minimum level of satisfaction of staff related to natural light in the hospital and then dissatisfaction with the effect of light on performance. One of the reasons for staff dissatisfaction with the natural light situation is the lack of windows and the use of windows with insufficient height. The results show also that people are dissatisfied with light shadows on their work surface, indicating a non-standard design and unsuitable lights in the lighting system.

An expert assessment of the lighting condition at all stations where staff have reported moderate lighting conditions indicates an undesirable condition, and the lighting condition was comfortable in all the stations where the users reported the condition very well. Therefore, this questionnaire can show some of the existing lighting problems.

In the lighting suggestions section, the maximum score was given to cleaning the lights, replacing the burnt lights, and combining artificial light with daylight.

This study, like other studies, had some limitations, such as non-cooperation in completing the questionnaire. Given that this questionnaire was evaluated in a hospital in western Iran, its results may be different in other target communities.

Conclusion

The designed subjective lighting assessment tool had good validity and reliability. This questionnaire is recommended to assess and improve the lighting of the hospital working environment due to the simplicity, inclusion of different aspects of lighting comfort, and solutions to improve the lighting system.

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