

Research Article

Study of compliance to prescribed lighting standards in hospitals of Delhi NCR, India

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ABSTRACT

Background: An adequate level of lighting is essential for clinical, diagnostic and other processes in hospitals. This study has been conceptualised to assess the existing lighting standards in Indian hospitals. Carefully designed lighting can transform the appearance of a space, making it attractive, welcoming and either restful or stimulating depending on the effect created. It can enhance the architectural appearance of the space and contribute to orientation and way finding.

Methods: Select hospitals of Delhi NCR were visited and the existing level of luminance in various areas of the hospital were recorded and analysed against prescribed National and International standards. The existing lighting standards in different areas of the hospital were assessed against the prescribed Indian standards given under National Lighting Code 2010 of India (2) and IS 4347: Code of practice for hospital lighting in India.

Results: There has been a gap in the existing and prescribed lighting standards in all the hospitals considered in this study. This study revealed that none of the Hospital was having 100% compliance to the prescribed lighting standards. The best compliance was with hospital 'A' (56.5%), which is a private Corporate Hospital and worst with hospital 'E' (8.7%), a govt. hospital. The areas where compliance was highest was OT complex (100%) and circulation areas (60%) while service areas have least compliance rate (20%), with only hospital 'A' having 50% compliance and others having 0% compliance. As far as wards are concerned, 80% of the Hospitals adhere to the prescribed lighting standards for general lighting and lighting at nursing station, but none of the hospitals adhere to the prescribed lighting standards for patient examination, reading lights for patients and night lighting. At the entrance 100% hospitals adhere to the prescribed lighting standards. The major reason cited by the concerned hospital authorities was the unawareness on the prescribed lighting levels and standards.

Conclusions: Major conclusions drawn from this study are there are identified gaps in the existing lighting standards in the Hospitals and the recommended lighting levels and standards. Compliance to lighting standards in Indian Hospitals range from 8.7% to 56.7%, with majority of the hospitals in the range of 26% to 35%. There is an urgent need to sensitise the environment regarding recommended lighting standards.

Keywords: Lighting in Hospital, Illuminance, Lux

INTRODUCTION

Lighting is of critical importance in hospitals. An adequate level of lighting is essential for clinical, diagnostic and other processes in hospitals. Lighting also has an important impact on operational cost of the Hospital. Carefully designed lighting can transform the appearance of a space, making it attractive, welcoming and either restful or stimulating depending on the effect created. It can enhance the architectural appearance of the space and contribute to orientation and way finding.

Provision of a good lighting system calls for co-ordination from the initial stages among the various parties concerned, namely, the architect, the medical consultant and the illumination engineer. Therefore, it is essential that information regarding lighting should be exchanged between the parties from the stage of planning to installation.

Though various developed countries including US and UK have formulated standardized guidelines for lighting in Hospitals but as far as India and other developing countries are concerned there are no specific guidelines pertaining to lighting in Hospitals. There is some mention regarding 'Hospital Lighting' in IS standard 4347 for Code of practice for hospital lighting in India and National Lighting Code 2010 of India, but these are no sufficient for hospital planners and architects to provide specific lighting solutions in the hospitals.^{1,2} This study was conceptualized to study the existing level of compliance to the prescribed lighting standards, with an aim to identify the existing gap, if any, so that necessary remedial measures can be instituted.

METHODS

To assess the existing lighting standards of select hospitals in Delhi NCR and to recommend good lighting practices and systems for Indian hospitals. Govt and private corporate Hospitals of Delhi NCR, having a bed compliment of more than 700 were selected for this study. Five Hospitals, including two from Public Sector and three from Corporate Sector in Delhi NCR were selected studied from Jan 2016 till Mar 2016.

Direct observation by the principal investigator. The existing lighting standards in different areas of the Hospital were assessed against the prescribed Indian standards given under National Lighting Code 2010 of India and IS 4347: Code of practice for hospital lighting in India.^{1,2} The existing lighting standards in these hospitals were tabulated and analysed. Various International guidelines including National Lighting Code (USA) Article 517, specific requirements for healthcare facilities, lighting and colour for hospital design R and D report year 2004 Status in Wales (UK) and Energy Conservation Building Code (ECBC) were also referred.³⁻⁵

RESULTS

Existing level of adherence to the prescribed lighting standards was recorded and tabulated in Table 1. Day lighting factor in different hospital areas was studied against the prescribed standards as per IS standard 2440:1975 Bureau of Indian Standard is a guide for Day-lighting of Buildings 1975. The results have been tabulated in Table 2.

Compliance to the prescribed lighting standards of each Hospital was calculated by taking the average of areas where prescribed lighting standards have been adhered. The results have been tabulated in Figure 1.

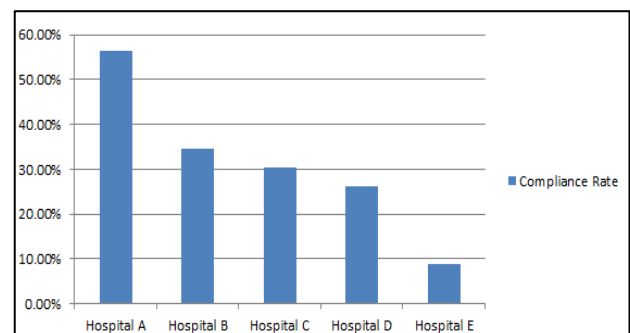


Figure 1: Compliance rate in different hospital.

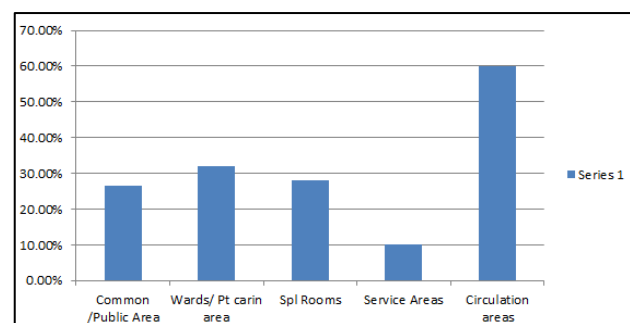


Figure 2: Compliance rate in different areas.

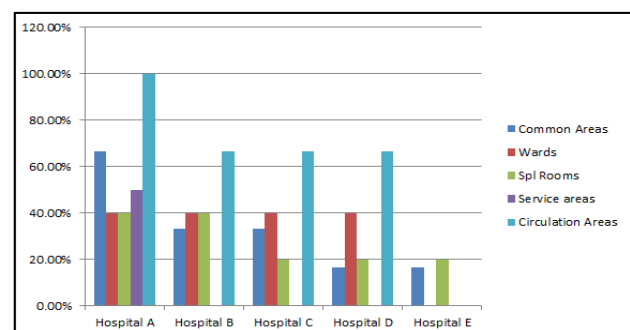


Figure 3: Compliance in each area of a particular hospital.

Compliance rate in different areas of the hospital were calculated by taking the mean of different Hospitals. The

results have been tabulated in Table 4, Figure 2. Data of each hospital was also analysed to find the compliance in

each area of a particular hospital. The results have been depicted in Figure 3.

Table 1: The existing lighting standards in the hospitals assessed in this study.

Hospital Area		Recommended level of lighting	Hosp A	Hosp B	Hosp C	Hosp D	Hosp E
Common / public areas	Entrance	200 Lux	√	√	√	√	√
	Reception	300 Lux	√	X	X	X	X
	Atrium	100 Lux	X	√	X	X	X
	Waiting areas	200 Lux	√	X	X	X	X
	Toilets	200 Lux	X	X	√	X	X
	Exit signage	5 Lux	√	X	X	X	X
Wards/ Patient caring areas	General lighting in wards	100 Lux	√	√	√	√	X
	Reading lamps	200- 300 Lux	X	X	X	X	X
	Examination lighting	500-750 Lux	X	X	X	X	X
	Night lighting	5 Lux	X	X	X	X	X
	Nursing station	200-300 Lux	√	√	√	√	X
Lighting for special rooms	OT	8000 to 100000 Lux	√	√	√	√	√
	Recovery room	400 Lux	√	√	X	X	X
	MRI centre	100 lux	X	X	X	X	X
	Ophthal dept	300- 1000 Lux	X	X	X	X	X
	Delivery suit	750-1000 Lux	X	X	X	X	X
Service areas	Manifold	300 Lux	√	X	X	X	X
	CSSD and laundry	200 Lux	X	X	X	X	X
	Kitchen	200 Lux	√	X	X	X	X
	Mortuary	100-1000 Lux	X	X	X	X	X
Circulation/ Other common areas	Corridors	100-200 Lux	√	X	X	X	X
	Stairs	100 Lux	√	√	√	√	X
	Lifts	100 Lux	√	√	√	√	X

Table 2: Day light factor in different hospitals.

Hospital Area	Recommended Day Lighting Factor	Hosp A	Hosp B	Hosp C	Hosp D	Hosp E
Entrance	1.25-2.5%	√	X	X	√	X
Atrium	2.5%-3.75%	√	√	√	X	√
Corridors	2.5%	√	√	√	X	X
Wards	1.25%	X	X	X	X	X

Day light factor of 1.25%= 100 Lux.

From the analysis of the data inference were drawn that none of the hospital was having 100% compliance to the prescribed lighting standards.

The Best compliance was with Hospital 'A' (56.5%), which is a private Corporate Hospital and worst with Hospital 'E' (8.7%), a govt Hospital. The areas where compliance was highest was OT complex (100%) and circulation areas (60%) while service areas have least

compliance rate (20%), with only hospital 'A' having 50% compliance and others having 0% compliance.

As far as wards are concerned, 80% of the hospitals adhere to the prescribed lighting standards for general lighting and lighting at nursing station, but none of the hospitals adhere to the prescribed lighting standards for patient examination, reading lights for patients and night lighting.

At the entrance 100% hospitals adhere to the prescribed lighting standards. The major reason cited by the

concerned hospital authorities was the unawareness on the prescribed lighting levels and standards.

Table 3: Compliance rate in different areas.

Hospital Area	Overall compliance rate of different Hospitals
Common/Public areas	26.7%
Wards/Patient caring areas	32%
Lighting for special rooms	28%
Service areas	10%
Circulation/Other common areas	60%

Table 4: Compliance rate in each area of a particular hospital.

Hospital	Common Areas	Wards	Spl Rooms	Service areas	Circulation Areas
Hospital A	66.70%	40%	40%	50%	100%
Hospital B	33.30%	40%	40%	0%	66.70%
Hospital C	33.30%	40%	20%	0%	66.70%
Hospital D	16.60%	40%	20%	0%	66.70%
Hospital E	16.60%	0%	20%	0%	0%

DISCUSSION

Various national and international guidelines were studied and salient features identified from reviewing of these policies are as follows that there should be adequate day-lighting factor in different hospital areas.⁶ Issues to be considered while planning the lighting installations are, task illumination, lighting appearance, architectural integration and energy efficiency.¹ The Hospital can be divided into five major areas for consideration of lighting requirement, public areas, patient caring areas, special rooms, service areas and circulation areas.^{2,3} Efficient lighting not only plays an important role in early recovery of patients but also improves the staff performance.^{7,8} Due emphasis should be given to energy conservation in Hospital as Hospitals are high energy consuming buildings because they are 24x7 operational and there are specific lighting and HVAC requirements.⁵ Hospital planners should emphasis on installation of Intelligent Building Management Systems (IBMS) because IBMS is the key to 'intelligent buildings', equipped with a variety of monitoring devices and control systems, both automated and manned. Together they help regulate a long array of building services and utilities.⁹ Latest concepts in hospital lighting that are followed in modern day hospitals: harvesting of day lights, maximum use of LEDs and use of Dimming and scheduling of Lights.^{10,11} In hospitals, a properly-designed visual environment, with the appropriate use of colour and lighting, will have important benefits. It can make the hospital experience more pleasant for a wide range of users from the elderly to the very young.⁴ Day lighting factor in public areas and circulation areas was 1.25 to 2.5%, though it is much less

than the desired value of 1.25% in wards. Day light has a very important role in healing and early recovery of patients but in spite of it majority of the hospital ignore this important planning and design criteria due to the ignorance and lack of expertise in medical architecture.^{7,12} Studies have shown improved patient recovery rates, linked to aspects such as window provision and appropriate lighting. This in turn boosts overall hospital productivity and staff retention in environments which are uplifting.^{7,8} Artificial lighting level in atrium are much more in spite of having sufficient day lighting factor, because of non-availability of automatic lighting controls. Energy Conservation Building Code (ECBC) guidelines of Bureau of Energy Efficiency (BEE) recommends for automatic time scheduling and daylight sensing controls for lights in hospitals, but more often this important aspect is being overlooked, which leads to unnecessary wastage of energy and add to the running cost of the hospital.⁵ Compliance to artificial lighting in public areas and circulation areas, especially at the entrance is quite high, to improve the physical appearance of the hospital building but the concept of task illumination and energy conservation by means of installing scheduling devices is found lacking in majority of the hospitals.^{2,3,5} General lighting level and lighting at nursing station in wards was adequate but there was no provision for examination and reading lights. The illuminance level at night was much more than the desired level of 5 Lux. which adversely impacts the sleep pattern of the patients.⁷ Lighting level are adequate in OT complex in almost all the hospitals as there are specific and well laid down guidelines for Hospital architects and administrators but due emphasis

to lighting was not given in other special rooms like delivery suits, MRI centre and ophthalmology examination rooms.^{12,13} Worst compliance to prescribed lighting standards are seen in support service areas like dietary services, manifold rooms, mortuary, laundry etc. Only one hospital out of the five under this study was adhering to the prescribed lighting standards for service rooms. The biggest misconception among hospital planners is that the lighting requirement for support services are similar to a normal building and finer details like installing downward light for task illumination on pressure gaze in manifold and laundry, task illumination of meat cutting block etc are never being considered. Non adherence to these specific details can have a catastrophic effect and can adversely affect patient and staff safety. The existing lighting levels in different areas of 'Hospital A' are similar to what has been observed in the study of healthcare facility done by OSHPD in Los Angeles in 2009.¹¹ Which shows that though adequate emphasis is being given to lighting standards in OT, wards and public areas but finer details like reading lamps for patients, examination lights, night lights etc are often overlooked due to ignorance. Average compliance to artificial lighting level as evident from this study, ranges from 26% to 35%. Compliance levels are similar to what has been observed in majority of the Indian Hospitals as mentioned in National lighting Code 2010.² Major reason cited by hospital authorities for non-adherence to the prescribed lighting standards is lack of knowledge. There are no specific lighting requirements for accreditation from JCI or NABH.¹⁴ Thus the hospital authorities overlooks this important aspect of hospital planning and design criteria. Adherence to the laid down norms for lighting can not only improve the clinical outcome, but can also reduce the running cost of the hospital, by bringing down the power consumption drastically.

CONCLUSION

Major conclusions drawn from this study are there are identified gaps in the existing lighting standards in the Hospitals and the recommended lighting levels and standards. Compliance to lighting standards in Indian Hospitals range from 8.7% to 56.7%, with majority of the hospitals in the range of 26% to 35%. There is an urgent need to sensitise the environment regarding recommended lighting standards. The salient features of various guidelines and standards on lighting in the hospitals, which have been identified through this study, should be considered by Hospital Administrators and Medical Architects before planning a new healthcare setup. These lighting standards should be circulated in the environment for strict compliance. Hospital planners and Medical administrators must consider the

recommendation of National Lighting Code 2010, BIS 4347 and the Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency (BEE). Before planning a healthcare facility.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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