5.6 Healthcare

Techniques

General

The lighting of healthcare spaces presents one of the most difficult tasks for any lighting designer, lighting both for an enormous range of tasks, some times requiring extreme levels of visual performance and yet creating a space that satisfies today's energy requirements and just as importantly the comfort needs of the patients, staff and visitors. The choice of lighting can affect task performance, well-being and whether patients and visitors feel the space is clean and safe. The information given below is in two sections, the fundamental requirements for lighting for healthcare and lighting requirements for specific locations.

The fundamental requirements for lighting for healthcare could be as follows:

Cleanliness

Infection control is of prime importance in all healthcare buildings. Airborne particulates as small as 0.5μm can transfer harmful bacteria. In addition, transmission by the touch of a hand can add to the spread of infection. In lighting terms we need to defend against this by using luminaires that have the minimum area of horizontal or near horizontal surfaces on which dust may collect. All luminaires that could collect dust or be touched by hand should be designed to be easily cleaned.

In areas of high infection risk, luminaires with only downward and vertical faces or those specifically designed for clean environments. Such luminaires will utilise materials impervious to bacteria, and also designed with suitable ingress protection for dust and moisture both into the luminaire and from the ceiling void through the luminaire into the clean space.

Daylight

Research shows that daylight and window view can have positive effects on patients, their sleep patterns, circadian rhythms and recovery rates form many illnesses. Thus it is common practice for modern spaces to include good daylight design. Given that good levels of daylight should be expected in areas for treatment, administration, waiting, circulation and overnight stay, the use of lighting controls offers not only added comfort but also impacts heavily on energy. The addition of lighting controls can allow for changing tasks, changes in daylight and add levels of user comfort to a space.

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Fields of view

Remember that the field of view in many healthcare spaces may include the ceiling and upper walls and often may include luminaires. The point of view of a recumbent patient will need to be thought about to limit discomfort glare in many circulation and treatment spaces.

Colour

Skin tone and eye colour in many healthcare establishments are often important in diagnosis. This is extended to include flesh and other colours during invasive treatments. Hence the ability of light sources to render true colours is vital in all areas where diagnosis and treatment is carried out, and a consistent, high quality source of colour rendering should be provided. All lamps within these areas should have an Ra of at least 90.

In other spaces where diagnosis and treatment is not carried out colour rendering can be relaxed to an Ra of 80, but on no account should lamps of different colour rendering be mixed in the same space.

The other aspect to colour is that of colour temperature. Common practice is to use 4000K lamps in all healthcare spaces, but in areas where there is a wish to provide a more homely feel, the colour temperature may need to be matched to that prevalent at home, for example nearer 2700K for the UK. Similarly different colour temperatures should not be mixed in any one space.

Emergency lighting

Emergency lighting is required for the movement of patients, staff and visitors to a place of safety. In certain healthcare buildings the emergency lighting will need to take account of tasks that have to continue even when other spaces may be evacuated, this is called Standby lighting. In critical areas, such as operating theatres, delivery rooms and high dependency units, the illuminance provided by the standby lighting should equal 90% of the normal mains illuminance or there about. Other important tasks but in non-critical areas will require standby lighting generally to 50% of the normal level.

Some patients will almost certainly be physically or mentally incapacitated. In this case it is likely that the condition of patients will mean it is difficult to evacuate them in an emergency. Emergency lighting for these situations should be sufficient to allow progressive evacuation, or to allow time at points of refuge. Apart from the above emergency lighting should be designed to meet the requirements of EN1838.

A generator will generally supply standby lighting and special account of the changeover and run up time will be needed. Escape routes generally will be covered by luminaires with integral emergency control gear.

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Light for comfort

Recent research shows strong links between good lighting, the colour of light and human comfort. For instance warm colour temperatures make patients look healthier and improve patient moral, but care must be taken to prevent compromising the ability for clinical diagnosis.

Recent research also indicates that light therapy may have potential for improving the quality of life for elderly people. The reception of blue light decreases with age due to the aging of the eye reducing its efficiency, especially at the blue end of the spectrum. Also in the elderly the reduction in mobility and tolerance of adverse weather (such as cold, wind and rain) mean elderly people experience a reduction in ability to go out of doors. Therefore they receive less exposure to bright light, and especially bright light of the correct wavelengths. Additionally the circadian functions may be compromised through age and damage caused by small strokes. All of these result in poor quality of sleep. Light therapy may be used to help improve sleep quality, using both artificial light and by designing the environment to aid access to natural light and to make the outdoor environment more attractive and friendly. However the use of blue biased white light for health is still a relatively new concept with limited knowledge on benefits and potential side-effects so at present blue biased white light should be used sparingly and with care.

Artificial lighting should incorporate features to help provide sufficient light during waking hours for health benefits, but during the night only provide minimum light for safety, preferable amber, orange or red in colour, to preserve the bodies sleep cycle. Importantly, the consequences of any artificial lighting on the carers should be carefully considered to prevent further problems.

Colour and reflectance

High reflectance materials are required to give visual lightness, otherwise the surface and hence the space itself will appear dark. Equally areas of strong colour, such as murals in children's wards, will need to be well lit to give full vibrancy.

High chroma colours will affect clinical diagnosis – Grey is a good, if boring, clinical background and has been shown to relax and reduce stress. But the effect of surface colour can be immense, not only in terms of reflected light but also energy efficiency and wellbeing. For instance colour should be chosen to flatter the patients appearance, soft lighting enhances this. Also consider colour psychology e.g. Use of blues and green (used for calming effect in mental health institutions) may actually exacerbate depression, the modern fashions (greys and browns) may be under stimulating for long-term patients.

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The lighting requirements for specific locations could be as follows:

Entrance canopies

It is important that entrances are clearly lit to advertise the way into the building whilst providing sufficient light for the task perhaps including driving, unloading ambulances, access for wheel chairs, and so on.

Lighting solutions should provide good vertical illumination avoiding down lights with harsh cut-offs. This will provide good facial recognition for CCTV.

Entrance halls, waiting areas and lift lobbies

Lighting here should emphasise points of interest such as reception desks, signage and onward routes.

Where there are a number of routes to different departments signage may take the form of coloured lines, flooring or other decoration, the lighting should enhance this where ever possible

Reception

These areas, including enquiry and patient reception, should make the patient and visitor feel welcome and provide both staff and visitors with good facial modelling through good vertical illuminance.

Staff here will often have to use computer display screens, but the emphasis on this should never out weigh user comfort. An approach focused on the many tasks and points of view is important.

Hospital streets and other circulation routes

Hospital "streets" form the major links between clinical departments with smaller corridors often running off to other areas. Streets will have relatively high use and will be wider and often higher than conventional corridors. In many corridors, certainly those in areas occupied by patient's overnight, the lighting will require dimming or switching to a lower level at night. This is can be achieved either through dimming or switching, care being needed to maintain uniformity above 0.2.

Where there is sufficient daylight savings can be made using daylight linked dimming controls.

Spill light and glare to patient rooms and to trolley bourn patients must also be considered, the latter being achieved through asymmetric luminaires mounted along one side of the corridor.

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Ward corridors need specific night lighting techniques to allow safe movement of staff without affecting patient rest. The lighting near the doors to bedded wards will require careful illuminance and luminance control. Three hour self-contained emergency lighting is needed on all escape routes.

Stairs

Stairs require careful lighting and tread colour design to ensure the tread is clear to all users including those with visual disability. Treads need clear and reasonably uniform lighting with some element of contrast to the riser.

Glare from wall-mounted fittings should be limited by using lower brightness light sources, whereas soffit mounted luminaires often create installation and maintenance problems.

Stairs will need careful emergency lighting.

WCs, washrooms and changing areas

Lighting should be sympathetic avoiding harsh directional light or shadowing.

Lighting should be positioned for lockers, mirrors sinks and make up areas with the task, facial modelling and veiling reflections in mind.

In wet or humid environments the lighting should be of a suitable ingress protection, normally IP54 or better.

Lighting of bedded areas

The general lighting must be adequate for the care of the patients by the nursing staff. For these duties to be performed efficiently the illuminance inside a curtained bedded area should be no less than 300 lux from a combination of ambient and task lighting and the illuminance in the central space between the bed foot rails should be not less than 100 lux (75 lux when all curtains are closed), measured at floor level. Good glare control is needed with UGR limited to 19. However, note that in some countries additional luminaire luminance limits are also specified.

The balance of brightness and colour of the surroundings should help to provide a visually pleasing interior. To achieve this the reflectance of the major surfaces should be of the order of 0.7 for the ceiling, 0.5 for the walls and 0.2 for the floor, though higher ceiling and wall reflectance is essential when lighting the ward from the bed head position.

Suspended luminaires: The ceiling height for suspended luminaires should not be less than 3m to ensure adequate clearance for mobile apparatus used at the bedside. The mounting height above the floor should not be less than 2.7m nor greater than 3.5m.

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Ceiling mounted luminaires: The ceiling height may be 3m or less. In areas with ceiling heights between 2.4m and 2.7m, it is possible to provide the recommended illuminance at the bedhead only by using ceiling mounted luminaires.

Wall mounted luminaires: Modern lighting systems comply with the general recommendations using only semi direct wall mounted luminaires with fluorescent lamps. The most suitable height for wall-mounted luminaires is a minimum of 1.7m.

Recessed and semi-recessed luminaires: Recessed and semi-recessed luminaires may be used in ceilings between 2.4m and 3m high. If these luminaires will not provide the illuminance required at the bedhead a dual system will be required.

Dual systems: For dual systems in which supplementary lighting along the side walls of the bedded area is used, ceiling mounted luminaires may still be suitable.

Reading lights/examination lighting: The patient's reading light is required to give 300 lux directly on a task area in front of the patient. Staff or nursing tasks at the bedhead can also use the reading light. If treatment is given at the bedside requiring an illuminance exceeding 300 lux, either a mobile examination luminaire is required or the reading light is to be designed to provide this illuminance by switching. Hand-held switches, if used, should be of the extra low voltage type. Reading lights are usually provided for all beds in hospitals, but it may be undesirable to have them within easy reach of children and mentally ill patients. For such circumstances, high-level wall or ceiling mounted luminaires should be used and the switches should be out of the patient's reach.

Night lighting: Night lighting is required to provide enough light for safe movement of patients and staff. It should not disturb lightly sleeping patients. The luminance of any luminaire left on during the night should not exceed 30 cd/m^2 as seen by patients from their beds, the cut off angle being 20° within the curtained area and 35° in central zones. The illuminance for the circulation space should be an average 5 lux on circulation spaces, 0.85m off the floor and a maximum of 10lux. The illuminance on the bedhead should not exceed 0.5 lux

Watch lighting: The purpose of watch lighting is to allow continuous observation of a particular patient after the general lighting has been switched off, without the disturbance, which would be caused by the patient's reading light. An illuminance of 15-20 lux is adequate.

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Nurses' stations and staff bases

Nurses' stations provide for a number of tasks including dispensing medicine, ad hoc meetings, greeting visitors and PC use. Lighting should allow for all these tasks both during the day and at night. To do so will require lighting that has good luminance control both to reduce glare to PC users and patients sleeping nearby.

Dimming control is essential to allow staff to reduce the illuminance at night.

Operating Theatres and associated clinical spaces

Lighting here needs to provide for clinical examination, preparation, treatment and movement, this will include good vertical illuminance from the ambient lighting. The theatre surgical lights are specialist and should be provided as part of the overall theatre equipment.

Lighting colour rendering and temperature should be chosen for clinical diagnosis rather than energy efficiency.

In an emergency all lighting should be retained at full brightness.

Lighting also needs to provide good uniformity, be dimmable to suit the surgical need and take account of the high number of monitoring screens, often using negative polarity displays.

Luminaires chosen for these spaces must be easy to clean and maintain and should have an IP rating of 65 from below and 54 or better from above.

Ancillary areas & other specialist spaces

Healthcare buildings contain many ancillary areas to do with the efficient and safe functioning of the whole building. Many of these are covered elsewhere, but special care may need to be paid to protecting healthcare environments from hospital bourn diseases. Improved IP ratings or luminaires suitable for regular wash down and cleaning may need to be considered.

In specialist treatment and examination rooms not mentioned above there may be other requirements too, such as dimming and glare control in ophthalmic rooms, noise and EMC control in scanner and audiology and electromedical screening rooms.

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Schemes

Healthcare rooms

Scheme: 4-bed ward, 7.6m x 6.6m x 2.7m
Luminaire(s) used: Bedhead mounted uplight and reading light
Ward floor: E_{av} = 141 lux ; E_{min}/E_{av} = 0.68

Scheme: Consulting room, 8m x 3m x 2.7m
Luminaire(s) used: 3 Diffusalux Hospital 2x35W T16
Desk height: E_{av} = 440 lux ; E_{min}/E_{av} = 0.7

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Lighting in hospital wards may use bed head luminaires with integrated services such as oxygen, electricity, etc. or ceiling mounted luminaires (either surface mounted or recessed). The advantage of a bed head luminaire is the flexibility of lighting, with uplighting supplying ambient light to the ward, and differing amounts of down light allowing a patient to read or a doctor to examine the patient. An additional advantage for bed head systems is ease of access for maintenance and cleaning.

Ceiling mounted luminaires allow easier centralised control of lighting by nursing staff and may be a more energy efficient solution as, unlike bed head systems, they do not rely on uplight being reflected from the ceiling to give ambient lighting to the room. When using ceiling recessed lighting it is important that it is planned in conjunction with other services to ensure a clear space in the ceiling void for the luminaire.

Corridors and circulation areas should be well lit and airy. Ideally ceiling mounted lighting should avoid the centre of the corridor as recumbent patients being wheeled along the corridor should not be looking directly into a luminaire as this may be glaring, and looking into luminaires whilst travelling down the corridor may create an unpleasant flicker effect.