

Best practice in using lighting within hospitals: now and in the future

LDH Health & Well-Being Paper 1

March 2009 - Page 1

Evidence-based research provides some ideas for designing the perfect healing environment but it is vital that more creative thought is applied to the design Process

The impact of the environment on health has been a concern to healthcare providers at least since the time of Hippocrates.(1) The inimitable Florence Nightingale was also voluble on the subject: "No ward is in any sense a good ward on which the sick are not at all times supplied with pure air, light, and a due temperature. These are the results to be obtained from hospital architecture and not external design or appearance"

Many factors influence the designed environment in 21st Century Healthcare. Most European countries health systems are rooted in the theoretical principle that healthcare is a fundamental human right and a key part of a civilised society . Taking centre stage in the direction of developments is the power of the consumer/patient. For example, some 7 million Britons have private health insurance and another 6 million have private health cash plans. In 2003 300,000 patients chose to self-fund for acute surgery without health insurance.(2) Patients therefore have the ability to make a choice about where and from whom they should be treated. Hand in hand with the ability to pay for services is also increased expectation and awareness; the internet enables patients to research for themselves; to know that improved environments will make them heal faster (3-5) ; that a view will improve their recovery(6-7) that enough daylight could literally be the difference between life and death (8) and possibly know that control over their environment will probably reduce stress and help them to get out of hospital more quickly (5).

Other factors that influence the design choices within modern and refurbished hospitals include:

- Emphasis on patient centred environments and care. Continuing research and positive proof of the financial benefits of designing truly therapeutic environments improving patients' environments. (because patients get better faster) New EU & UK legislation and government funded research and guidelines for healthcare design professionals.
- Exponential advances in Technology and

related increase in academic research projects into the effects of light on our bodies.

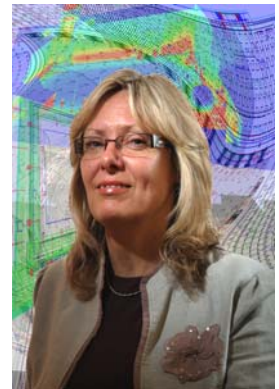
- Sustainability; Increasingly stringent "green" regulations; public awareness of the importance of energy efficiency; spiralling cost of energy

What this means for hospital environments and the provision of care

Good environments make us feel better, and feeling better is the key to getting better. Even though many environmental designers would say that it is impossible to define a clear set of objectives for answering the subjective needs of patients, staff and visitors to hospitals, from hugely variable backgrounds, with different philosophies, different cultural needs, different spiritual needs, international environmental design academics have devoted thousands of hours to the subject.

In the UK, Sheffield University has produced two excellent tools – "I.D.E.A.S – Inspiring Design Excellence and Achievements" and "A.S.P.E.C.T. - a staff and patient environment calibration tool". These documents assist healthcare and design professionals in assessing their designs and proposals against an extensive list of potentially beneficial design criteria. Their research shows that not only comfortable conditions but the ability to control levels of comfort for yourself may be very important in reducing stress. Allowing patients control over their environment is thus important and may also reduce demands on staff, particularly nurses.

For the lighting designer and architect this means ensuring that there is a variety of artificial lighting patterns appropriate for day and night and for summer and winter; that patients and staff can easily control the artificial lighting and patients and staff can easily exclude sun light and day light. There is also a Section dealing specifically with the interior design of healthcare buildings and in particular what they look like. Although this section is probably one of the most subjective of all the sections in ASPECT never the less the statements included here relate to research



Mary Rushton Beales
IALD
Creative Director
Lighting Design House

Lighting Design House
380 Great West Road
Hounslow
Middlesex
TW5 0PB
UK

Best practice in using lighting within hospitals: now and in the future

LDH Health & Well-Being Paper 1

March 2009 - Page 2



Image 1. The atrium of the "Heart of Hounslow" healthcare centre; Architects Penoyre & Prasad for "Building Better Health"

References

1. Hippocrates. *On airs, waters, and places*. Adams F, trans.
2. Evans T. A healthy market? *Public private realities in health-care: an analysis of European hospitals*. Stockholm Network, 2007.
3. Ulrich RS. How design impacts wellness. *Healthc Forum J* 1992;35(5):20-5.
4. Altimier LB. Healing environments: for patients and providers. *Newborn Infant Nurs Rev* 2004;4(2):89-92.
5. Lawson B. *Evidence-based design for healthcare*. Business briefings, 2005.
6. Ulrich, Lunon & Eltridge. Prolonged exposure to natural views not only helps to calm patients, but can also have positive effects on other health outcomes and shorten recovery periods; 1993.
7. Ulrich RS. View through a window may influence recovery from surgery. *Science* 1984;224(4647):420-1.
8. Beauchemin KM, Hays P. *Dying in the dark: sunshine, gender and outcomes in myocardial infarction*. University of Alberta, Edmonton, Canada.

evidence. Of key interest to the lighting designer are that the interior should feel light and airy, there should be a variety of colours, textures and views and Ceilings are designed to look interesting.

There is also emphasis that a health-care building should make good provision for staff to lead their personal lives as well as perform their professional duties. Of particular relevance to the lit environment are the provisos that staff should have convenient places to concentrate on work without being on demand and they can rest and relax in places segregated from patient and visitor areas.

There is also emphasis on maximising natural light into the buildings both for energy saving and health benefits; related to this is of course the need for a view and the importance of placing as many patients as possible near a window. Image 1 shows the atrium of "Heart Of Hounslow" healthcare centre – a great example of using daylight effectively. Many of these concepts are rationalised and discussed in the excellent update of L2 Lighting for Hospitals and Healthcare (9) published in May 2008 by the Society of Light and Lighting.

The effect of light on our bodies.

Light is not just important for vision. It is also a physiological human necessity with a huge impact on our health. The therapeutic value of light has been recognized for thousands of years. According to Florence Nightingale

"Direct sunlight, not only daylight, is necessary for a speedy recovery" The diurnal cycle of night and day and the spectral properties of light are essential to the regulation of stress and fatigue as well as a range of physiological functions.

Over the last 25 years the type and capabilities of light sources have increased and improved dramatically.

In tandem with this huge increase in choice scientific research into the potential benefits/negative effects of light quality, light distribution and the relationship between our body clock and brightness levels has been revealed.

In 2001 a "new" photoreceptor in the eye was discovered that has nothing to do with vision and everything to do with hormonal regulation of the body. (10) Scientists found a set of cells in the retina that were neither rods nor cones which respond to wavelengths of light – 480–540nm – the blue end of the visible spectrum. Among other functions they regulate production of melatonin/serotonin; an incorrect balance of these hormones is related to seasonal affective disorder.

Following on from this discovery, several studies appear to show that use of low levels of blue light – mostly from Light Emitting Diodes – are more effective than the more common approach of blasting the eye with 5,000–10,000 lux at suppressing melatonin and reducing the impact of SAD. (11)

Best practice in using lighting within hospitals: now and in the future

LDH Health & Well-Being Paper 1

March 2009 - Page 3

Related research has shown a correlation between irregular circadian rhythms, exposure to light at night, shift workers and increased propensity to breast and prostate cancer. The World Health Authority issued a press release in December 2007 (13) that defined shift work leading to irregular circadian rhythms as a probable cancer cause.

In hospital interiors the use of variable light levels and cooler colour temperatures of white light during the day and warmer light at night has been pioneered by BDP Lighting, with the first example at Brighton Children's Hospital. Martin Lupton, director of BDP Lighting, comments: "We used dawn simulation integrated into the bed head with a 17,000K lamp to provide a soft "wake-up" experience for the patients with the hope that this would also have a positive effect on circadian rhythm and melatonin levels in winter months and for patients not able to experience normal levels of day-light."

Looking at research into the effect of light on our bodies, it seems fundamental to health that our bodies need the dark and/or certain wavelengths of light to promote healing. Nobel prize winner Finsen put patients with smallpox in rooms with red glass in the windows, which reduced their scarring. Melatonin is also regarded by many as the body's natural healer for many conditions, including cancer.

This recent research must surely lead to careful reconsideration of the night-time lit environment in hospitals for patients and nursing staff – as even low light levels containing the cooler wavelengths of light could begin to disturb circadian rhythms.

Sustainability

The long operating hours of hospitals and the need for maintenance that does not disturb patients has always had a "common sense" influence on the choice of lighting techniques and light sources. The gradual implementation of the EU standards of energy efficiency and the rising cost

of energy combine to make high light output, low energy consumption and long light source life essential components in developing lighting design of any environment, especially hospitals. Combined with a definite need for lighting control, light sources that have come to the fore are:

- 16mm diameter, high-colour rendering, low-mercury fluorescent tubes.
- The top end of the light-emitting diode revolution.

The future

You can't expect evidence based research to provide all the answers for designing the perfect healing environment and luckily enough market forces are providing impetus for imaginative approaches to healthcare.

Who wouldn't want to go to the hospital of the future – as envisioned by the Philips group? Here you are woken gently by the gradual increase in light and natural sounds; you can communicate with your family via a video link from your bedside; your physician explains your operation using a holographic projection; you can rest in a womblike space and see the child in your womb projected on the screen. And, should you be unlucky enough not to have a real view, you can programme and play with the false window until you arrive at a slowly fading inspirational visual tableau. In the meantime it seems that it is vital to healthcare design that more thought is applied to the space planning, interior design and lighting design of healthcare facilities.



Hospital of the future: a physician explaining an operation using a holographic projection.

9. Chartered Institute for Building Services Engineers. *LG2: Lighting for hospitals and health care buildings*. 2008.

10. Thapan K, Arendt J, Skene DJ. An action spectrum for melatonin suppression: evidence for a novel non-rod, non-cone photoreceptor system in humans. *Journal of Physiology* 2001; 535(1):261-7.

11. Brainard GC, Hanifin JP, Greeson JM, Byrne B, Glickman G, Gerner E, Rollag MD. Action spectrum for melatonin regulation in humans: evidence for a novel circadian photoreceptor. *Journal of Neuroscience* 2001; 21:6405-12.

12. Brainard GC, Levin R, Glickman G. Ocular input for human melatonin regulation; relevance to breast cancer. *SN: 5/13/95*, p. 300. [PUBLICATION?]

13. World Health Organisation International Agency for Research on Cancer. *Press release no 180: IARC Monographs Programme finds cancer hazards associated with shiftwork, painting and firefighting*. December 2007.