



# Designing Window & Door Treatments for Improved Patient Outcomes

White Paper

*The future of vision & daylight control*

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## DESIGNING WINDOW & DOOR TREATMENTS FOR IMPROVED PATIENT OUTCOMES



### How vision, noise and light control solutions can measurably impact patient recovery and well-being

Hospital design and architecture can play an important role in a patient's recovery and well-being. This becomes even more important as the US government now allocates billions of dollars every year to replace and improve the majority of US hospitals built in the 1960s and 1970s. Since the early 1990s, a number of studies have examined how hospital design and architecture affect patients and healthcare workers, and the results make a compelling case for design geared toward optimal patient environments.



## THE NEED FOR NOISE REDUCTION



Recent studies of US hospitals have shown that the average ICU patient is exposed to background noise that is eight times louder than the guidelines set out by the World Health Organization (WHO). WHO states that ICU background noise should not exceed 35dB (decibels) for patients. In most US ICUs, background noise averages 75dB, with peaks reaching in excess of 95dB. It is important to note that dB increases do not result in a linear increase in audible noise; an increase of 10dB will result in twice the perceived noise<sup>1</sup>.

This increased noise level has a wide range of effects on patients and healthcare professionals. In addition to the obvious difficulty in sleeping, patients exposed to higher levels of noise consistently show higher levels of stress, increased heart and respiratory rates, higher blood pressure and even decreased levels of oxygen saturation in infants<sup>2</sup>. These can all decrease the body's ability to recover and heal, and lead to longer hospital stays, along with higher rates of re-hospitalization<sup>3</sup>.

Similarly, healthcare workers have been shown to endure higher levels of stress and anxiety due to noise, which also creates workplace issues. Nurses and doctors often experience decreased productivity and a higher incidence of error with patients. The increased stress has also been linked to the 20 percent turn-over rate among nurses in US hospitals<sup>4</sup>.



<sup>1</sup> Ulrich, R. (2007). Sound Control for Improved Outcomes in Healthcare Settings. Health Design, (4), 2-2. Retrieved March 27, 2015, from <https://www.healthdesign.org/sites/default/files/SoundControl.pdf>

<sup>2</sup> Slevin, M., N. Farrington, G. Duffy, L. Daly, and J. F. Murphy. 2000. Altering the NICU and measuring infants' responses. Acta Paediatrica 89(5):577-81.

<sup>3</sup> Blomkvist, V., C. A. Eriksen, T. Theorell, R. S. Ulrich, and G. Rasmanis. 2005. Acoustics and psychosocial environment in coronary intensive care. Occupational and Environmental Medicine 62:1-8.

<sup>4</sup> Topf, M., and E. Dillon. 1988. Noise-induced stress as a predictor of burnout in critical care nurses. Heart Lung 17(5):567-74.

## THE NEED FOR PRIVACY

Much like increased levels of noise, a lack of patient privacy has adverse effects on recovery times and patient outcomes. Hospital stays are often a time of weakness and vulnerability for patients, and the ability to recover in private is important.



In addition to the heightened levels of stress, a lack of privacy has been proven to interfere with treatment as well. Patients have admitted to withholding aspects of their medical history or refusing physical examinations when they have concerns regarding their privacy<sup>5</sup>. Additionally, over 82 percent of US nurses surveyed strongly preferred collecting patient information and performing examinations in private rooms or areas with increased privacy<sup>6</sup>.

Health Insurance Portability and Accountability Act (HIPAA) requirements for doctor-patient privacy are an increasingly important consideration for healthcare facilities and designers. From a legal standpoint, greater acoustic and visual privacy also helps protect healthcare workers from inadvertently breaching patient privacy regulations. Studies conducted on emergency departments discovered that confidentiality breaches were far more common in multi-bed rooms with only curtain partitions<sup>7</sup>.

<sup>5</sup> Barlas, D., A. E. Sama, M. F. Ward, and M. L. Lesser. 2001. Comparison of the auditory and visual privacy of emergency department treatment areas with curtains versus those with solid walls. *Annals of Emergency Medicine* 38(2):135-39.

<sup>6</sup> Chaudhury, H., A. Mahmood, and M. Valente. 2006. Nurses' perception of single-occupancy versus multi occupancy rooms in acute care environments: An exploratory comparative assessment. *Applied Nursing Research* 19:118-25

<sup>7</sup> Mlinek, E. J., and J. Pierce. 1997. Confidentiality and privacy breaches in a university hospital emergency department. *Academy of Emergency Medicine* 4(12):1142-46.

## THE NEED TO INCLUDE NATURAL LIGHT AND CONTROL ARTIFICIAL LIGHT

The positive impacts of natural light on human dispositions are well documented. In healthcare environments, there is much evidence to support the healing benefits of controlled sunlight for patients.

For example, in a study comparing the incidence of postoperative delirium in patients located in windowed and windowless ICUs, twice as many windowless patients demonstrated delirium and, among patients with abnormal hemoglobin or blood urea, the incidence was threefold<sup>8</sup>. Hallucinations were more than twice as high in windowless units as in windowed units<sup>9</sup>.

Further studies have noted the following positive contributions of daylight: warmth, functional lighting, contact with the outside and the biological effects of solar radiation. It found that 91 percent of patients considered sunlight to be pleasurable<sup>10</sup>. In 2005, researchers compared the use of pain medications on patients who were on the bright and dim sides of a hospital. Those on the bright side were exposed to 46 percent higher sun intensity and perceived less stress and less pain, and took fewer analgesics<sup>11</sup>.

Studies conclude that daylight markedly impacts outcomes in healthcare settings by reducing depression among patients, decreasing length of stay in hospitals, improving sleep, lessening agitation among dementia patients, easing pain, and improving adjustment to night-shift work among staff. The presence of windows in the workplace and access to daylight has been linked with increased satisfaction with the work environment.

While natural light has positive benefits for patients, bright artificial lights can be a deterrent to healing. Patients need to sleep to bolster healing, and bright lights seeping in from corridors, nursing stations and other adjacent rooms can significantly impact a patient's rest.



<sup>8</sup> Wilson L. Intensive care delirium: The effect of outside deprivation in a windowless unit. *Archives of Internal Medicine* 1972; 130:225-226.

<sup>9</sup> Keep P, James J, Inman M. Windows in the intensive therapy unit. *Anaesthesia* 1980; 35:257-262.

<sup>10</sup> Ne'eman E. Visual aspects of sunlight in buildings. *Lighting Research and Technology* 1974; 6 (3):159-164.

<sup>11</sup> Walch J, Rabin B, Day R, Williams J, Choi K, Kang J. The effect of sunlight on postoperative analgesic medication use: A prospective study of patients undergoing spinal surgery. *Psychosomatic Medicine* 2005; 67:156-163.

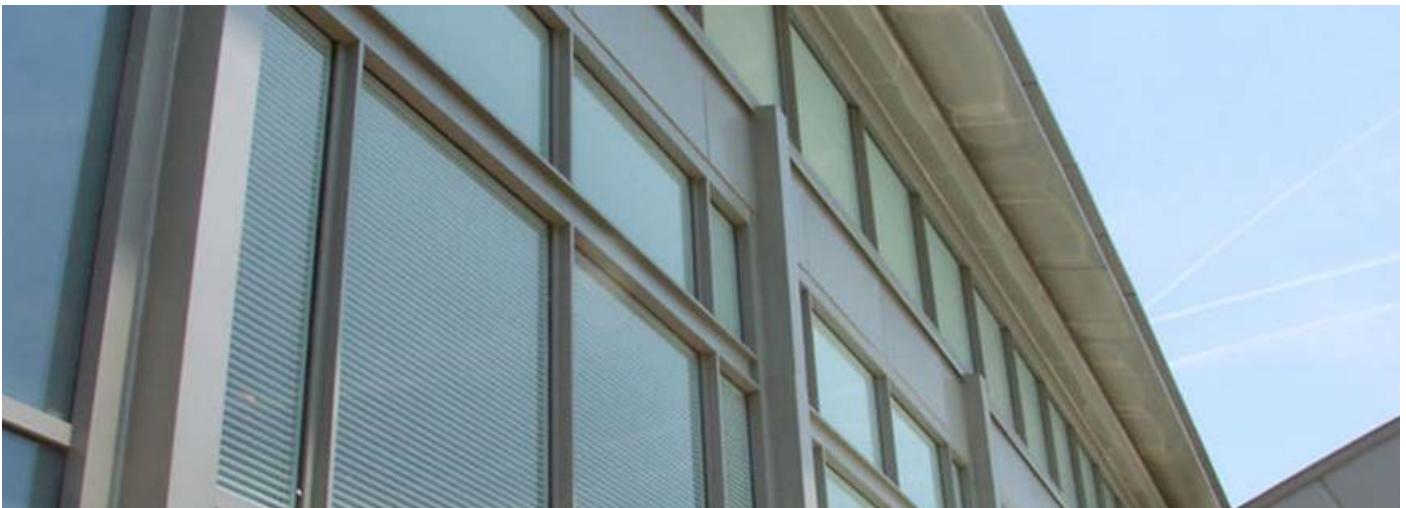
## THE NEED FOR TEMPERATURE CONTROL

Hospital design must pay particular attention to temperature and climate control. Excessive heat or cold can cause stress in patients, similar to that of heightened noise levels.



For wounds, temperature controls the rate of chemical and enzymatic processes and the metabolism of cells and tissue engaged in the healing process. Cooler temperatures impede the healing process of wounds. Colder environments or wound cleansing with cooler room temperature solutions may reduce wound temperature, often requiring several hours for recovery to physiological levels<sup>12</sup>. Clinicians need to make sure that the wound and the patient remain at a stable or constant temperature for optimal healing.

In addition to internally-controlled temperatures, hospital facilities also need to consider temperature fluctuations from external sources through exterior windows. Both heat and cold need to be mitigated to ensure optimal healing temperatures and comfort for patients.



<sup>12</sup>Driscoll, P. (2013, July 22). Affecting Wound Healing. Retrieved March 27, 2015.

## THE NEED FOR OPTIMAL HYGIENE

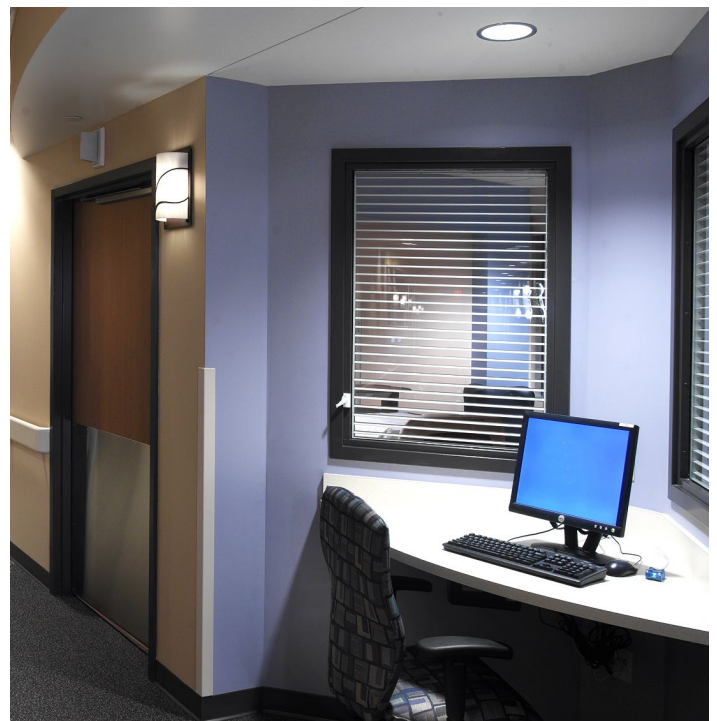
Creating more sterile environments is of critical importance for patient outcomes. Building materials need to encompass the most optimally hygienic finishes. In isolation rooms or ICUs, the minimization of horizontal surfaces that collect dust is absolutely critical. Dust contaminated by infectious agents can build up as a reservoir that can cause an outbreak of infection, even after the infectious patient has left.



## THE NEED TO MITIGATE MAINTENANCE AND POWER REQUIREMENTS

Architects have many operational requirements to consider when designing healthcare facilities. Solutions need to meet the privacy, safety and infection prevention standards without adding significantly to operating costs. Any design solution that requires undue maintenance processes or power usage can be a burden on healthcare budgets.

Hospitals also have strict emergency requirements that seek to limit power consumption<sup>13</sup>. In the event of a power outage, patient privacy, heat and sound control solutions must be able to operate without draining precious electricity that is needed for more essential functions.



<sup>13</sup> AS&HF Article: (n.d.). Retrieved March 27, 2015, from <http://facilitymanagement.com/articles/maintenance-2013-06-3.html>

## DESIGN SOLUTIONS FOR WINDOW AND DOOR TREATMENTS

To ensure patient safety and the best possible outcomes, hospital designers must find a way to provide patients with privacy and noise reduction without removing the visibility nurses and doctors need to properly care for them. They also need to consider heat and light control, ongoing maintenance and power requirements and hygiene.

There are a number of solutions available ranging from very basic curtains to more advanced smart glass solutions.

PRODUCT	VISUAL CONTROL	ADJUSTABLE VISION	ACOUSTIC CONTROL	LIGHT CONTROL	HEAT CONTROL	ZERO MAINTENANCE	HYGIENIC SEAL	NO POWER REQ'D	FULL (100%) VISIBILITY
CURTAINS	★			★				★	★
BLINDS	★	★		★				★	★
BLINDS-BETWEEN-GLASS	★	★	★	★	★		★	★	★
SULL SASHES	★	★	★	★	★			★	★
FROSTED GLASS	★			★		★	★	★	
LIQUID CRYSTAL GLASS	★			★			★		★
SMART GLASS	★			★			★		★
LOUVERS-BETWEEN-GLASS	★	★	★	★	★	★	★	★	



High performance



Low/partial performance

## MAKING THE CASE FOR LOUVERS-BETWEEN-GLASS

**Curtains** can provide basic visual privacy. However, they provide no acoustical privacy—conversations behind curtains can be easily overheard. Most compellingly, curtains are easily the dirtiest surface in a patient room. They gather dust and dirt, are difficult to clean and are therefore rarely sanitized. They do not provide the required adjustable levels of visibility. They will block sunlight, but will not allow for flexible daylight management.

**Blinds** offer adjustable levels of vision control, but accumulate dirt and dust, making them unhygienic and difficult to maintain. They also have holes and gaps, which render them ineffective for those instances when complete privacy or darkening is a must. Even when fully closed, blinds will still have gaps between the slats that prevent complete privacy or light blockage. They offer no sound control, and they provide only moderate daylight control.

**Venetian blinds-between-glass** are more hygienic than just blinds, but are prone to damage. Exterior cords frequently lead to entanglement and other maintenance issues. They can also get easily misaligned leaving visual gaps. Even when fully closed, the spacing between slats does not offer complete privacy and light blockage. They are not known for long-term durability, and they provide only moderate levels of daylight control.

**Sull Sashes** are windows that have one fixed piece of IGU (insulating glass unit) glazed in a frame (like a window frame) with a set of non-sealed blinds hung on the interior side and another panel of glass set in front of these blinds to protect them. This third lite of glass is removable for cleaning, or is on a hinged panel so it can open inwards for cleaning. Sull sashes can provide basic vision control, but offer limited adjustability and light control. As they are not hermetically sealed, they are prone to allowing dust, particles and bugs to settle inside the cavity. They are unwieldy to adjust and clean as patients or nearby furniture must be moved in order to pull out the hinged glass panels. Their corded design gets easily tangled and does not allow for complete darkening. They require frequent maintenance.

**Frosted or sandblasted glass**, which slides up and down to mimic the lines of blinds, offers only a partial solution. Visibility can be hindered with limited capacity for adjustment. Frosted glass only offers a maximum of 50 percent visibility. When healthcare workers need to view into patient rooms for monitoring purposes, patient privacy will be impeded by the two-way visibility. The translucent lines do not fully block light—either from the sun or bright hospital lights—which can significantly inhibit a patient's rest. Additionally, the mechanical lever can be hard to lift as the mechanism carries the full weight of the glass being lifted, making it unwieldy to operate.

**Liquid crystal glass** solutions can provide instant privacy with the click of a button. They can also easily infringe on patient privacy when the switch is turned ON to reveal clear glass. These solutions don't provide adjustable levels of seclusion, and are impractical as their on-or-off-only options do not permit discreet observation of patients by medical staff. Their default position is opaque, which means that in case of power outages they will require valuable emergency power sources to provide visibility into patient areas. They are more expensive to install, operate and maintain, and offer no daylight control.

**Smart glass**, magic glass, or switchable glass refers to electrically switchable glass or glazing which changes light transmission properties when voltage is applied. Smart glass is a less than ideal solution for hospitals in terms of installation costs, increases in electrical use and long-term functionality issues. It is also very limited in terms of quick control, and does not offer complete privacy – only a darkening of the glass. In exterior applications, Smart Glass offers virtually no daylighting control.

**Integrated louvers** – insulating glass units with integrated cord-free louvers – are currently the only solution that competently addresses virtually all design requirements. Integrated louvers offer completely adjustable vision control. When fully opened, they provide 80 percent visibility. When fully closed they ensure 100 percent vision blocking. They can be angled to provide discreet observation by healthcare personnel, while preventing patients from feeling observed and exposed. They typically feature double glazing with a 2" airspace that has a Sound Transmission Class (STC) rating on par with drywall and concrete block walls. As they are hermetically sealed with a contaminant proof seal, they ensure maximum levels of hygiene and infection control. In exterior applications, the integrated louvers offer complete daylight control and optimal thermal efficiencies.



## CASE STUDIES



### Cincinnati Children's Hospital

In keeping with its vision of the highest levels of patient and family experience, Cincinnati Children's has installed Unicel Architectural's Vision Control® hermetically sealed glass units with integrated louvers in interior doors and windows in multiple campus locations to ensure adjustable levels of visibility and improved sound attenuation.



### Mercy Medical Center NICU

As part of the overall design approach, Unicel Architectural's Vision Control® integrated cord-free louvers were selected for both interior windows and sliding doors to ensure flexible privacy options along with sound attenuating attributes. Vision Control® advanced louvered glazing technology eliminates strings, ensures alignment, requires no maintenance and provides the ideal privacy solution for ICUs, operating rooms, nurseries and more.



### Sidra Medical Research Center

Unicel Architectural's Vision Control® solution was selected after a careful consideration process for the world-class new Sidra Medical Research Center in Qatar. Sidra now features over 200 Vision Control® units in patient areas. The inpatient rooms are organized around three healing garden atria. The atria include the Vision Control® units to ensure privacy and filter and soften the strong sunlight.



### McCook Community Hospital

Unicel Architectural's Vision Control® hermetically sealed glass units ensure adjustable privacy in patient rooms and nursing stations at the Community Hospital in McCook, Nebraska. Interior windows and multiple doors feature Vision Control® units to allow for partial or complete privacy, and darkening as required. The integrated louvers also help attenuate noise for more tranquil recovery environments.



### Children's Hospital, Boston

Ranked #1 children's hospital in the nation for 2014-2015, Boston Children's Hospital is a 395-bed comprehensive center for pediatric health care. One of the largest pediatric medical centers in the US, Boston Children's uses Vision Control® integrated louvers in interior windows and doors to ensure vision, noise and lighting control.



### Cleveland Clinic Abu Dhabi

Unicel has installed over 250 Vision Control® units in doors, windows and borrowed lites at the Cleveland Clinic Abu Dhabi Hospital (CCAD) - a multi-specialty academic medical center located in the United Arab Emirates (UAE). Glass types include clear tempered, laminated, and Pilkington Pyrostop® fire-rated glazing rated for 45, 60 and 90 minutes. CCAD is now one of the largest medical centers in the Middle East and offers advanced medical technologies within an atmosphere that promotes wellness and recovery.

