

## LIGHTING IN NURSING HOMES – THE UNMET NEED

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### ABSTRACT

As people age they become more dependent on their environment to compensate for increasing frailty and sensory loss. Normal age-related changes to the eye decrease the amount of light reaching the retina impacting both vision and circadian rhythm. Typical nursing home lighting is inadequate to meet the lighting needs of their residents. Compared to age-matched community dwelling adults, nursing home residents have greater visual impairment and receive far less bright light exposure for circadian rhythm and vitamin D synthesis. As a result nursing home residents experience more falls, hip fractures and sleep problems than those living in the community. It is clear that the physical environment does not meet the needs of the people they are built to serve. The goal for all new construction and renovation of existing nursing homes must go beyond shelter and provide for lighting to meet both the visual and the photobiological needs of older people. Bringing daylight into the building provides not only higher light levels during the day, but also contains the spectrum to which the circadian clock is most sensitive. Garden areas for regularly scheduled outdoor group activity programs would provide the direct exposure to sunlight for vitamin D, bright light exposure for circadian rhythm, and the connection to nature that older people treasure. To be successful, these areas must provide environmental conditions and quality lighting for aging eyes defined as the avoidance of direct and reflected glare, uniform light levels, and sufficient light to compensate for the decrease in light reaching the retina.

Keywords: visual impairment, falls, hip fractures, light quality, daylight, bright light, sleep

### 1. INTRODUCTION

Are you having difficulty sticking with your New Years resolution about exercise, diet

and life-style changes? The following account of conditions currently found in nursing homes should strengthen your resolve to stay the course and remain as healthy as possible. Unfortunately, accidents do happen which might find you recuperating in a nursing home or you may be facing the gruelling decision of placing a parent or loved one there. The following issues which impact the health and quality of life of the nursing home resident should be included in the criteria for making a selection. Also, when administrators hear that lighting is important from a marketing aspect, they will implement the change to appropriate lighting more quickly.

### 2. LACK OF LIGHTING REGULATIONS OR STANDARDS

As a society, we expect our national, state or provincial government to protect the health and safety of all its citizens. Considering the growth of the aging population, it is important to include the needs of older adults and for governments to expand their standards and regulations to address normal age-related changes, and provide appropriate environments to meet their needs. In nursing homes or institutional settings, individuals are unable to make environmental modifications. They are dependent upon governmental regulation to ensure that their needs are met. However, I have yet to find any national regulations requiring the quality and quantity of light to meet the visual needs of older people in their communities or in nursing homes specifically. The photobiological effects of light are not addressed at all.

Since there are no federal standards for nursing home lighting in the United States, each state is allowed to create their own regulations. There is great variability between states. Some are vague, others require light levels which are too low for older people, and a few states' lighting regulations are appropriate and consistent

with the quality and quantity of light found in the ANSI/IESNA (*Recommended Practice RP-28-2001 Lighting and the Visual Environment for Senior Living*).<sup>1</sup> However, most are too general to be useful and do not provide for the special needs associated with normal age-related changes to the eyes. For example, Virginia requires A) that artificial lighting shall be by electricity, and B) all areas shall be well lighted for the safety and comfort of the residents according to the nature of activities.<sup>2</sup> Without specific minimum target illuminance values to guide code officials, lighting designers and inspectors, the desired intent is not achieved. What may be judged by a younger person to be “safe and comfortable” will not be adequate for an older adult.



**Figure I:** An example of lighting problems a) glare from doors at the end of the corridor, b) uneven lighting, and c) low light levels.



**Figure II:** The diffused daylight coming into this corridor creates a pleasant visual environment along with the spectrum and higher light levels for circadian rhythm.

### 3. Light for Vision

A survey of 53 nursing homes in four states found that the facilities were often dimly lit. Illumination levels for ambient and task light were compared to the minimum requirement found in Table 1 of *RP-28-2001*.<sup>3</sup> The illumination was rated as inadequate or barely adequate in 45 percent of hallways, 17 percent of activity areas and 51 percent of the resident rooms.<sup>4</sup> Nursing homes serve very old people, 85 years of age being the average age of residents in the United States. It is commonly accepted that most people in this age group experience age-related visual impairment. The lighting conditions reported in the above study are particularly troubling in view of the fact that nursing home residents experience 13 to 15 times greater visual impairment than age-matched people living in the community.<sup>5</sup>

### 4. LIGHT EXPOSURE

In addition to light for vision, the photobiological effects of light for entrainment of circadian rhythms and vitamin D synthesis are very important to older people. When people age their mobility decreases, and consequently, so does their exposure to daylight. However, a move to a nursing home will dramatically reduce the daylight exposure older people experience when living at home in the community.

Older people living in the community experience less daylight exposure than younger people. A recent study showed that the daily exposure for younger people age 21 – 42 years above 2000 lux was 90 minutes,<sup>6</sup> compared to older people age 55 – 81 years above 2000 lux was 59 minutes.<sup>7</sup> When people are placed in a nursing home their light exposure diminishes significantly from that of people living in the community in regard to intensity, duration and spectrum.

In one study they found daily light exposure over 1000 lux averaged only 9 minutes a day for nursing home residents age 60 – 100 years.<sup>8</sup> Without sufficient exposure to bright light for entrainment of the body-clock, people living in nursing homes experience a high degree of circadian disruption; problems with sleep being the most observable aspect. A Canadian research team noted that people

who reported no sleep problems when living at home developed sleep problems after they were admitted to a nursing home.<sup>9</sup> Sleep fragmentation is a major problem in nursing homes.<sup>10</sup>

Calcium and vitamin D are essential to maintaining healthy bones through out life. Osteoporosis, the most common disease of the bones, characterised by a decrease in bone mass and density, is often called the silent epidemic. Worldwide osteoporosis afflicts an estimated one-third of women aged 60 to 70, and two-thirds of women aged 80 or older.<sup>11</sup> Vitamin D deficiency and hip fractures are more common among nursing home residents than among the community dwelling elderly.<sup>12</sup> Nursing home patients constitute 20% of all osteoporosis hip fractures. These residents do not receive adequate sunlight exposure containing ultraviolet B radiation (290-320 nm) required for vitamin D synthesis.<sup>13</sup>

Typical interior lighting does not contain the spectrum to treat vitamin D deficiency or the spectrum to which the circadian system is most sensitive.

## 5. STAFFING PROBLEMS

For those outside the long-term care industry, the quick-fix to the photobiological effects of light is for the staff to take individual residents outdoors. For those who are familiar with the industry, this seems almost impossible. One of the current general problems is that of being under-staffed. In Oregon, a state regarded as a leader in aging issues, the governor has established a special committee to review and make recommendations to alter the high resident to staff ratios. The current ratio requires a minimum of one certified nurse's assistant (CNA) for every 10 residents during the day shift, one CNA per 15 residents during the swing shift, and one CNA per every 25 residents during the night shift.<sup>14</sup> The day shift is very busy with bathing, dressing, toileting and getting the residents to meals, leaving no time for individual activities. Given that a large number of these residents will have sleep disorders, many will be awake during the night and needing more care than is humanly possible for only one staff member to deliver to 25 residents.

## 6. HIGH PERFORMANCE NURSING HOMES

When we start to think beyond shelter and begin to provide for all the many age-related changes that are common to older people, plus the unique problems currently being experienced by those living in a nursing homes or other institutional setting we will have homes that are good for the residents, staff and the global environment. Studies have demonstrated that student perform better in schools designed with good daylighting techniques.<sup>15</sup> The authors hypothesize that possible reasons might include improved visibility due to higher light levels and improved light quality, improved mood and higher arousal levels keeping the students more alert. Nursing home residents would benefit from all of the above. Dining or activity areas with daylight containing the action spectrum of 446-477 nm to which our body clocks are most sensitive<sup>16</sup> would reduce the demand for electric lighting during the day. Daylight within the building would replicate the natural rhythm of light happening outside, bringing in cool bright light during the day and providing darkness at night. The electric lighting system should provide warm light for evening activities in the common areas, keeping in mind that bedrooms should be dark for sleeping.



**Figure III** The dining and activity areas of this Alzheimer's Care Facility had very low light levels (between 70 – 180 lux) with very little daylight.



**Figure IV:** This is the same facility with large skylights added to the dining and activity areas, increasing the daylight fenestrations by 320 percent.

## 7. IMPROVING QUALITY OF LIFE

When quality (electric) lighting was used to increase the light levels in private homes of older people they experienced an improved quality of life, noting improvements in contact with others, appetite, physical condition, loneliness, self-confidence, mood and anxiety.<sup>17</sup> With better lighting in nursing homes it might be possible that residents could be more independent, reducing the demand on an over-worked staff. Improved lighting would go along way to maximize aging vision and might help to prevent the fall-related hip fractures associated with impaired vision.<sup>18</sup> Good nutrition is basic to human health and improved lighting has been demonstrated to improve eating and calorie intake in nursing home residents.<sup>19</sup> Bringing adequate bright daylight into the nursing home might bring about an end to the sleep problems best described by Sonia Ancoli-Israel, PhD, a researcher in sunny San Diego, CA, "Nursing home patients spend their final years in a twilight state, rarely fully awake or fully asleep, and physiologically in the dark".<sup>20</sup> And finally, regularly scheduled outdoor group activities, depending upon the seasons and geographical location, would provide not only the bright light needed for circadian rhythm, but exposure to sunlight for vitamin D. A study in Japan reported that with 15 minutes per day of sunlight exposure on face and hands during clear weather

(averaging 236 days per year) that the patients in the experimental group had 84 percent fewer hip fractures than the control group. An outdoor garden also adds pleasure, fresh air and a chance to connect with the natural world.



**Figure V:** Nursing home residents enjoying a family visit in the garden.

## 8. QUALITY OF LIGHT AND THE VISUAL ENVIRONMENT

Since older eyes are much more sensitive to glare and adapt much more slowly to changes in brightness, careful consideration must be given to the design of both the daylighting and electric lighting systems and the material used within the visual environment for the lighting intervention to be successful with older people. Glazing materials in skylights must diffuse the light to prevent glare and the creation of shadows. Skylights and clerestory windows located above the field of view are preferred. Indirect/direct luminaires which spread diffused light over a broad area and eliminate the brightness of a luminaire are recommended. Floor, wall and ceiling surfaces should be a matte finish. The surface materials for sidewalks or patios should be a medium value to prevent the reflected glare of strong sunlight from bounding up into the eyes. A more detailed description of proper lighting for older adults is found in the previously referenced *ANSI/IESNA (Recommended Practice) RP-28-2001 Lighting and the Visual Environment for Senior Living*.

## 9. CONCLUSION

Governmental agencies need to take seriously the lighting needs of older adults, especially those living in nursing homes, and

develop regulations for both lighting for vision and the photobiological effects of light. The use of daylight should be encouraged, due to the spectrum it provides, as well as the global concern for energy efficiency. People from diverse backgrounds, including scientists, lighting manufacturers, lighting designers, geriatricians, concerned individuals and those affiliated with the long-term care industry, need to come together to assist government regulators developing strategies that truly work for older people and those who care for them.

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