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Lighting and the visual environment for senior living

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Recommended Practice for Lighting and the Visual Environment for Senior Living

Publication of this Recommended Practice has been approved by the IESNA. Suggestions for revisions should be directed to the IESNA

Prepared by:
The IESNA Lighting for the Aged and Partially Sighted Committee

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Recommend Practice for Lighting and the Visual Environment for Senior Living

1.0 INTRODUCTION

The Illuminating Engineering Society of North America (IESNA) has made lighting recommendations since the publication of the first lighting handbook in 1947 to the present edition. Those recommendations have been based on a variety of considerations and have been derived from experience with "what works," as well as from more scientifically determined models of visual performance. By and large, where data have been utilized either to design a specification system or to validate a particular recommendation, these data have represented a relatively young (20-30 year-old) population group.

This recommended practice is the authority for lighting recommendations for older people. The current IESNA recommendations do not make allowances for older persons. Generally, the visual requirements of older persons are different from younger persons. Advanced age is accompanied by changes in the eye, and visual nervous system. Recognizing these changes and their effects is essential to mitigating their impact. With advancing age the total light transmittance of the eye decreases (see **Figure 1**). The pupil, for example, becomes smaller and reduces the amount of light entering the eye. The loss of lenticular transparency scatters light and reduces the apparent contrast between objects. The change from pale to deep yellowing of the lens changes the colors of objects in the visual field. The reduced ability to focus on objects results in increased blur. An increase in the prevalence of ocular disease with increasing age contributes to the need for special attention to the lighting requirements of older persons. As the population ages, it is increasingly important that these requirements be addressed to assure the comfort, productivity, and quality of life for the elderly.

The lighting environment affects more than vision. There are photobiological effects as well. These include effects upon circadian rhythms and vitamin D synthesis. Direct exposure to the intensity of daylight declines dramatically as the mobility of a person decreases. This restricts the person to the interior environment where lighting conditions are often less than adequate.

While the daytime visible light levels needed to drive circadian rhythms can be found outside even on a

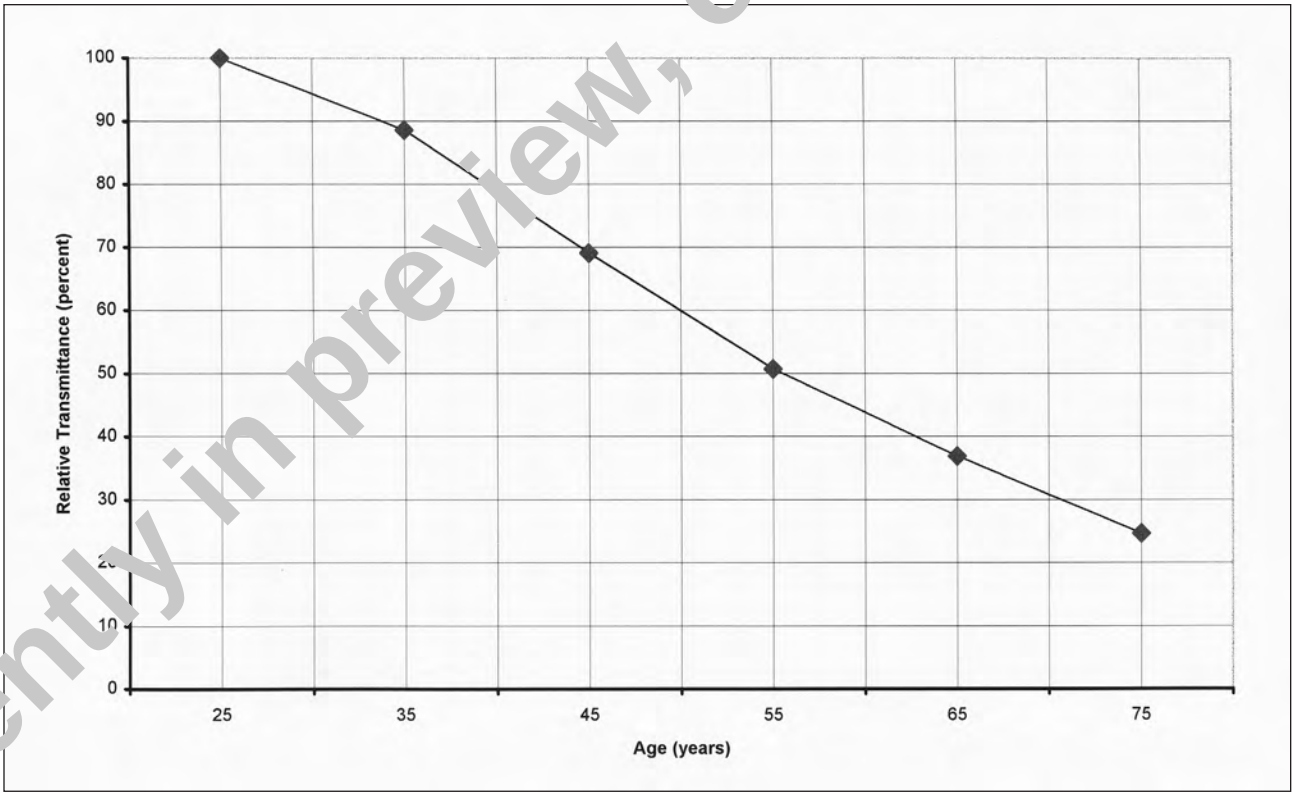

Figure 1. The transmittance of the human eye plotted as a function of age.[9] As people get older, they may require greater illuminance to offset the reduction in the amount of light reaching the retinas of their eyes.

cloudy day, comparable light levels are rarely found inside private homes and care facilities. It is also essential for private homes and care facilities to offer dark spaces in the evening for sleeping. Insufficient daytime light and evening darkness can result in health and wellness problems such as a disrupted sleep/wake cycle. Only 20 percent of older people report no difficulties with sleep.[1]

Inadequate sunlight exposure of the skin has an effect on the production of vitamin D needed for development and maintenance of strong bones and muscles. A second source of vitamin D is through the consumption of vitamin D fortified foods and/or dietary supplements. This avoids the risk of overexposure to UVB which is a cause of skin cancer.[71] Insufficient dermal sunlight exposure impairs calcium metabolism and results in decreased bone mass and muscle weakness,[2] contributing to falls and fractures.[3] The Surgeon General Richard Carmona, MD., MPH FACS, warns that by the year 2020, 50 percent of those over age 50 will be at risk for fractures from osteoporosis and low bone mass if no immediate action is taken by individuals at risk.[4] Convenient access to outdoor areas will encourage people to take advantage of the therapeutic impact of free sunlight.

1.1 Demographics

Between the years of 1995 and 2030, it is anticipated that the elderly will increase numerically and as a percentage of total population in all developed countries. Numerical increases will be especially pronounced in Canada and Japan, where the elderly head count will more than double. The United States also will experience a relatively sharp increase (almost 90 percent) in the number of people age 65 and older. Projections indicate that by 2030 there will be more people over age 65 than under age 17 in the U.S.[5]

This older population's growth will impact many industries with particularly great demands placed on building construction and healthcare. However, few people have considered the potential impact lighting can have upon the aging population's health and quality of life. This document addresses the special lighting needs of the aging population.

1.2 Light for Visual Tasks and Vitality

As people age they become more dependant on their environment to compensate for increasing frailty and sensory loss. Appropriate lighting conditions help maximize personal independence while promoting health, well-being, and safety. Many age-related changes in the visual system can be compensated for by proper illumination.

In a study conducted by Sorensen and Brunnstrom in private homes in Sweden, a direct correlation was discovered between "good" illumination in an older person's residence and that person's quality of life. The study defined good illumination as: a sufficient quantity of light, appropriate direction of the light, good contrast, and light that does not cause glare. Physical condition, appetite, general good health, and self-confidence improved with good quality lighting. In addition loneliness, anxiety, and temper were diminished.[6]

Poor lighting is associated with falls among the elderly.[7] Investment in proper lighting is an excellent means of reducing health care costs and maintaining an independent life style. A high quality lighting environment is one important aspect in maintaining an environment supportive of the aging process, promoting wellness and reducing accidents. Good lighting should be viewed as prevention, and must receive priority attention in retirement complexes, long-term care facilities, seniors living at home, and the community at large. The U.S. Surgeon General's 2004 report calls for improved lighting to minimize risk of falls.[4] "Optimum light exposure ought to be as uncontroversial an aim of future health policy as best-possible nutrition."[8]

1.3 Energy Conservation

Energy conservation is a global concern. To help control energy consumption efficient design must be employed. This can be accomplished by using energy-efficient light sources, task lighting, controls, and daylight.

Designers can address lighting challenges with design efforts dedicated to making built environments support human needs – the "why" of design – and by reuniting light and form as one entity – the "how" of design. Daylighting integrated with efficient electric lighting can enhance physical and mental well-being. When properly designed, these design elements help reduce energy use and meet the higher light levels needed by the aging population.

2.0 LIGHTING CONSIDERATIONS FOR THE ELDERLY

While many aspects of life seem to improve with age, our sense of sight is not one that follows this trend. The human visual system consists of three parts: the eye, which gathers information about the outside world in the form of reflected light; the visual pathways, which transmit the signals from the eyes; and the visual cortex of the brain, which processes the