



# Light conditions for older adults in the nursing home: Assessment of environmental illuminances and colour temperature

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## ABSTRACT

Over 40% of nursing home residents in the Netherlands are estimated to have visual impairments. In this study, light conditions in Dutch nursing homes were assessed in terms of horizontal and vertical illuminances and colour temperature. Results showed that in the seven nursing homes vertical illuminances in common rooms fell significantly below the 750 lx reference value in at least 65% of the measurements. Horizontal illuminance measurements in common rooms showed a similar pattern. At least 55% of the measurements were below the 750 lx threshold. The number of measurements at the window zone was significantly higher than the threshold level of 750 lx. Illuminances in the corridors fell significantly below the 200 lx threshold in at least three quarters of the measurements in six of the seven nursing homes. The colour temperature of light fell significantly below the reference value for daylight of 5000 K with median scores of 3400 to 4500 K. A significant difference in colour temperature was found between recently constructed nursing homes and some older homes. Lighting conditions of the examined nursing homes were poor. With these data, nursing home staff have the means to improve the lighting conditions, for instance, by encouraging residents to be seated next to a window when performing a task or during meals.

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## 1. Introduction

For many people, the loss of a part or all of their vision will become a reality as they grow older. In a recent epidemiological study in the Netherlands, over 40% of nursing home residents were estimated to have visual impairments [1]. Apart from the influence of ageing, there are pathological changes such as cataract, macular degeneration, glaucoma, and diabetic retinopathy that lead to low vision and eventual blindness. These impairments can affect several visual functions as well as daily functions in general [2–5].

Visual impairments stemming from biological ageing are diverse [2,3,6,7]. First, the visual field area declines with age. This means that the portion of space in which objects are simultaneously visible is declining. Second, colour discrimination decreases with age. Blue, green, and violet colours are most affected by the natural yellowing of the lens. Blue objects tend to be observed as darker than they actually are. Third, adapting to the dark can be impaired for older adults when moving from light to dim environments. Fourth, older persons require more light than younger persons for carrying out the

same tasks, as the amount of light that reaches the retina is reduced with increasing age [8]. A 60-year old person, therefore, needs three times the amount of light as a 20 year old to complete a visual task comfortably. And fifth, glare or light that is reflected directly back into the eye creates difficulties for older adults to see and should be minimised. The recovery time from the effects of glare is much longer for older than younger adults.

The abovementioned changes in vision do not happen overnight and are the result of the progress of biological ageing. After the age of 50, glare and low levels of light become increasingly problematic. People require more contrast for proper vision and can have difficulty in perceiving patterns. After the age of 70, fine details become harder to see and colour and depth perception may be affected [3].

Although visual impairments can result in the loss of basic visual abilities in over 50% of the cases, treatment of low vision or slowing down of a further decline are possible [1]. Nevertheless, the impact of vision loss in older adults affects daily care. It also influences the way daylight access and light conditions in the nursing home should be designed to meet the needs of older residents of these homes. Achieving adequate care and ambient light levels is a task involving all care and technical professionals in nursing homes. The most important benefits of sufficient light levels inside nursing homes are 'visual', i.e., supporting the ability to see and the

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