Light: Special Needs of the Aging Population

Transforming Healthcare and Well-Being through Lighting Workshop
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Prevalence of Sleep Disturbance Increase:

- Surveys indicate that 40% - 70% of people over the age of 65 suffer from chronic sleep problems. (Van Someren, 2000)

Consequence of Sleep Problems:

- Insomnia leads to increased falls and hip fractures. (Avidan et al. 2005)
- Use of sleeping pills result in mobility problems, daytime drowsiness & drug-induced insomnia. (Prinz, Vitiello, Raskind & Thorpy 1990)
- One out of five hip fracture patients dies within a year of their injury. (Farahmand, Michaelsson, Ahlbom, Ljunghall, & Baron, 2005)
- One in three who survive a hip fracture require nursing home care for at least a year. (Leibonson, Toteson, Gabriel, Ransom & Melton, 2002)
Factors Leading to Circadian Rhythm Disruption

Mobility decreases as people age:
• Limits exposure to the outdoors and daylight

Changes to the eyes as people age:
• Less light reaches the retina, changes to the retina
• Lens of the eye turns amber

Environmental Conditions:
• Living with spectrum deficient lighting during the day
• Exposure to light with blue content at night

Impaired functioning of the suprachiasmatic nucleus:
• Lack of input or irregular input impinging on the central & peripheral clocks

Comparative Light Exposure: Community to Long-Term Care

**Community Dwelling Adults**
- Aged 21-42 years - 90 minutes >2000 lux (1)
- Aged 40-64 years - 58 minutes >1000 lux (2)
- Aged 55-81 years - 9 minutes >2000 lux (3)

**Institutionalized Adults** 60-100 years
- Mild, mod or no dementia - <9 minutes >1000 lux(4)
- Severe mixed dementia - 1 minute >1000 lux (4)

# Use of Outdoor Space by NH Residents

## How often able residents went outdoors (N-1058)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>22%</td>
</tr>
<tr>
<td>Less than daily</td>
<td>16%</td>
</tr>
<tr>
<td>About weekly</td>
<td>17%</td>
</tr>
<tr>
<td>Less than once a week</td>
<td>13%</td>
</tr>
<tr>
<td>Less than once a month</td>
<td>32%</td>
</tr>
</tbody>
</table>

## Percentage of resident participation in planned outdoor activities (N-1058)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>4.6%</td>
</tr>
<tr>
<td>Less than Weekly</td>
<td>16.8%</td>
</tr>
<tr>
<td>Not at all</td>
<td>48.1%</td>
</tr>
</tbody>
</table>

Quality of Life in Nursing Homes Study: Funded by CMS: 40 Nursing Homes In 5 states: (FL, MN, CA, NY, NJ)
Typical Plan of Dementia Care Home: Common Areas Do Not Have Windows or Daylight
Survey of Light in Care Facilities

- 66 NH Residents median exposure 54 lux
- 42 Care Facilities in the United States
  - 34% met the requirement for ambient light for vision (300 lux)
  - 11% met the requirement for task light (500 lux)


Consequences of Inadequate Light in Nursing Homes

- Residents fall more often. ¹
- Sustain more hip fractures ²
- Sleep problems develop or increase after NH placement
- Without regular light input the body clock malfunctions. ⁴


² Nieves, JW, Lindsay R, Vitamin D Malnutrition and Skeletal Health in the Nursing Home, Nursing Home Medicine, 1994, 2:8, 167-170;


Objective of the Study

To determine if long-term application of bright light during the day and melatonin in the evening could ameliorate cognitive and noncognitive decline of those with AD, including:

- Depression
- Agitation
- Sleep Efficiency
- Physical Abilities (activities of daily living)

Design, Setting, Participants

- Long-term (12 months to 3.5 years), Double blind, Placebo Controlled Study
- 189 Residents from 12 Group Care Homes
- Average age 85.5, 90% Female, 87% Dementia

Intervention (Research before RBG color tuning)

Light Intervention: (Measured in the direction of the gaze)
- Bright Light = 1000 lux (93FC)
- Placebo = 300 lux (28 FC)

Color Temperature of Light Source:
- CCT 4000k fluorescent

Timing of Intervention:
- 9:00AM – 6:00PM
- All other times: Existing Incandescent Lighting

Melatonin Intervention: (Used only with specific groups)
- 2.5 mg pill of Melatonin taken in the evening
- Conclusion of the study states that 2.5 mg may be too much.
Study Results Show: Bright Light Slows the Decline of Alzheimer’s

- **Bright Light Only**
  - Cognition: Reduced by 5%
  - Depression: Reduced by 19%
  - Physical Abilities (ADL): Reduced by 53%

- **Bright Light + Melatonin**
  - Increased Sleep Efficiency 3.5%
  - Reduced Nocturnal Restlessness 9%
  - Reduced Agitation 9%

- **Melatonin Only**
  - Increased agitation & withdrawal
Center for Medicare – Medicaid Services Mandates:
• Reduction of Antipsychotic Drugs for those with Dementia

FDA does not approve:
• Antipsychotic Drugs to control agitation, aggression or mood challenges for those with dementia.

Antipsychotic drugs prescribed “off label” for dementia result in:
• Falls due to impaired mobility
• Increased risk of death

Light has no negative side effects and improves mood and behavior.
Hope for the Future: Dynamic Lighting Systems

Pilot Project: ACC Care Home, Sponsored by Sacramento Municipal Utility District and DOE, PNNL
Hope for the future: Dynamic Lighting Systems

Trial Project: Carmen Oaks Memory Care, Springs Living
Why Environmental Lighting is the Answer

• Light has no negative side effects.
• Appropriate light improves mood and behavior.
• Lighting can be programmed automatically, reducing demands on the staff.
• Lighting will serve two important functions:
  – Circadian rhythm entrainment
  – Provide adequate light needed to support aging vision
• Providing greater independence of residents by increase their ability to perform activities of daily living.
Large scale studies utilizing LED dynamic technology are needed:

- Test different circadian stimuli for this age group.
- Provide conclusive evidence to the Center for Medicare – Medicaid Service (CMS) regarding the benefit of circadian lighting.
- Assist CMS and states to draft new regulation for care facilities.
  - This would improve the quality of life for all seniors, especially those in long-term care and memory care.

Questions?