The Nurses' Perspective on Hospital Patient Room Lighting
Lighting for Healthcare
High pressure ridge

Fading hurricane

Extratropical low
High pressure ridge

Fading hurricane

Extratropical low
Non-visual effects of light

Healthcare demographics

LED lighting technology
US Healthcare by the Numbers

16.2

8.8

13.6

Energy Use Intensity

The graph shows the energy use intensity (kBtu/ft²) for various sectors. Food service has the highest energy use intensity, followed by hospitals. Outpatient health care and public order and safety also have relatively high energy use intensities. Retail and religious worship have the lowest energy use intensities.

Source: DOE 2018
Energy Use Intensity in Healthcare

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Outpatient</th>
<th>Inpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical office</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>Clinic/other outpatient health</td>
<td>124</td>
<td></td>
</tr>
<tr>
<td>Nursing home/assisted living</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>Hospital/inpatient health</td>
<td>259</td>
<td></td>
</tr>
</tbody>
</table>

© E Source: data from the U.S. Energy Information Administration (DOE 2003)
Energy Use per Building

- Hospitals
- Lodging
- Education
- Public order and safety
- Food service
- Office
- Public assembly
- Grocery stores
- Outpatient health care
- Warehouse and storage
- Retail
- Service
- Religious worship

Source: DOE 2005
Electricity end uses in healthcare

- **Lighting**: 43%
- **Refrigeration**: 3%
- **Space Heating**: 2%
- **Computers**: 4%
- **Cooling**: 14%
- **Ventilation**: 17%
- **Other**: 17%
US in 2014: 46 million people age 65 or older
US in 2060: 98 million people age 65 or older
- 24% of the US population
Tunable LED Systems

Report 23: Photometric Testing of White-Tunable LED Luminaires

August 2015
Addendum January 2016

UNDETERNING
LED Color-Tunable Products

SPECIFYING
LED Color-Tunable Products

CONTROLLING
LED Color-Tunable Products

TESTING
LED Color-Tunable Products
Visual & Non-visual effects of light

Visual Pathway
Retinal Ganglion Cells (RGCs) carry signals from the rods and cones to the visual cortex, which controls vision

- Writing
- Reading
- Watching
- Communicating
- Learning
- Focusing
- Appreciating
- Enjoying

Non-Visual Pathway
ipRGCs are photoreceptors connected to the hypothalamus, which controls many biological effects

- Suppressing melatonin
- Enhancing alertness
- Affecting cognition

- Photic
- Non-photic
Non-visual effects of light

Healthcare demographics

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DOE Healthcare Webinar Series

The Nurses’ Perspective on Hospital Patient Room Lighting
Sept 13, 2016  Robert Davis & Andrea Wilkerson, PNNL
Pat Lydon, Legacy Health

Evidence-Based Design for Healthcare Lighting: Where’s the Evidence?
Oct 4, 2016    Robert Davis & Andrea Wilkerson, PNNL
Anjali Joseph, Clemson University

Tuning the Light in Senior Care
Oct 18, 2016  Robert Davis & Andrea Wilkerson, PNNL
Connie Samla, Sacramento Municipal Utility District
About Legacy Health

- Nonprofit, locally owned, based in Portland
- Serving Oregon and Southwest Washington
- 6 hospitals on 5 campuses:
  > Legacy Good Samaritan Medical Center (NW Portland, OR)
  > Legacy Emanuel Medical Center (N Portland, OR)
  > Randall Children’s Hospital at Legacy Emanuel (N Portland, OR)
  > Legacy Meridian Park Medical Center (Tualatin, OR)
  > Legacy Mount Hood Medical Center (Gresham, OR)
  > Legacy Salmon Creek Medical Center (Vancouver, WA)
- Approx. 4.5 million sq. ft.
Institutionalizing Energy Efficiency

- Energy Trust of Oregon Strategic Energy Management participants
  - Continuous improvement in O&M
    - Site assessments
    - Monthly energy reviews
  - Capital planning cycle
    - Energy efficiency currently secondary priority
    - Need to do more to focus on TCO and investment quality
- Employee engagement
  - New employee orientation
  - Physician portal
  - Nurse recruiting to sustainability committee
The Nurses' Perspective on Hospital Patient Room Lighting

DOE SSL Healthcare Lighting Webinar Series
September 13, 2016

Pat Lydon, CEM
Legacy Health

Robert Davis, Ph.D., FIES
Andrea Wilkerson, Ph.D., LC
Pacific Northwest National Laboratory
Nurse Survey

What:
17 Question Nurse Survey

Where:
4 Hospitals
- Older, Urban Renovated
- Older, Urban
- Older, Suburban
- Newer, Children’s

Who:
252 Nurses

When:
2015 August
27-42% of nurses at a given hospital worked the night shift.
### Who? Department

<table>
<thead>
<tr>
<th>Department</th>
<th>Older, Urban Renovated</th>
<th>Older, Urban</th>
<th>Older, Suburban</th>
<th>Newer, Children’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Department</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Intensive Care Unit</td>
<td>15</td>
<td>15</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>Med-Surg Unit</td>
<td>38</td>
<td>38</td>
<td>4</td>
<td>39</td>
</tr>
<tr>
<td>Post-Anesthesia Care Unit</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Short Stay Unit</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Step-Down Unit</td>
<td>16</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

95% of nurses were female.

67-80% of nurses at a given hospital had worked for more than 5 years at their current hospital location.
Survey Design

For the patient room in which you most often work:

Rate and Rank Impact of Attributes
- Patterns
- Light Level
- Control
- Color
- Flicker
- Shadow
- Glare

Rate Area
- Guest Area
- Entrance
- Equip. Monit.
- Bathroom
- Comp. Monit.
- Patient Bed

Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental
Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental
We have to use a flashlight to place a Foley catheter because there is no adequate over-bed light.

Whoever came up with the idea that not having direct overhead lighting was a good idea obviously never worked as a nurse!!!

For inserting catheters, it would be nice to have a very bright adjustable light fixture attached to the ceiling to be able to move into place.

Overhead lighting would improve my ability to successfully perform my duties as an IV nurse, which has a large impact on patient satisfaction!
If lighting is needed, it would be nice to be able to **turn it on remotely**, because sometimes you are all set up to do a procedure and realized that you need a little more light.

I think bathroom light switch should be **outside the room** so patients and staff aren’t fumbling for them inside the bathrooms.

For a critical patient, it is **challenging** to get an **appropriate amount of light**. The **spotlights provide more light** but often **skew skin tone**, create **glare**, and create a **blind spot**. It takes a **lot of adjusting** and readjusting.

Placement of **light switches** is not always **obvious**. I have to search around to figure out what switch works which lights, and what will work best for a given situation.
Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental

All comments (excluding supplemental)

What is best, what needs improvement
Variance of natural and artificial light is sometimes difficult.

Ability to adjust lighting from low (calming, less stimulating) to high (for lab draws, exams, wound care, etc.) would impact our patient care experience greatly in both a therapeutic way for patients, and in helping us with better visibility for staff when needed.

Sometimes the best lighting for staff work ability is the brightest overhead bed light, but it is painful to patient's eyes (when usually brighter light is needed by staff doing care of lower body areas).

The overbed light is obnoxiously bright; however, necessary at times. It would be nice if there were more dim light options around the room.
Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental

Note: Ratings of “Neutral” or “NA” are not included in this graph
The best thing about the lighting is being able to close the bathroom door, with the bathroom light on.

I use the scanner to shine on the computer so I can see it in the dark without turning on lights.

Flash lights are very necessary for me to do my job. I'm always having to change out the flash light batteries each week.

The lighting is often too harsh in the patient rooms if I turn on the lights to complete my exam in the middle of the night.
Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental

For the patient room in which you most often work:

- Do you require additional lighting?
  - NO: 32%
  - YES/SOMETIMES: 68%
Sometimes I will turn the harsh room lights off and do my care by the light of extra lights (bathroom light, otoscope, flashlight).

IV starts require optimal lighting, which is not currently available in patient rooms.

The feature of pulling the top light down (head of bed) is helpful for IV starts at times; however, not adjustable enough if the head of the bed is elevated.

Need a light that shines from the foot of the bed for urinary catheterizations.
Results? **Light Level** · **Controls** · **Dimming** · **Nighttime Navigation** · **Supplemental**
Results? Light Level · Controls · Dimming · Nighttime Navigation · Supplemental
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