

# Characterizing and Prescribing - Preferred Light Intensity and Color

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## Introduction

Improved lighting may benefit many with traumatic brain injury (TBI), but it is challenging to measure and prescribe. A new tool, called the LuxIQ™, is the first-of-a-kind device to provide clinicians and researchers a standard tool to measure lighting needs for near tasks. It quickly quantifies near vision performance over a broad range of light levels, color temperatures and colors. The calibrated source is placed over visual acuity charts or reading materials using the individual's working distance. The lux (brightness) and color (°K/nm) are adjusted to the individual's need and these settings are recorded. With the LuxIQ practitioners can prescribe optimum task lighting in less than 5 minutes.



Reading an eye chart with the LuxIQ (white light)



LuxIQ (green light mode)

Case reports show improved near visual performance for TBI-induced nystagmus with focused, high intensity light (VisionEdge™) providing both illumination and a vision guide. Others who experience light sensitivity and/or eyestrain may find benefit using green light which reduces glare and appears to provide a more comfortable lighting than white light.

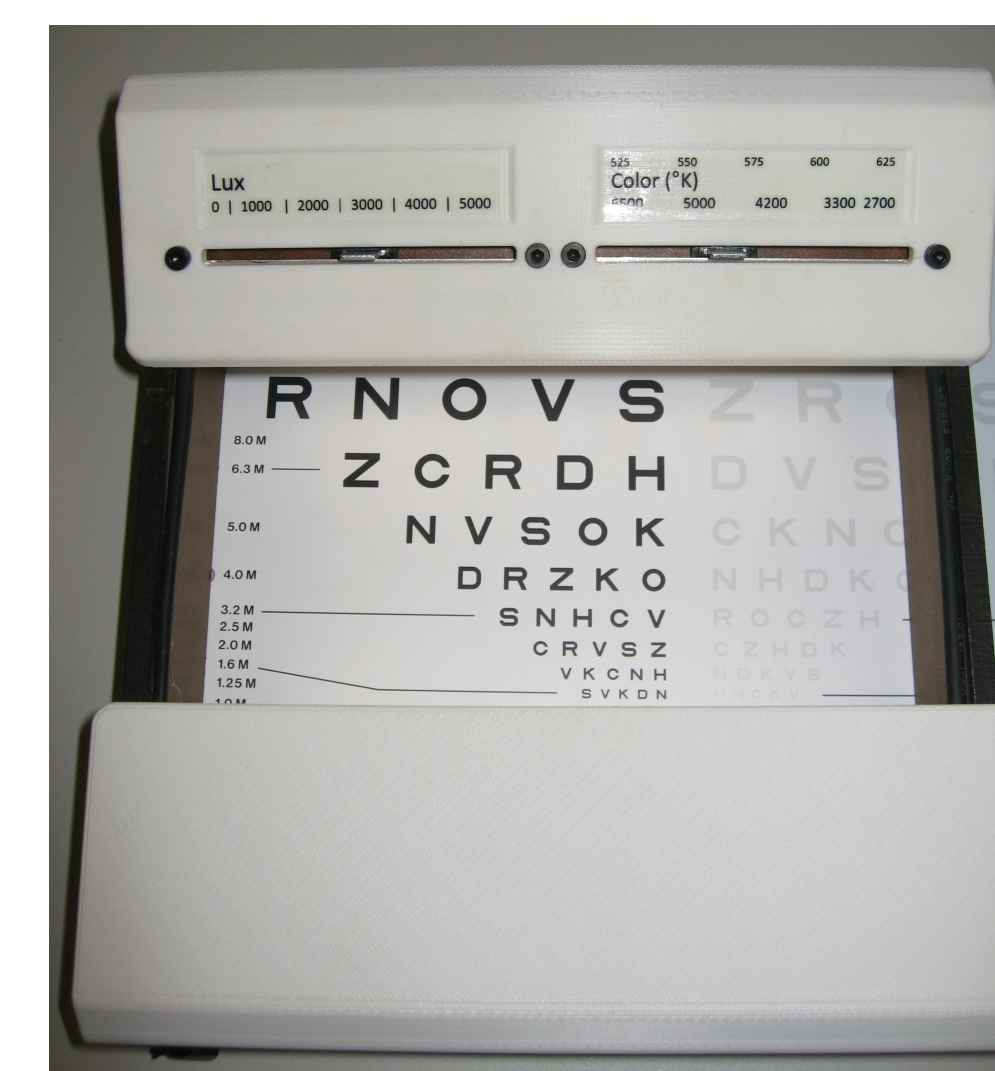
## Methodology

The LuxIQ uses four arrays of high-brightness light emitting diodes (LEDs) which provide uniform illuminance in a 14 x 20 cm viewing area. The viewing area accommodates standardized near acuity charts and reading materials such as newspapers. Sliders are used to vary the illuminance over an intensity range of 0 to 5,000 lux. For white light, color temperature may be varied over a range of 2,700 to 6,500°K (warm to cold). Alternately, the color may be varied over a range of 525 to 620 nm (green to red).

## Results

The VA Palo Alto has acquired a LuxIQ system and initiated studies to develop protocols for use. Work is also underway at sites including Smith-Kettlewell Eye Research Institute. In parallel work, methods are being developed to translate the measurements of illuminance into recommendations for commercially available lighting. Sample tables are provided at the poster. In the near future an iPad app will provide lighting recommendations in customizable electronic and printable formats. The app is presently in beta testing.

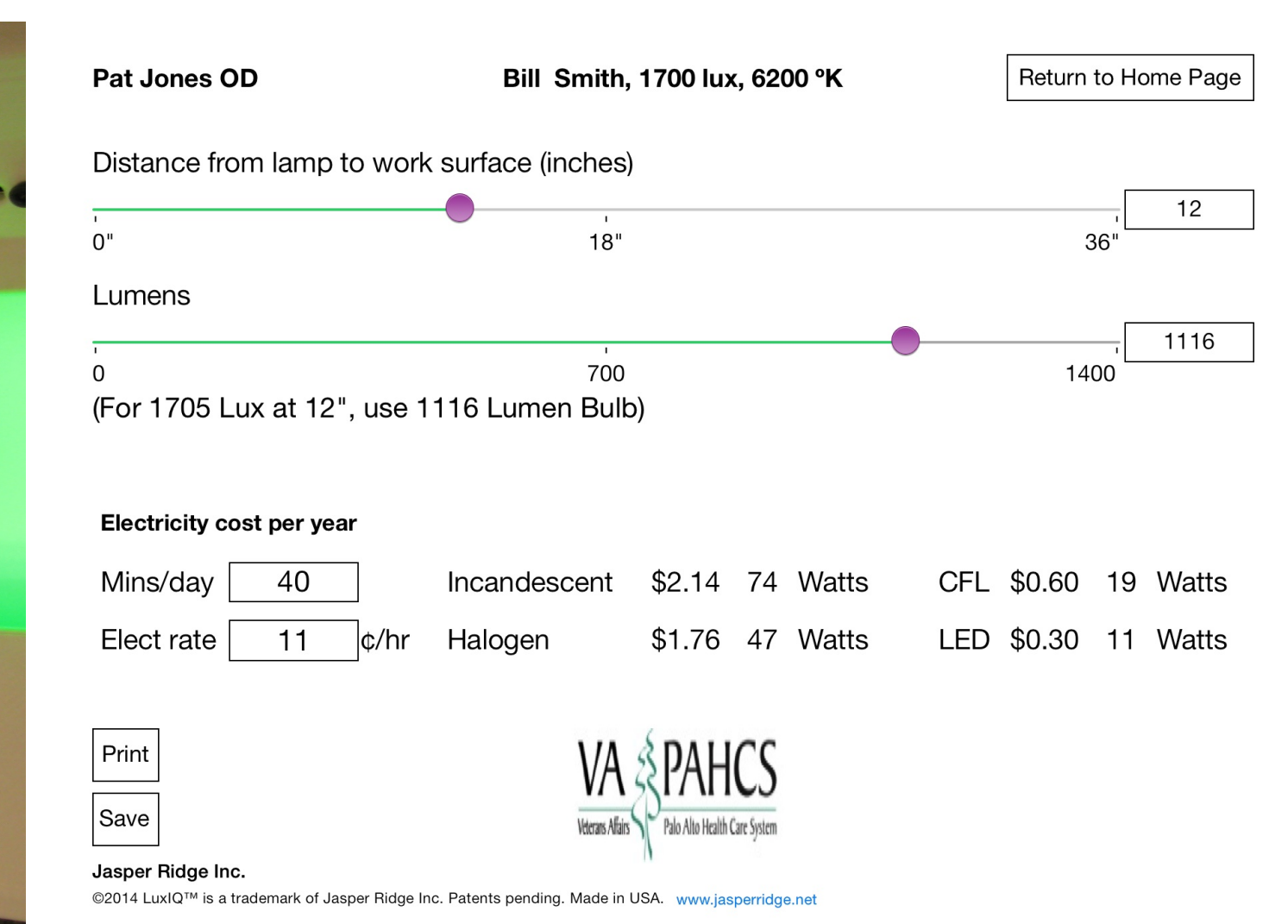
Case studies: 1) In one case, a veteran with nystagmus increased both reading comprehension (from 80% to 100%) and reading speed (by 27 words per minute) when using a VisionEdge white light, with an intense band of LED light, compared to traditional lighting. 2) In another study low vision veterans found the VisionEdge green light more comfortable for reading than conventional lighting<sup>1</sup>.



LuxIQ exam tool



LuxIQ with red, white and green light



App converts measurements to task lighting recommendations

## Conclusion

Improved lighting has the potential to improve the ability of those with TBI to perform near tasks such as reading and fine work. We are developing methods to quantify task lighting using standardized tools, and to translate lighting measurements into practical solutions where illuminance, color and lighting distribution are combined to provide individually optimized task lighting. This provides a scientific basis to discuss and recommend task lighting.

1. Borden, P., Klein, M., Goodrich, G.L. (2013). Considerations for prescribing portable LED lights for low vision. *Visibility*, 7 (1), 1-8.

Patents pending