

USING MORE DATA FOR LIGHTING SCIENCE

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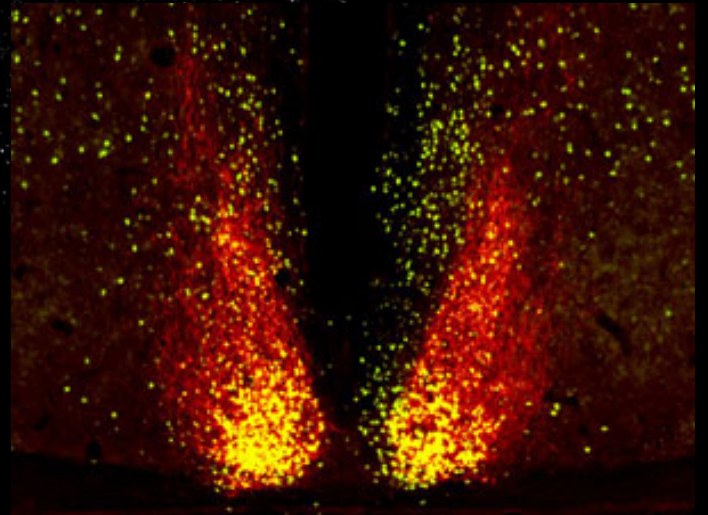
sarahman@partners.org

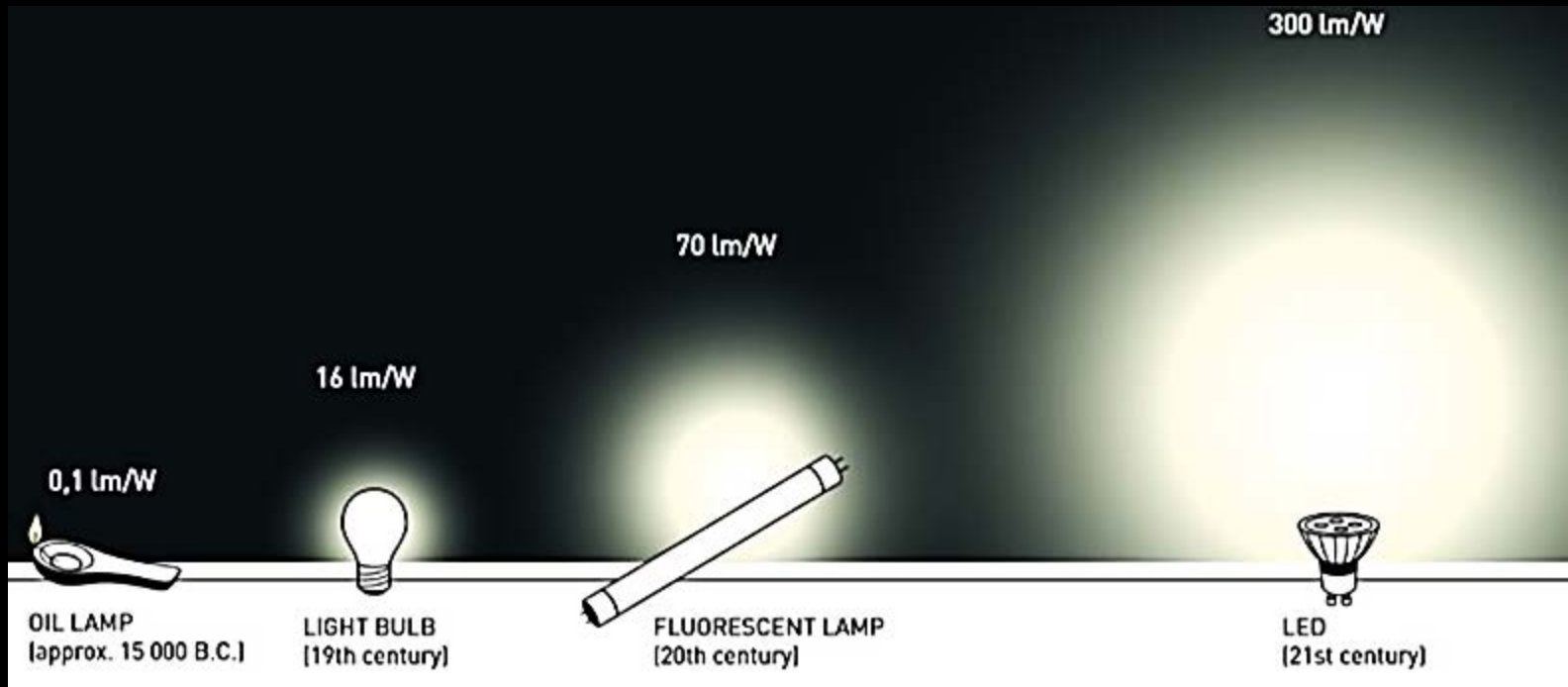
Financial Disclosure

- SAR holds IP for Prevention of Circadian Rhythm Disruption Using Optical Filters, and Improving sleep performance in subject exposed to light at night;
- SAR owns equity in Melcort Inc., which owns a stake in Circadian ZirLight Inc.,
- SAR is a co-investigator on studies sponsored by Biological Illuminations, LLC; Vanda Pharmaceuticals Inc.
- SAR is a paid consultant for Sultan and Knight t/a Circadia



SPL / NASA / NOAA / GETTY IMAGES





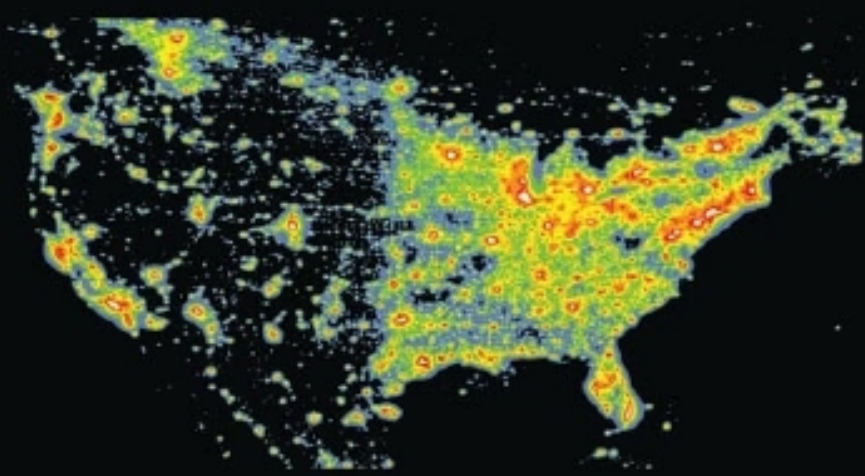
<https://www.edouardstenger.com/wp-content/uploads/2014/10/Evolution-of-lights-sources.jpg>



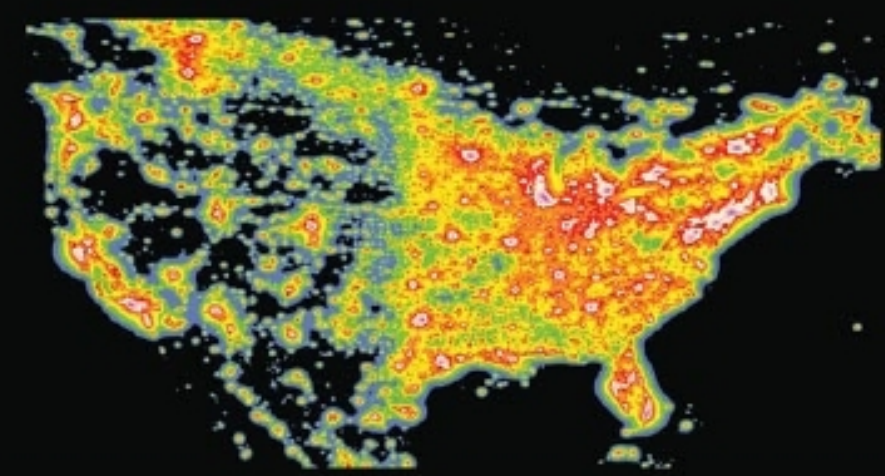
Late 1950s



Mid 1970s

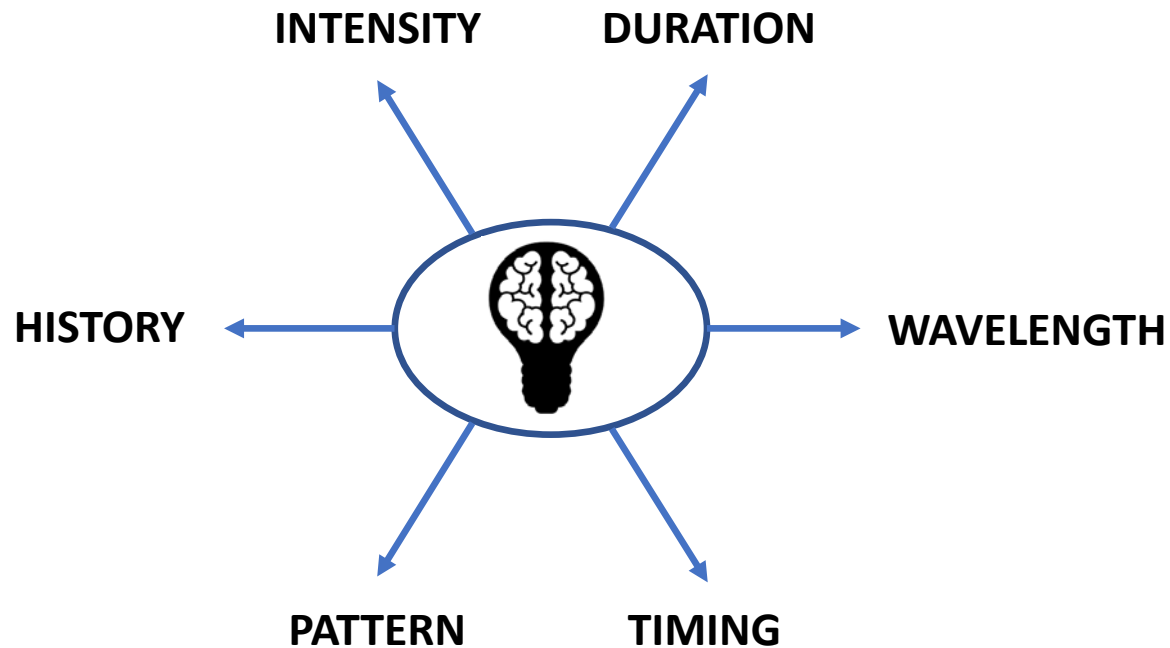


1997

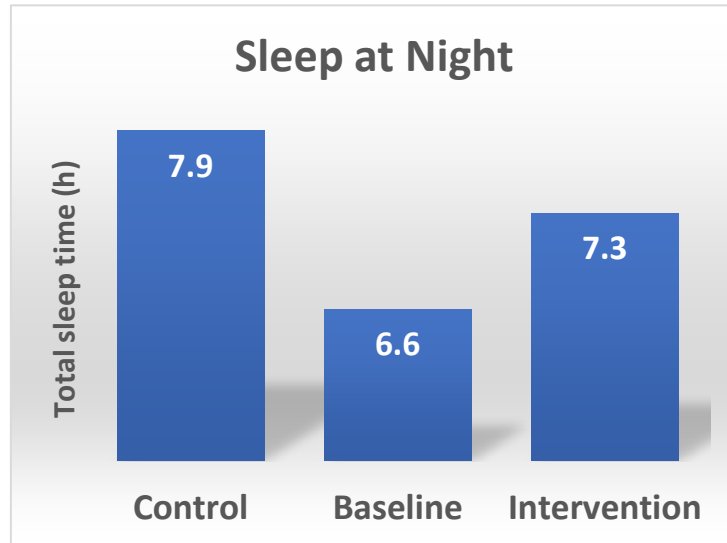


2025

Lighting characteristics that modulate biological response



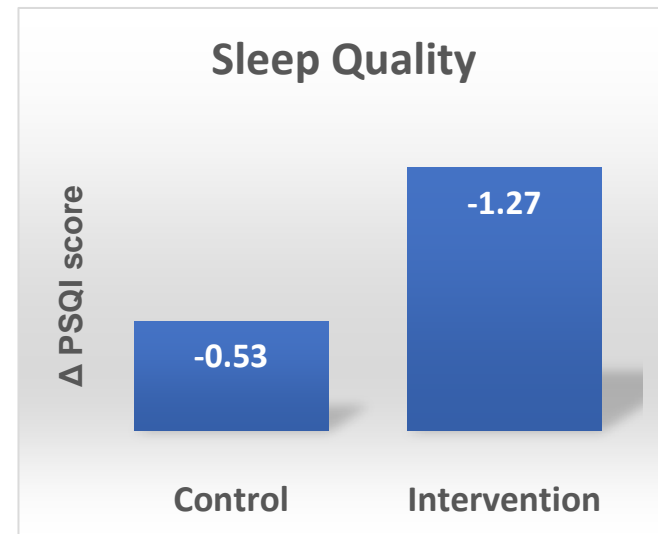
Application of basic studies



Rahman et al., *Chronobiol Int* 2013

n=9, longitudinal, 7 weeks

n=94, cross-over, 8 weeks



Viola et al., *Scand J Work Environ Health* 2008

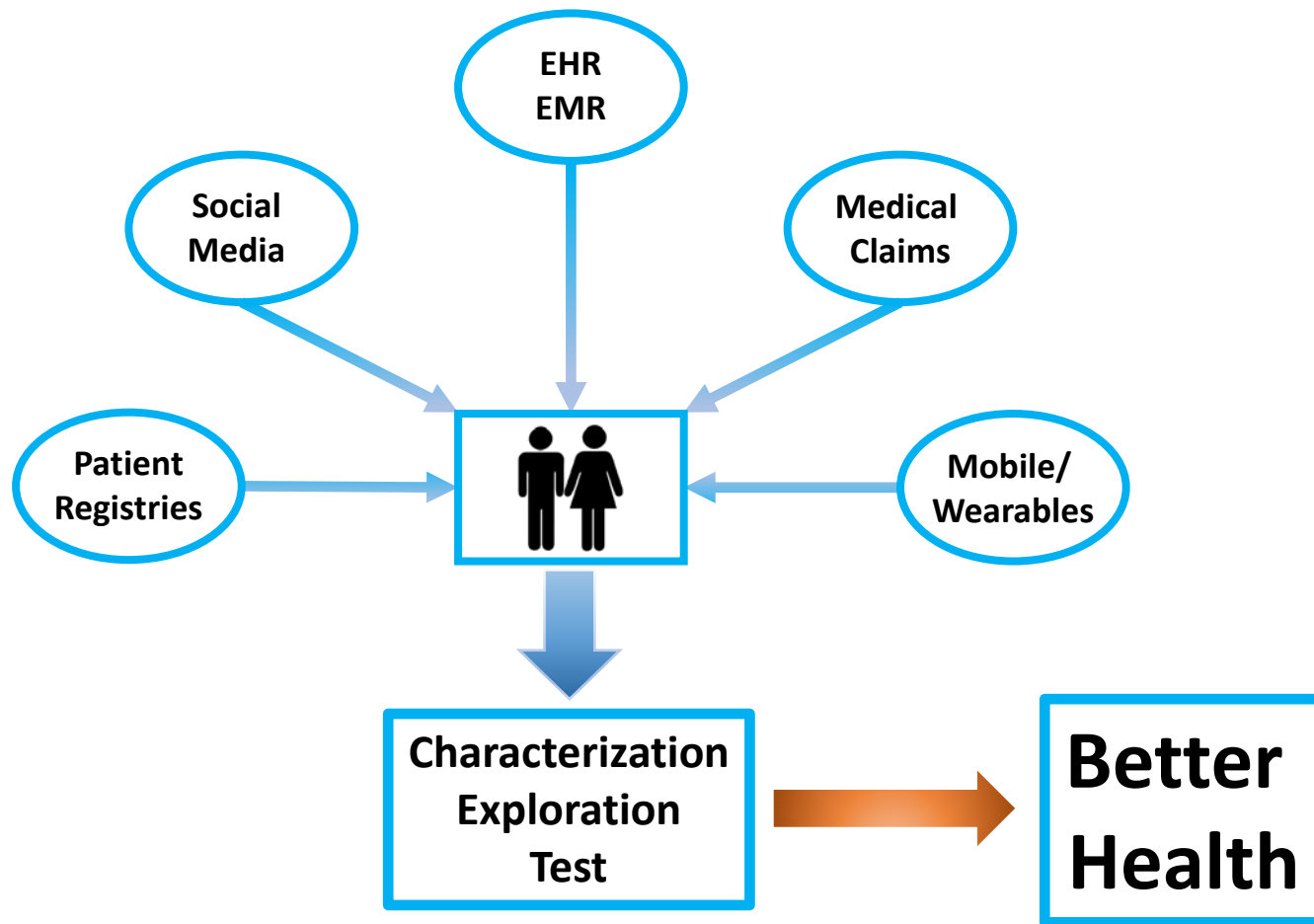
Problems of limited sample size

- Limited statistical power
- High false discovery rate
- Limited reproducibility
- **LIMITED GENERALIZABILITY**

Advantages of large sample size

- Accuracy
- Subgroup analysis
- Diversity and outliers
- **GOOD GENERALIZABILITY**

Sources of “Big Data”



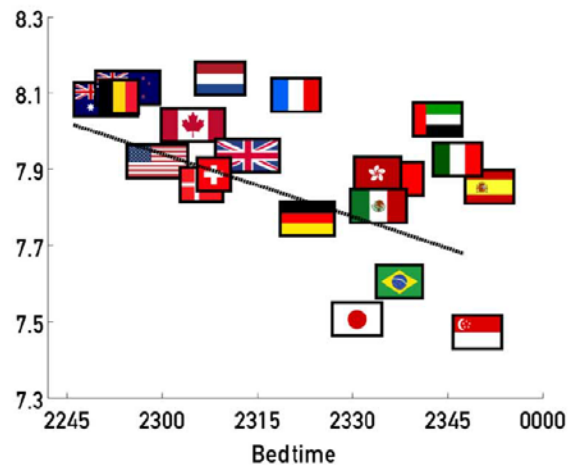
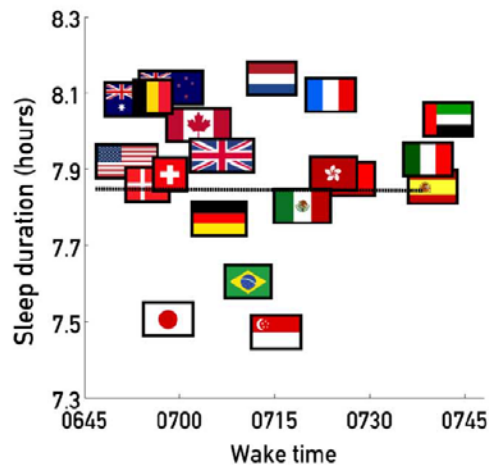
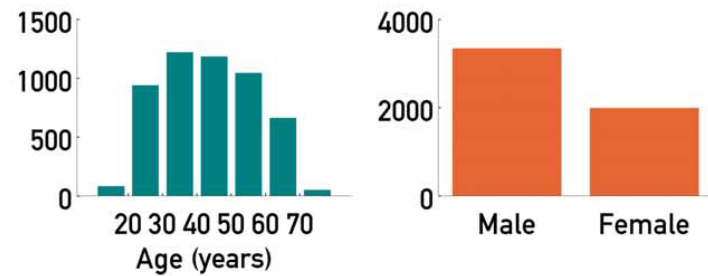
Prevalence of sleep disorder risk in first responders (US)

Sleep disorder	% total respondents at high risk	
	Firefighters (n=6933)	Police (n=4957)
Obstructive sleep apnea	28%	34%
Insomnia	6%	7%
Restless legs syndrome	3%	2%
Shift-work disorder	9%	15%
One or more sleep disorder	37%	40%

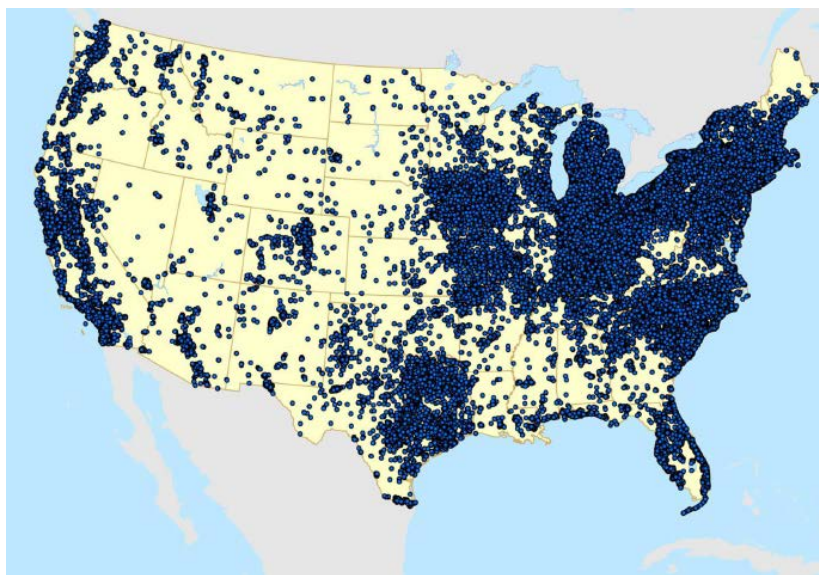
Global sleep patterns



$n=5450$, cross-sectional, 1 year

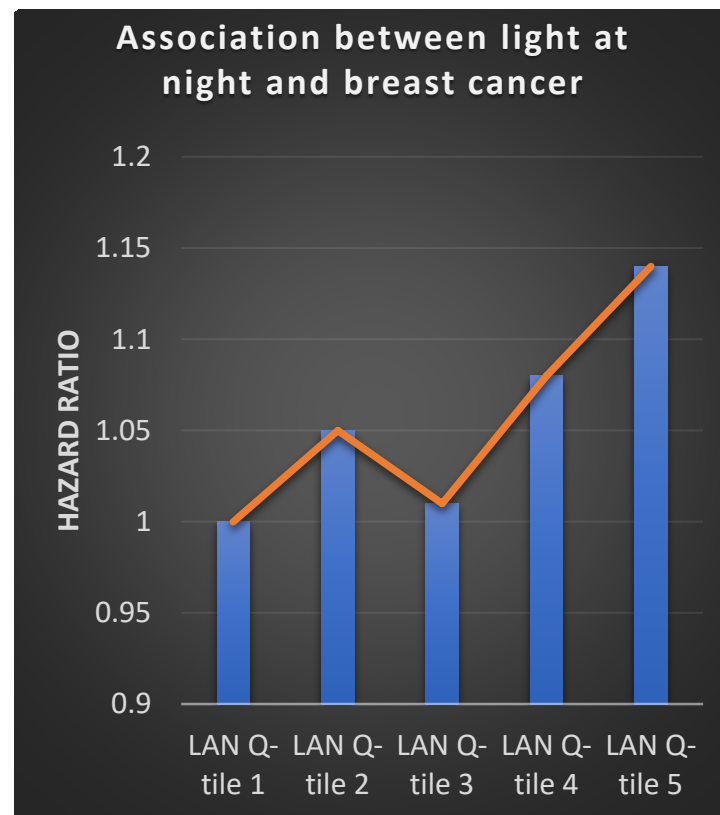


Light at night and breast cancer



James et al., *Environ Health Perspect.* 2017

$n=109,672$, longitudinal, 24 years





OPERATION STAY ALERT

Federal Emergency Management Agency
Harvard Work Hours, Health and Safety Group



$n=1,189$

Randomized Paired Design

1 year

Control

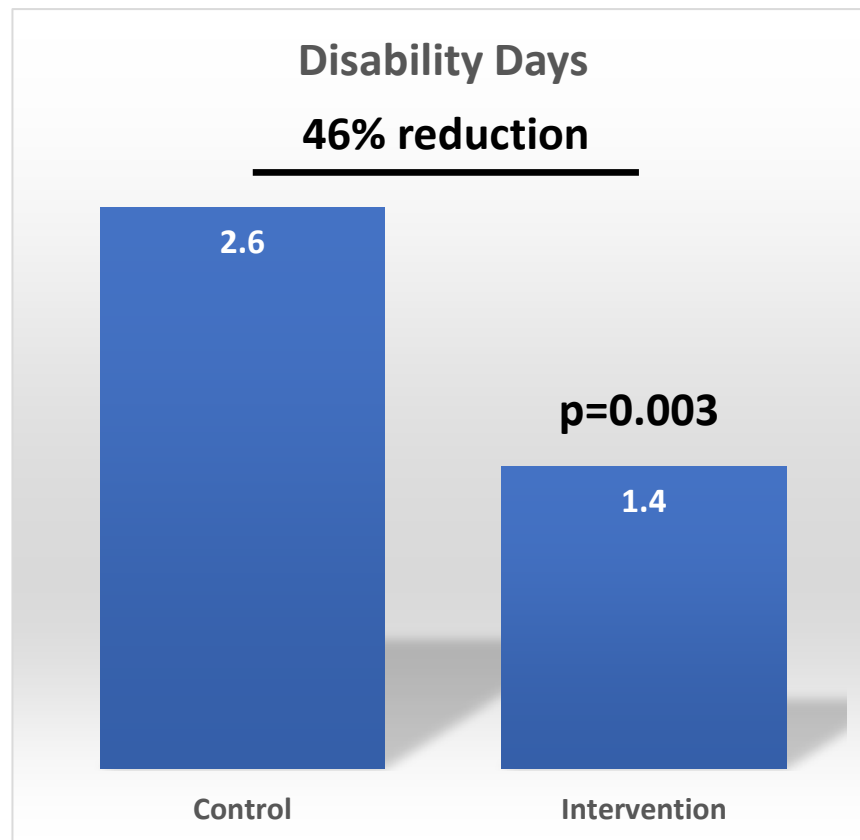
16 stations

~588 firefighters

Intervention

16 stations

~601 firefighters





Sorry, Kindle, you're just not that good in bed.



Introducing
NOOK Simple Touch™
with **GlowLight™**

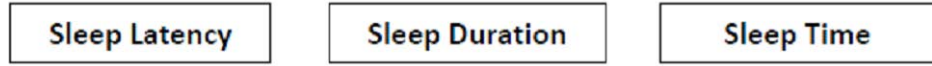
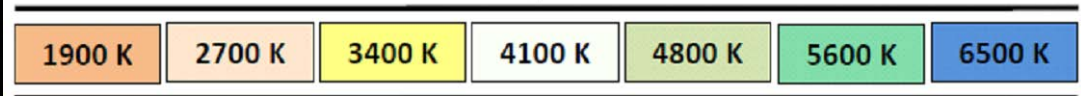
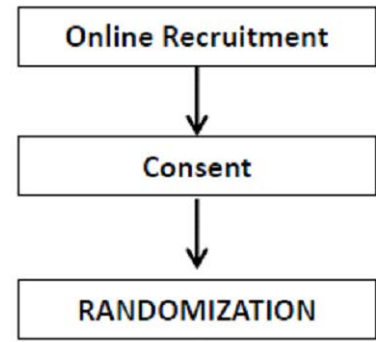
It's the first Reader that offers crisp, paperlike reading with the lights on or off. Just \$139.

nook
by Barnes & Noble

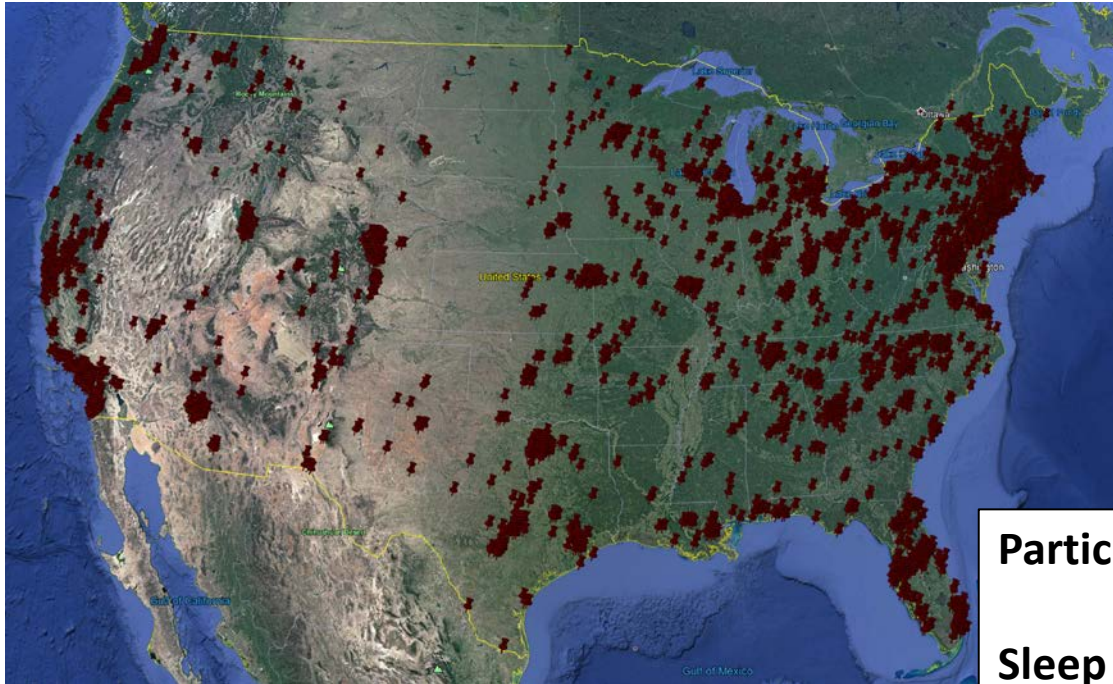


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MEASURING THE EFFECTS OF LIGHT FROM ELECTRONIC DEVICES ON SLEEP



F.Lux study map



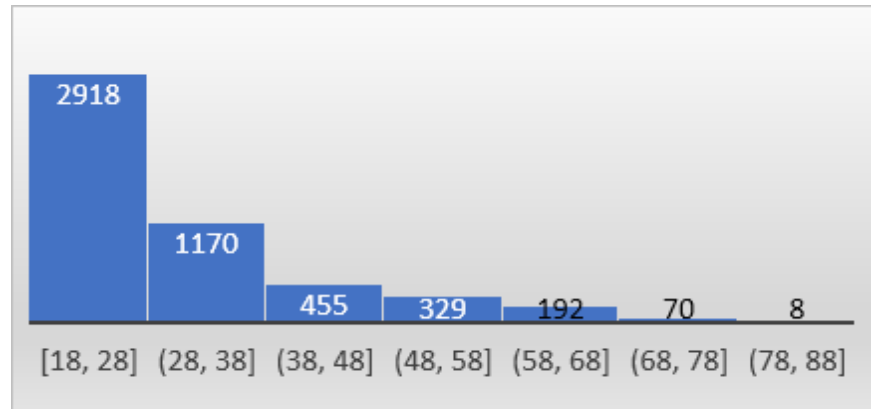
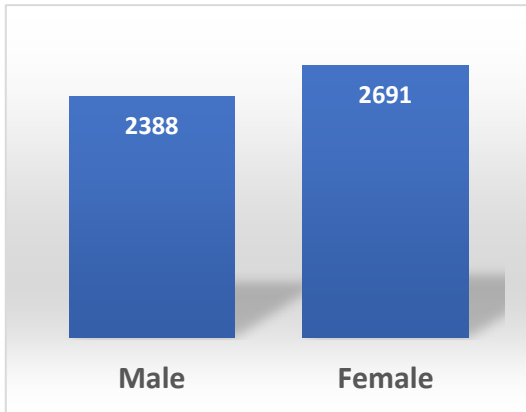
Participants = 5154

Sleep diary data = 2709

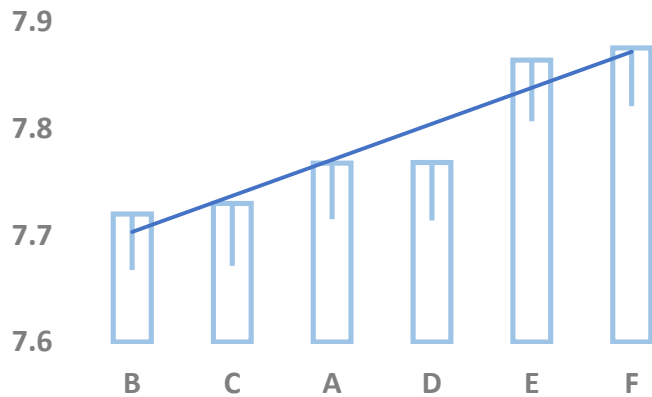
Nights of data = 19,217

~460/condition

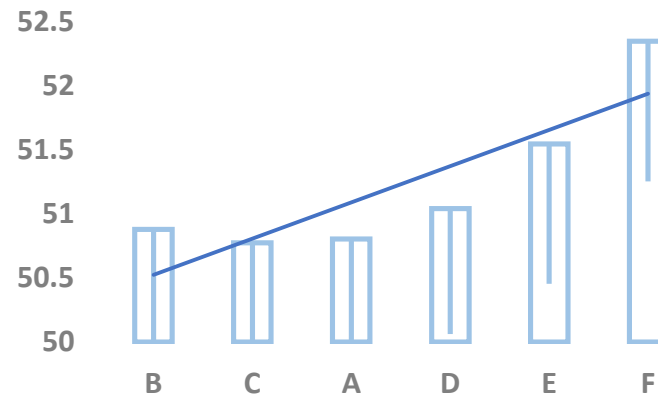
Intervention results



TST (hours)



Energetic



Future directions for using more data in lighting science

- Study the impacts of light on:
 - Worker/provider safety
 - Production
 - Health

USE EXISTING DATA

- Take advantage of “natural experiments”
 - Retrofits (pre- post-designs)
 - New fits (parallel designs)
 - Between sites (dose response)

Future directions for using more data in lighting science

- Prospective studies with industry partners because:
 - Perfectly define exposure
 - Perfectly model light environment
 - Limit data collection bias
 - **COST EFFECTIVE STUDIES**

Summary

- “Big data” is the way forward
- BUT...controlled “small data” studies are not a thing of the past

Acknowledgements

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F.Lux

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Thank you...

