

Impact of the Built Environment on the Neuroendocrine Immune Axis & Health: Implications for Green Building Design

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Disease: Neuroendocrine Stress Response Out of Balance

Too Much

Too Little

↑ Infection

↓ Vaccine
take-rate

↓ Wound
healing

↑ Cancer
Growth/
Angiogenesis

↑ Chromosomal
Aging

Autoimmune/
Inflammatory
CVD

Diabetes/
Metabolic

Osteoporosis

Depression

Pro-inflammatory

Anti-inflammatory

Elements of Place

that can trigger the stress response:

- Noise
- Crowding
- Light - too much/too little
- Odors
- Mazes

Include Spaces to Reduce Stress & Enhance Wellbeing:

- Green - gardens, views of nature
- Social Support
- Exercise
- Contemplation, meditation, prayer
- Activities that engage the senses (art, music etc.)

Study Design

- 63 white-collar workers (39 women)
- Evaluation performed at work place
- 8 AM - 24 h



OLD WORK SPACE

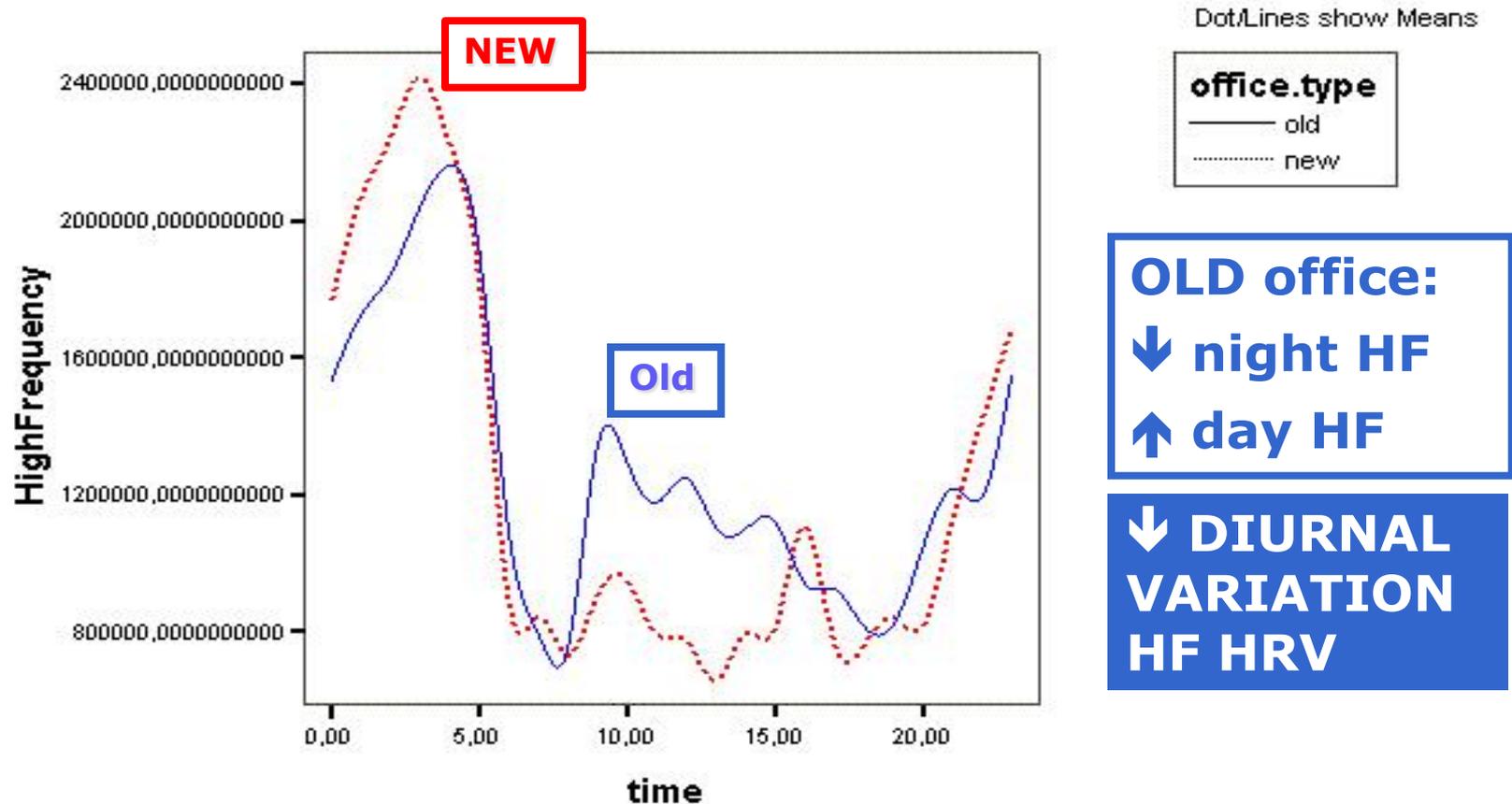
(poor lighting & ventilation)
(n= 43)



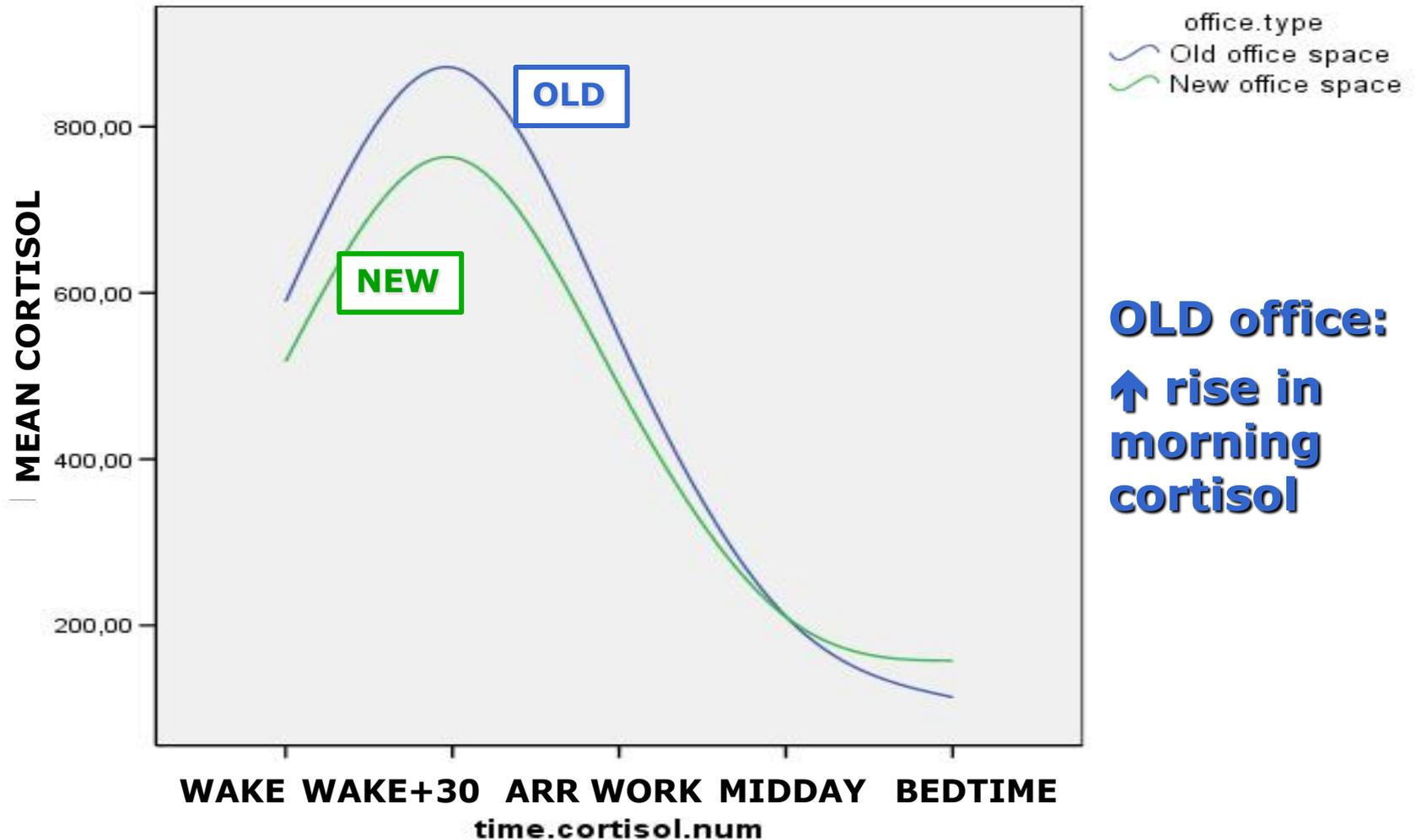
NEW WORK SPACE

(improved airflow; natural light)
(n=20)

Lower Stress/Higher Relaxation Response New Space compared to Old Space



Lower Stress Response New Space compared to Old Space

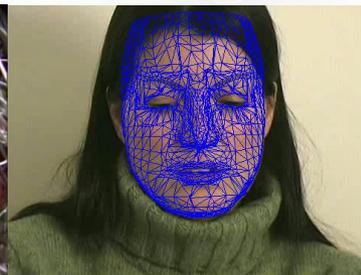
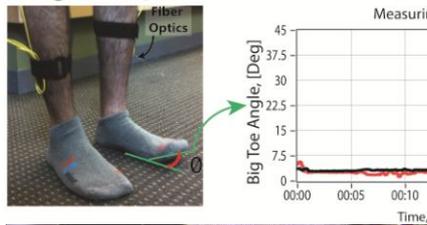
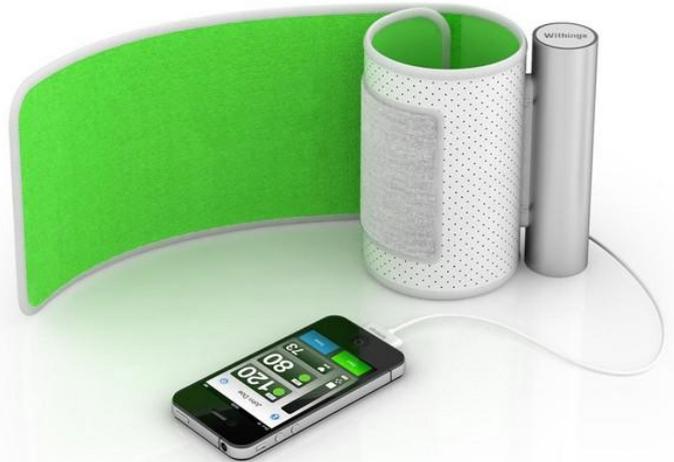
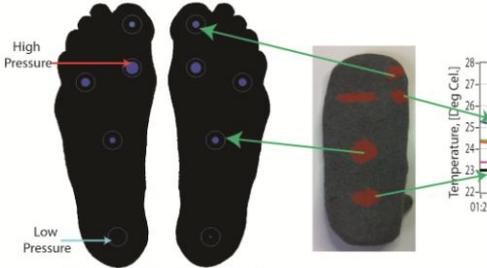


THE FUTURE

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Measuring plantar pressure **SmartSox**



Draft Recommendations 11-12-13:

- **Building labeling should report on potential stressors**
 - **Low hanging fruit: stay within known ranges of human comfort supporting health & wellbeing**
e.g.
 - **noise levels**
 - **temperature**
 - **air flow**
 - **light**
 - **pollutants etc.**
- **Future labels: human responses to building IEQ in real time & place (tie metrics to the occupants rather than to building).**
- **Recommend: future research to refine and define ranges.**

FROM: DRAFT REPORT: Indoor Environmental Quality and Health: Pathways to Reduce Risks and Promote Health

TABLE 3: Potential Measures to Assess Outcomes

IEQ Factor	Suggested Measures
Thermal	Radiance Gun for air temperature Ventilation rates, air change rate Surface temperatures Spot measures using portable data collectors In place data collectors for longer time periods
Light	Lux (iPhone app) for spot checks Luminous ratios (IES Handbook)
Pollutants/VOCs	California 01350 List of Pollutants CO2 monitoring Aircuity monitor or other device
Acoustics	Decibels - dB(A) Acoustic meter (iPhone app) for spot checks Acoustic consultant for more rigorous analysis Behavioral observations to identify human inputs to acoustic conditions
Human Health and Well Being	Suggested Methods and Measures
Comfort and satisfaction	Center for the Built Environment on line survey Interviews, focus groups, walk-throughs
Movement and exercise	Pedometer to measure steps; behavioral observation; stairwell counters
Physiological	Stress (Heart rate variability, salivary cortisol, non-invasive stress and immune biomarkers from sweat and skin); health surveys; light exposure ("daysimeter"); circadian effects (sleep quality)
Psychological	Mood, subjective well being, happiness, alertness (survey instruments)
Organizational	Engagement (Gallup Q12), complaint logs, turnover rates, absenteeism



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Office of Federal High
Performance Green Buildings
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Institute of the Environment

Bio 5

College of Architecture, Planning & Landscape Architecture

- Architecture
- Urban Planning
- Landscape Architecture

 Institute on Place and Wellbeing
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