

Administrator and Staff Preference and Perceptions Regarding Sustainable Design

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Administrator and Staff Preference and Perceptions Regarding Sustainable Design

Three Research Projects:

1.

Administrator perceptions of evidence-based design and sustainable design (Baum, Shepley & Rostenberg)

2.

Administrator perceptions of LEED factors in healthcare buildings (Hill)

3.

Hospitals Healthy workplaces? (Natural light: the power of Change) (Zadeh)

Administrator Perceptions of Evidence-based & Sustainable design

- Some argue that evidence-based design and sustainability are mutually supportive or closely aligned, while others suggest that they are incompatible or unrelated.
- The purpose of this study was to provide data to **clarify the relationship between these two approaches as perceived by healthcare facility administrators.**



www.buildinggreen.com

Administrator Perceptions of Evidence-based & Sustainable design Hypotheses

- **EBD and EED are compatible approaches when designing healthcare facilities.**
- PIs conceded minor conflicts (e.g., some materials support infection control but are not easily recyclable).
- Some objectives were neither synergistic nor contradictory (e.g. storm water management would not have a direct effect on patient outcomes.)



www.midbrook.com



www.sewerhistory.org

Administrator Perceptions of Evidence-based & Sustainable design

Tools included:

- practitioner focus groups,
- snowball sampling for the identification of experts,
- best practice facility survey, and
- the EBD/EED questionnaire.

Administrator Perceptions of Evidence-based & Sustainable design

Practitioner Focus Groups

- Focus groups identified 10 issues for the survey ranging from the degree to which EBD or EED was incorporated in the completed facilities to perceived conflicts between the two approaches.
- 31 EBD and 52 EED projects were selected for the pool of potential best practice facilities.

Administrator Perceptions of Evidence-based & Sustainable Design Results

Snowball Expert Sampling

- 52 experts contacted to select best practice projects; 26 EBD and 26 EED experts.
- From universities, professional practice, and organizations whose missions focused on evidence-based design or sustainability.



Administrator Perceptions of Evidence-based & Sustainable design

Best Practice Facility Surveys

- Of the 26 EBD and 26 EED experts who were approached, 16 EBD experts and 16 EED experts responded, representing 62%.
- Those projects (9 EBD and 9 EED) in the 1/3 were included.
- There was significant agreement regarding EBD facilities and all in the 1/3 had 6 or more votes.
- For EED, some top 1/3 projects only had 3 votes.
- One additional project was suggested and the majority of experts selected fewer than 10 of the potential projects.

Administrator Perceptions of Evidence-based & Sustainable design

Supportiveness and conflicts



- 50% EED felt approaches supportive, 10% saw conflicts.
- Positive relationship re: access to nature, distraction, choice, and infection control.
- EBD acoustics/lighting problematic for EED.

Administrator Perceptions of Evidence-based & Sustainable design

- 50% saw EBD having a positive impact on EED; 45% saw it having no impact,
- Sustainable landscape, water efficiency, reuse of rainwater and air quality equip. perceived as problematic for EBD by a small %.
- Nature & daylight unanimously supported regarding positive impact on health.



Administrator Perceptions of Evidence-based & Sustainable design

Frequency of data collection

- About 85% of EBD facilities gathering data on EBD, only 12% gathering data on EED.
- Only 50% of EED facilities were gathering data on EED. EED facilities were more interested in outcomes on EBD amenities, hence, more than 60% were gathering data on EBD.



Administrator Perceptions of Evidence-based & Sustainable design

Decision making and design



- 80% of EBD facilities took EBD into consideration at a moderate or significant level, and 65% considered sustainability.
- In EED facilities, EBD is considered to play a moderate to significant role in decision-making 100% of the time, while EED plays a moderate to significant role in decision-making about 90% of the time.

Administrator Perceptions of LEED Factors (Hill)

Research Question

- When staff and administrators evaluate their LEED certified health centers, what is their level of satisfaction with perceivable green building features that are intended to impact occupants? (Hill, 2009)

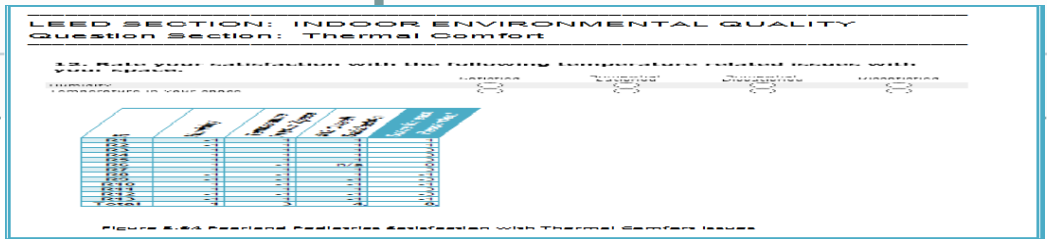


www.centerforsustainability.org

Administrator Perceptions of LEED Factors (Hill)

- Cases studies were selected from the USGBC database of LEED certified buildings in 2006.
- Four LEED certified health centers agreed to participate.
- The study evaluated LEED points that could be perceived by occupants who are not familiar with LEED standards.
- A Likert scale was used to assess the level of satisfaction regarding each LEED point.

Administrator Perceptions of LEED Factors (Hill)



R	Humidity	Temperature in your Space	# 12 Overall Satisfaction	Score for Each Respondent
R1	-1	1	1	1
R2	-1	1	1	1
R3	1	1	1	3
R4	1	1	1	3
R5	1	1	1	3
R6	1	-1	n/a	0
R7	1	1	1	3
R8	-1	-1	1	-1
R9	-1	1	-1	-3
R10	1	-1	-1	-1
R11	1	1	1	3
R12	-1	-1	-1	-3
R13	-1		-1	-1
Total	1	3	4	8

Source: Hill, A. (2009). Occupant evaluation of LEED certified health centers.

Administrator Perceptions of LEED Factors (Hill)



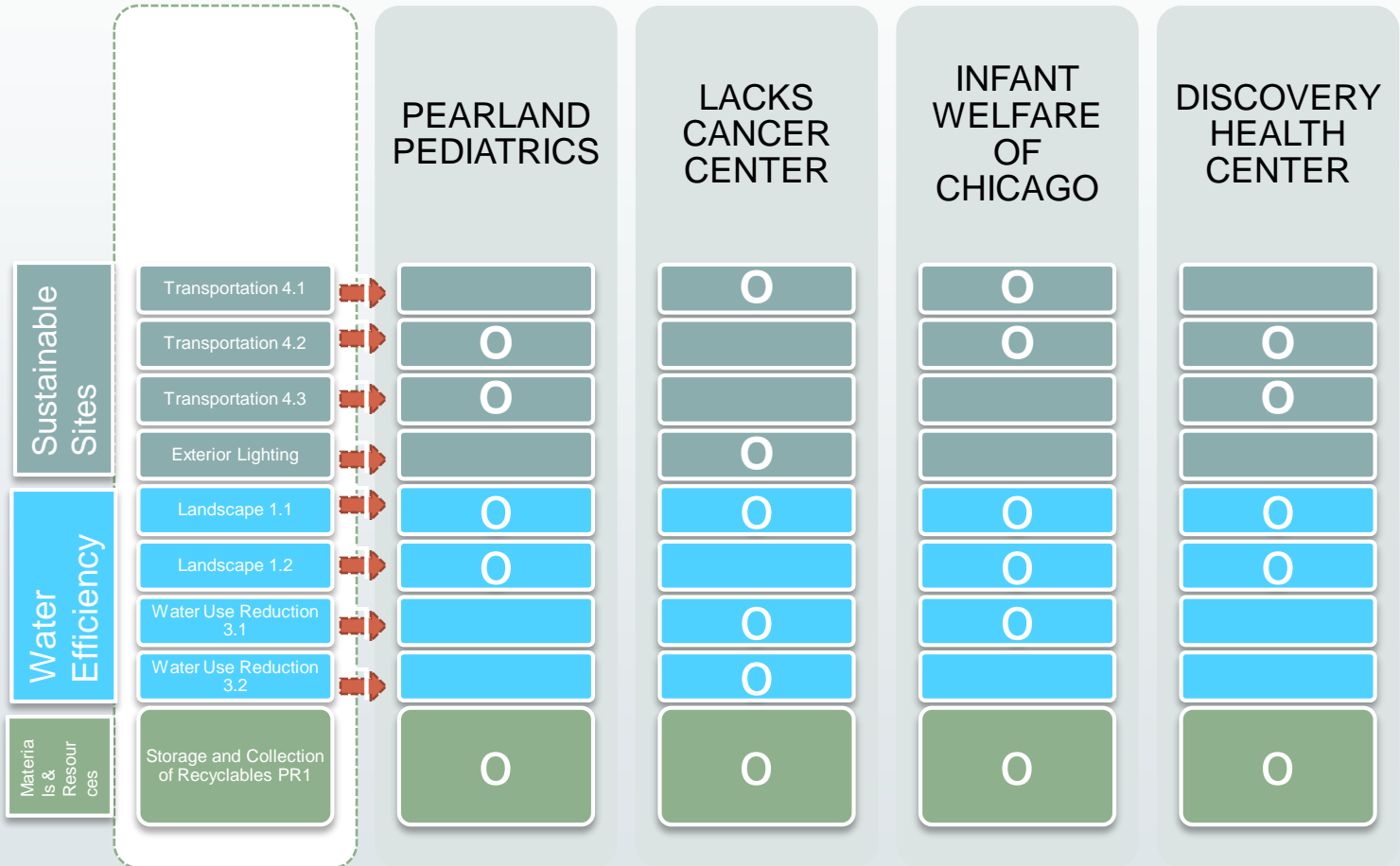
www.bpmarch.com

- After the surveys were collected, the data was organized by case study.
 - Pearland Pediatrics
 - Infant Welfare Society of Chicago
 - The Center for Discovery
 - The Lacks Cancer Center

“49 total subjects”

Administrator Perceptions of LEED Factors (Hill)

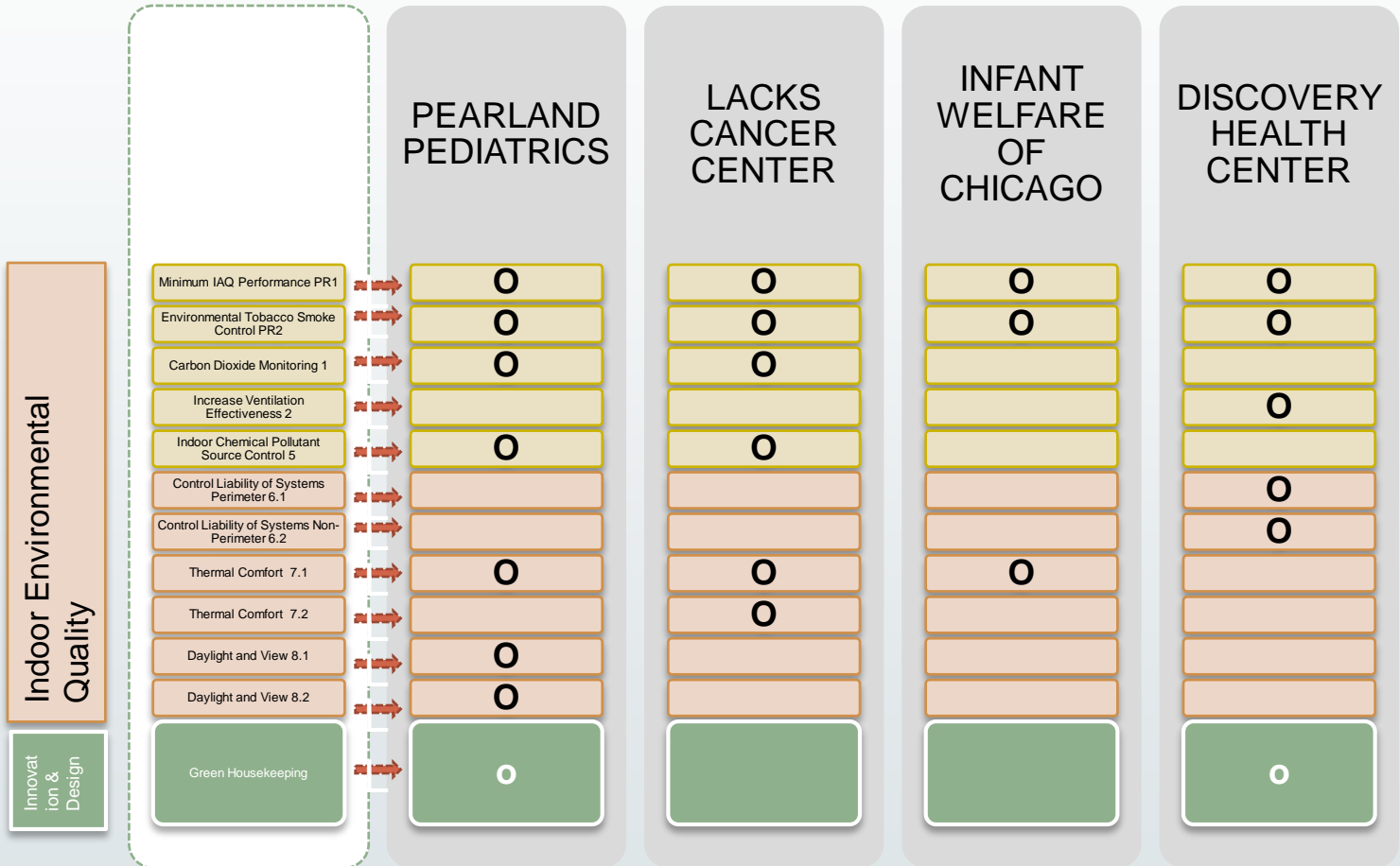
Comparison of Perceivable LEED points received by the LEED Certified Health Centers



Source: Hill, A. (2009). Occupant evaluation of LEED certified health centers.

Administrator Perceptions of LEED Factors (Hill)

Comparison of Perceivable LEED points received by the LEED Certified Health Centers



Source: Hill, A. (2009). Occupant evaluation of LEED certified health centers.

Administrator Perceptions of LEED Factors (Hill)

Transportation Category	Staff Parking	Bike Storage	Shower Facilities	Access to Public Transportation	# 12 Overall Satisfaction	Score for Health Center
Transportation	1	1	1	-1	1	3

Category	Facility Drive Ways	Facility Entrance	Exterior of Building	Staff Parking Area	Walking Paths to the Parking Area	Overall Safety at Night	# 12 Overall Satisfaction	Score for Health Center
Exterior Lighting	1	1	1	1	1	1	1	7

Category	Health of Plantings	Satisfaction with Landscape Design	# 12 Overall Satisfaction	Score for Health Center
Landscape	1	1	1	3

Category	Fresh	Stuffy	Smoky	Exhaust	Chemicals	Dusty	Pollen	# 12 Overall Satisfaction	Score for Health Center
Indoor Air Quality	1	1	1	3	1	1	1	1	6

Administrator Perceptions of LEED Factors (Hill)



www.greenbeanchicago.com

- The results of these four case studies were similar. The overall occupant response to building features influenced by LEED was satisfactory.

Hospitals, healthy workplaces? Natural Light: the power of Change

- **Introduction,**
 - Four dimensions of real Green Healing practice
 - What is the scope of our study?
 - Why is daylight important for green healthcare ?

- **Literature review**
 - The business case for sustainable healthcare
 - Why to reduce stress?
 - Why to decrease medical errors?
 - Does daylight have the power of change?

- **Research Methods**
- **Real life applications**
- **Conclusion**

Introduction

Are our hospitals healthy working environments?

Healthy Buildings...

in terms of energy use → Administrators
in terms of occupants' well being → Staff

Problem Statement

Introduction

- Cost and quality of care in the United States has been yet a great concern for health care leaders, patients, doctors, and nurses.

Healthcare

- **The cost of care in the United States is the highest in the world** (Health Affairs, Schoenbaum et al, 2003)
- **At the same time, different aspects of care such as safety, effectiveness, timeliness, and efficiency have been yet big issues for care givers** as stated by the Institute of Medicine (IOM) (Health Affairs, Schoenbaum et al, 2003).

Is there a Solution?

Introduction

Our decisions have multi-dimensional outcomes.

Energy Saving

Case 1: X University campus has signed an agreement to move the thermostat points to improve efficiency and save \$19000 yearly.

Question: What is the impact of this temperature change on energy saving?

Occupant's Comfort & Wellbeing

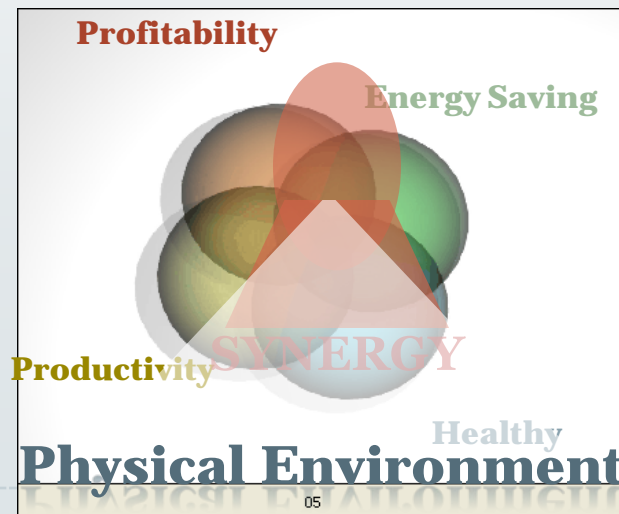
Question: Has the university investigated the effect of this temperature change on occupants' comfort?

Case 2: A study by Cornell University on typists showed increasing thermostat levels has reduced typing errors by 49% and typing output by 150% (for each degree Fahrenheit) around 5% decrease in error and 16% increase in productivity.

Introduction

- Experience shows any real practical sustainable solution is embedded in a holistic approach. Only a multi-level solution can lead to maximum potential (Huang, Guest lecturer, 2009).
- Professionals encourage the initiation of developing design guidelines that meld both sides of the issue, effective and efficient design approaches to highlight best practices. (Shepley et al, 2009).

Besides saving energy, green design strategies suggest the improvement of **environmental** quality (LEED 2007).



Healing design suggests the improvement of **environmental** conditions to provide a more effective care.

Four dimensions of green healthcare affected EBD and EED strategies



www.ifoapplestore.com

<http://leedbootcamp.blogspot.com>

<http://www.nytimes.com>

<http://www.djc.com>



e

Healthcare

Effective (Healthy & Productive)

Economical

Efficient

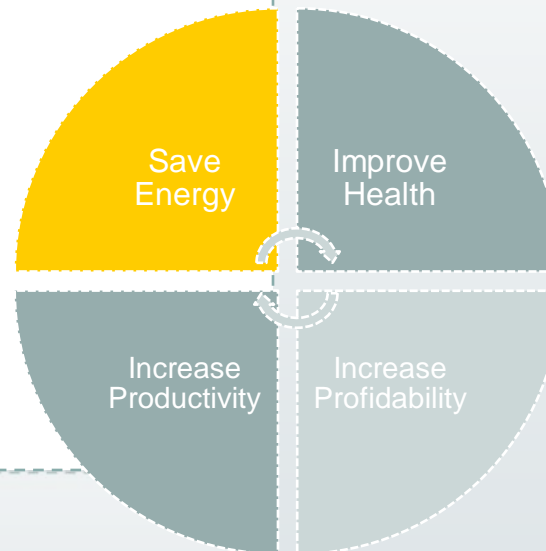
1. Save Energy

Background: Natural light is a free energy source with the potential of controlling and minimizing electricity consumption. Different studies show correct daylighting design also decreases building heating and cooling loads.



www.archicentral.com

1. Energy saving and efficiency,
2. State of health and wellbeing,
3. Productivity, and
4. Profitability.



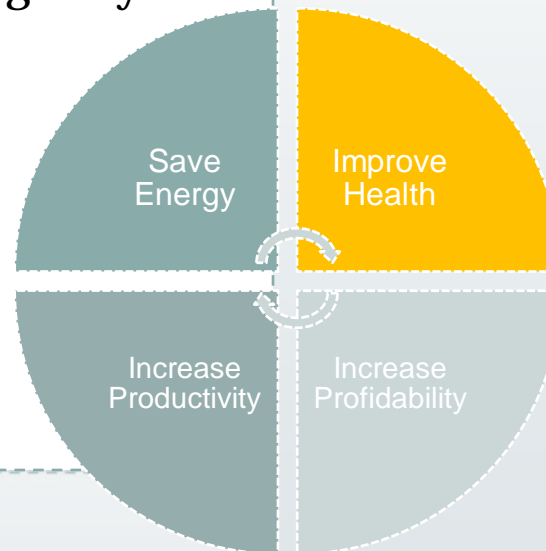
2. Improve Human Health

The healing and rehabilitating effects of natural light have been observed on school children, workers in factories, and on patients in hospitals. We will investigate the effects of natural light on hospitals' working environments to create a psychologically healthier workplace.



www.archicentral.com

1. Energy saving and efficiency,
2. **State of health and wellbeing,**
3. Productivity, and
4. Profitability.



3. Improve Productivity

Methods: To measure the impacts of daylight on care givers' health and work performance, we will observe if daylight availability in nurse stations can reduce their stress , improve mental health and impact human related medical errors.

1. Energy saving and efficiency,
2. State of health and wellbeing,
3. Productivity, and
4. profitability.



www.archicentral.com



4. Increase Profitability

We **hypothesize** that natural light will increase profitability by reducing medical errors and the following costs. At the same time by minimizing job stress, it will improve nurses physiological mood which has effects on turnover rates.

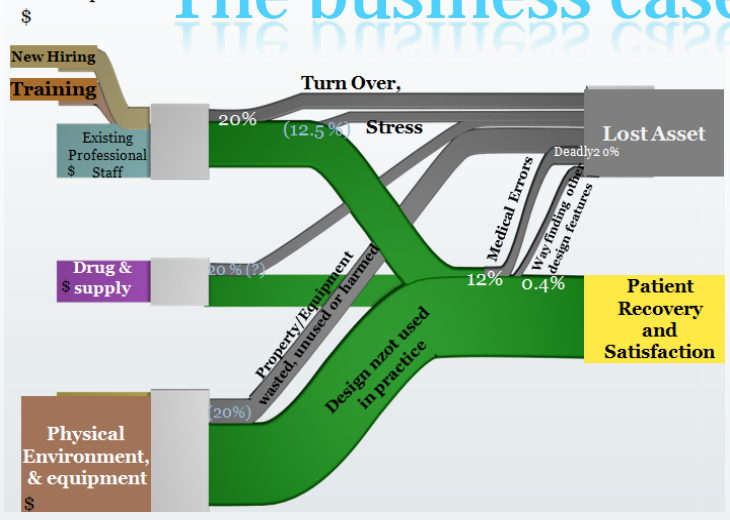
- 1. Energy saving and efficiency,
- 2. State of health and wellbeing,
- 3. Productivity, and
- 4. Profitability.



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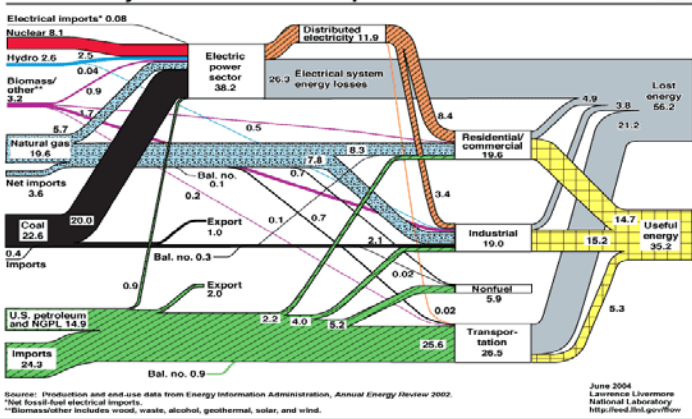


The business case of sustainable healthcare



- Studied 1,440 stroke patients, 12 % of them had experienced adverse event (JYI, 2008).
- One out of five incidents with the chance of death (Healthgrades, 2008)
- Wayfinding and giving directions wasted time of trained healthcare professionals as much as 2 fulltime jobs out of 500 employees. (Zimring, 1990)
- In the United States, the average annual nurse turnover rate is 20 percent (JCAHO 2002).
- Design modifications reduced infection by 50%, patient falls by 70 %, increased patient satisfaction by 18%,improved job satisfaction(AHRQ, 2005)

Numbers in Light blue are uncertain estimates
U.S. Energy Flow Trends – 2002
Net Primary Resource Consumption ~97 Quads



Lawrence Livermore National Laboratory (LLNL)
 US Energy Flow in 2002

Literature

What is Stress?

- Stress is “the harmful physical and emotional responses that occur” when the demand of the job is much higher than “capabilities, resources, or needs of the worker” (NIOSH, 2008).
- Records show health care occupations are highly stressful and associated with “higher psychological distress rates than other professions” (NIOSH, 2008).



Why does stress matter?

- Medical errors along with other outcomes such as physical and psychological symptoms, absenteeism, turnover, errors, and low morale are the various responses of occupational stress in the healthcare profession (NIOSH, 2008).
- Stress is a significant contributor to chronic illnesses, which own the most costly share of healthcare (Ulrich, personal communications, 2009).

Literature

- Should we be concerned about stress?



<http://todaystaffingmanager.com>

A strong study in 2005 on 25,000 individuals identified the nursing occupation to be among the top twenty jobs with the most potential of stress due to physical and psychological outcomes. (Cooper, 2005)

The same study found that nursing is among the top ten occupations with lowest job satisfaction rates .

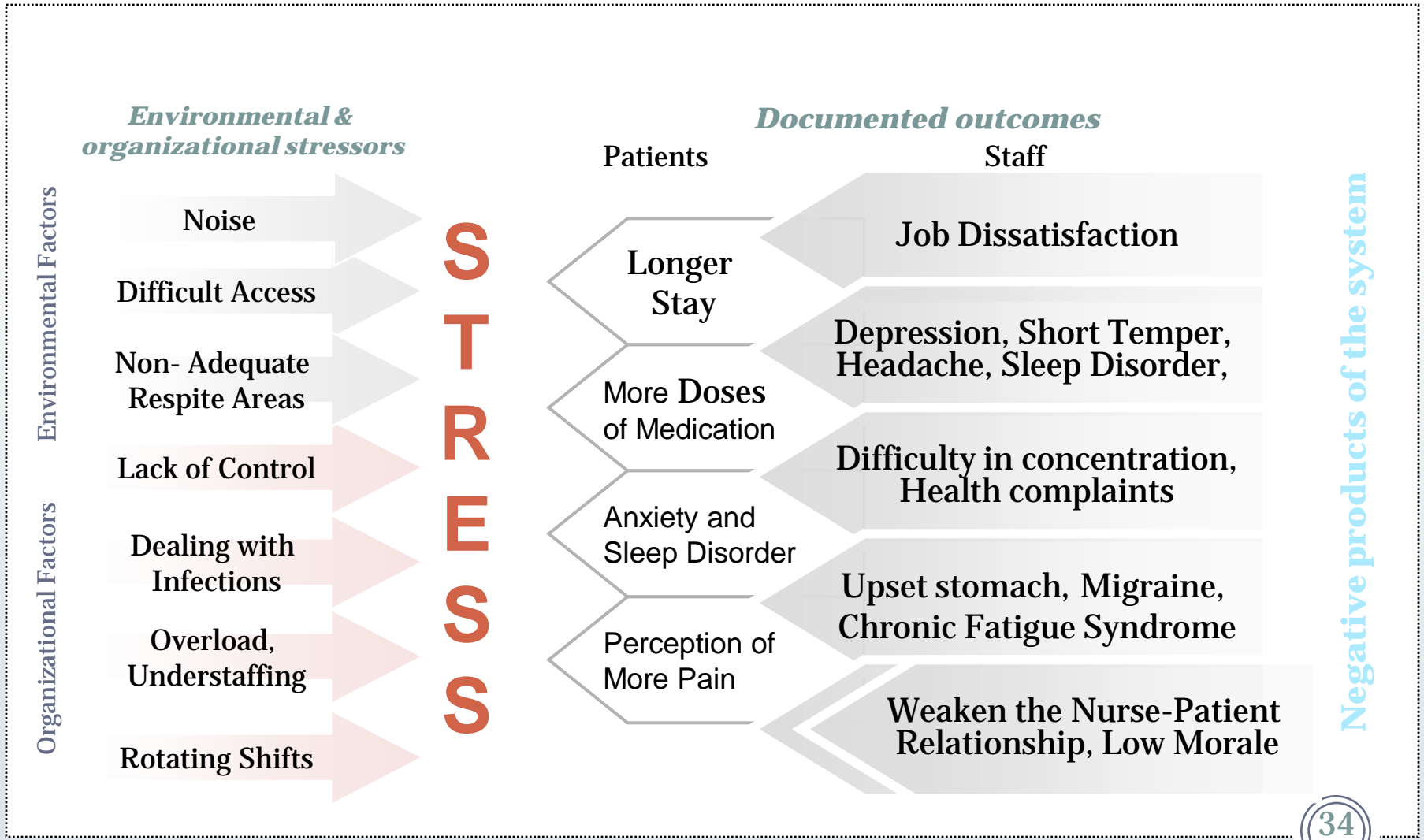
Rank	Physical Health	/Psychological Health	Job Satisfaction
1	Ambulance	Social services providing care	Prison Officer
2	Teachers	Teachers	Ambulance
3	Social services providing care	Fire Brigade	Police
4	Costumer service-call Center	Ambulance	Customer service
5	Bar Staff	Vets	Social Services providing care
6	Prison Officer	Lecturers	Teachers
7	Mgmt(Private Sector)	Clerical and admin	Nursing
8	Clerical And Admin	Mgmt(Private sector)	Medical/dental
9	Police	Prison officer	Allied health professionals
10	Teaching assistant	Research- academic	Bar staff
11	Head teacher	Police	Mgmt (Private sector)
12	Secretarial/business support	Customer Services	Fire brigade
13	Research- academic	Director(Public Sector)	Vets
14	Lecturers	Allied Health professionals	Clerical and admin
15	Senior Police	Bar Staff	Mgmt (Public sector)
16	Nursing	Nursing	Lecturers
17	Mgmt (Public Sector)	Medical/dental	Head teachers
18	Allied Health Professionals	Senior Police	Teaching assistant
19	Medical/ Dental	Secretarial/ business support	Secretarial/business support
20	Accountant	Head teachers	Director (Public sector)
21	Fire Brigade	Mgmt(Public Sector)	Research- academic
22	Vets	Accountant	Senior Police
23	Director (Public Sector)	Teaching Assistant	School lunchtime supervisor
24	Analyst	Analyst	Accountant
25	School Lunchtime Supervisors	School Lunchtime Supervisor	Analyst
26	Director/MD (Private Sector)	Director/MD (Private Sector)	Director/MD (Private Sector)

Occupations ranked on the three stress related variables (psychological well-being, physical health and job satisfaction)

(Cooper, 2005)

Stress, A major concern in the healthcare setting (Ulrich et al, 2006)

Literature



Literature

- Evidence shows stress makes the **workplace unproductive and unhealthy** (Reskin, 2008).
- The stress reported was **mostly caused by: Physical Environment, Organizational Measures, and Low Job Status** (NIASH, 1998).
- “The consequences of job stress from **high turnover** and **low morale** to greater **risk of illness** and injury are damaging to the organization and for the individual” (Reskin, 2008).
- Evidence shows **Cardiovascular Disease, Psychological Disorders, Suicide, Cancer, Ulcers, and Impaired Immune Function** can be related to job stress (CDC, 1998).
- Research by Khodadadi (2008) found a strong statistical relationship between **nurses’ job stress and the occurrence of migraine, chronic fatigue syndrome, and anxiety.**
- Hoiberg (1982) examined occupational **stress which reported that the rate of hospitalization increased with tenure** due to stress (The longer you work the more you are affected).
- **“Health care expenditures are nearly 50% greater for workers who report high levels of stress. *Journal of Occupational and Environmental Medicine*”** (CDC, 1998).
- Invisible psychological **outcomes of occupational stress** and the organizational hazards are **just as pervasive as** many of the **physical hazards** (Reskin, 2008) .



www.medical.siemens.com

Respond to the Problem Literature

**Organizational
Change (CDC)**



www.medical.siemens.com



**Environmental
Changes (Ulrich)**

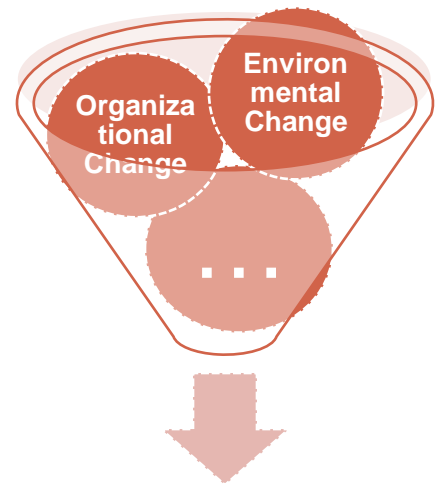


Dell Children's Medical Center
www.childrenshospitals.net
Karlsberger Architects



**Healthier
Work Places**

Ulrich, Class Lectures, 2009)



Healthy Work Environment

Literature

Medical Errors

The new approach is to look at medical error as system failure rather than individual failure. (Leape L. *Journal of Evaluation in Clinical Practice* 1997)

- A study by an insurance company on stress prevention measurements in hospital settings reported 50% decline in medication errors after the implementation of stress prevention activities.
- In a second study, there was a 70% reduction in malpractice claims in 22 hospitals that implemented stress prevention activities (*Journal of Applied Psychology*) cited by NIOSH, 2009).



Mahlum Architects

“A clerestory channels natural light into the ER nursing station at St. Mary's Hospital in Walla Walla.”

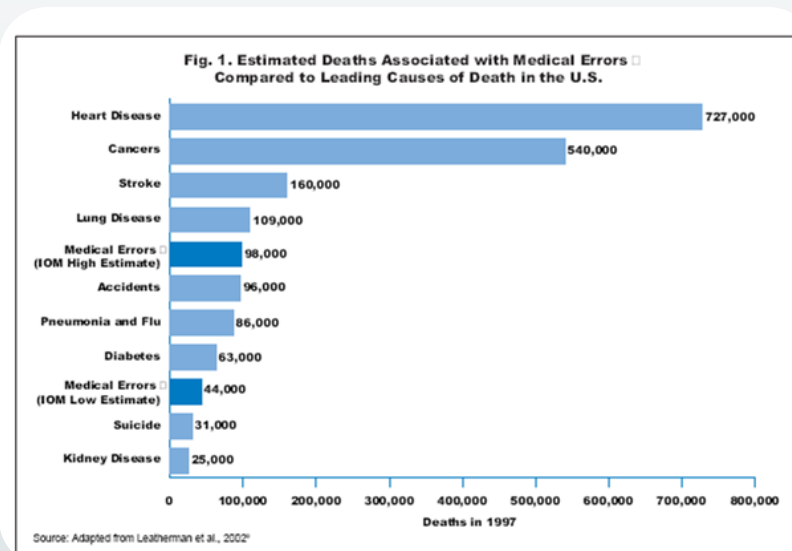
Photo by Jim VanGundy

<http://www.djc.com/>

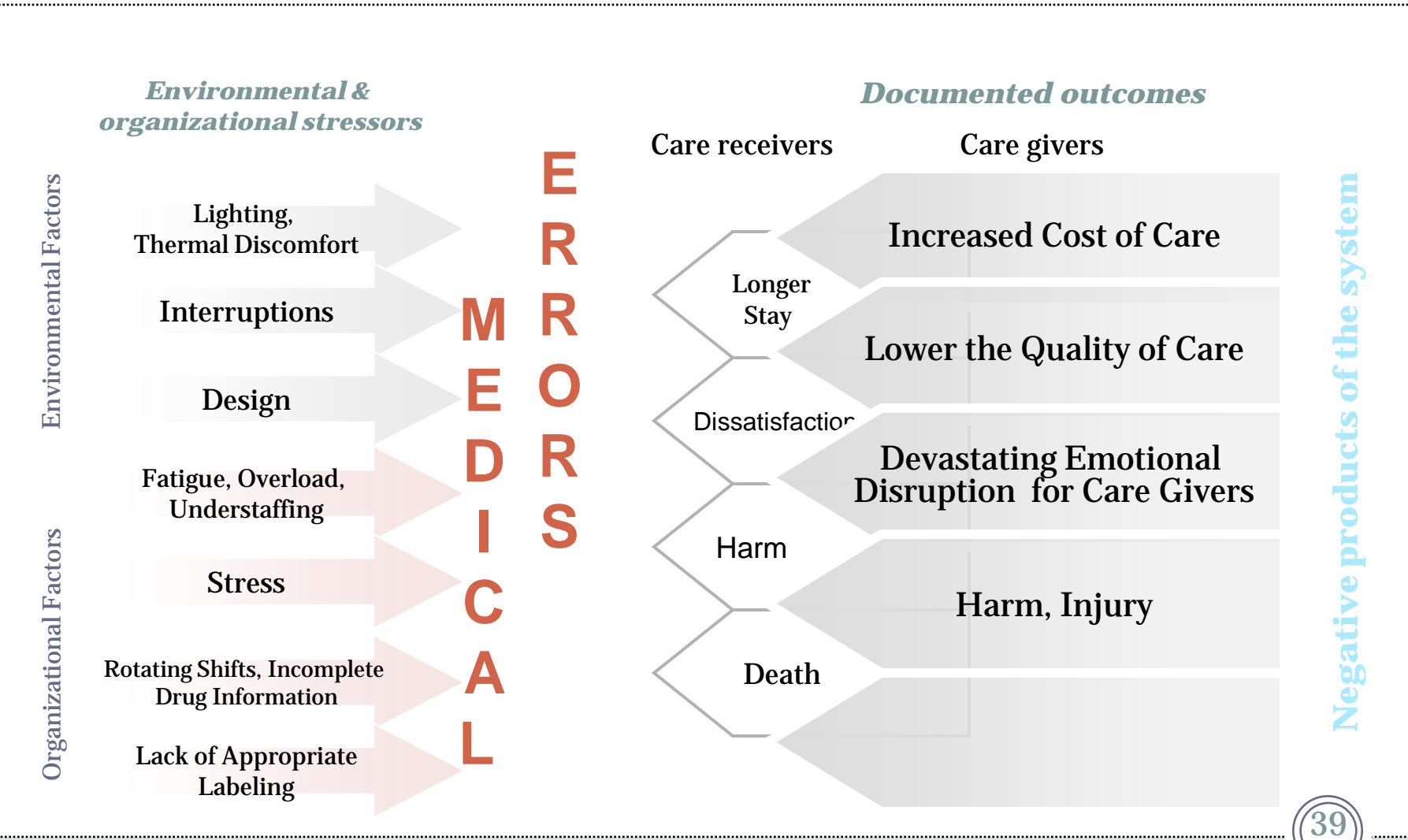
Literature

Why do we care about **medical errors**?

- Preventable medical errors are responsible for 44,000 to 99,000 deaths yearly in the US. This number does not include injuries and harms to patients and staff who survived the mistakes (IOM, 1999).



- Medical Errors**, One of the Most Important Hazards
Literature



Does Natural Light have the Power?

Literature



- **Physiological Effects**

Daylight improves the body's circadian system, reduces depression among patients, decreases length of stay in hospitals, and eases pain. (Joseph, CHD, 2006)

Daylight exposure has curative impacts on mood disorders and depression (Beauchemin and Hays, 1996; Benedetti et al., 2001; Lam et al., 1992; Painter, 1999; Wirz-Justice et al., 1996, Alimoglua and Donmez, 2006).

A study by Roberts (2000) indicates that visible light can lead to mood alteration by modulating the pituitary and pineal glands, leading to neuroendocrine changes

(Alimoglua & Donmez, 2006).

Does Natural Light have the Power?

Literature

- **Effects in Other Settings**

Workers' productivity improved in factories and schools by increasing access to daylighting (cited by Guenther & Hall, 2007; Kates, 2006).

Windows and views of nature buffered job satisfaction and improved health of white collar and blue collar workers (Leather et al, 1998)(cited by Environment's impact, Ulrich et all 2006).

Office workers with a window view reported lower frustration and higher life satisfaction and overall health (Kaplan 1993; cited by Environment's impact, Ulrich et all 2006).



www.healthcareinteriorsdigest.com

DesignGroup: Richard M. Ross Heart Hospital

Does Natural Light have the Power?

Literature



<http://justinbraem.com>

Northwestern
Memorial Hospital

- **Effects of Daylight on Patients**

A study on patients undergoing spinal surgeries showed patients assigned to brighter rooms had “less perceived stress, pain, took 22% less analgesic medication per hour and had 20% less medication costs (Walsh et al, 2004, In press; Cited by Ulrich et al, 2004)

Patients with bipolar disorder who were assigned to bright east sunlight had a shorter length of stay (Benedetti , Francesco et al, 2001; Cited by Ulrich et al, 2004).

White, in 2007, suggests daylight illumination to be the most suitable for the caregivers tasks “including charting and evaluation of infant skin tone”

What about for the healthcare staff?

Research Needed on Daylight Literature

- Previous researchers have found daylight exposure has a significant impact on patients in hospitals or workers in different settings (Shepley, 2004). Little has been done for hospital staff and daylight.
- Ovitt (1996) suggested that proper daylighting may decrease medical error rates, a reduction which can save lives and also costs associated with medical errors (cited by Guenther & Hall, 2007).
- A study of nurses' burnout , job satisfaction, and daylight only found indirect effects and suggested further studies to obtain an appropriate conclusion on daylight (Alimoglua & Donmez, 2006).
- "More research is needed to understand the optimal lighting requirements for supporting the complex tasks performed by nurses and physicians" (Angeli Joseph, 2006).



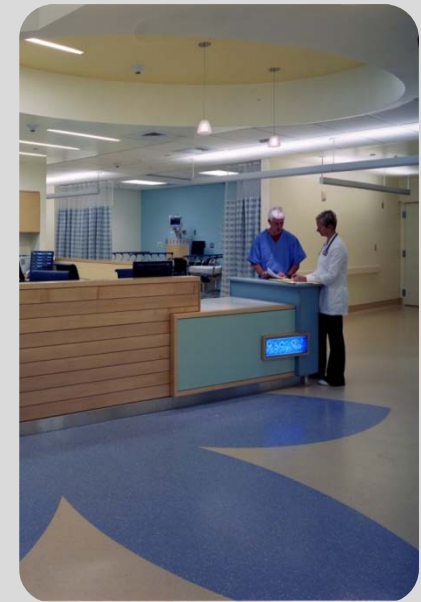
planetgreen.discovery.com

Staff Errors & Stress as Impacted by Natural Light

Methodology

Data Collection: We will conduct the study on a population of nurses in 3 different hospitals in the US.

- Those stations which are similar in design and organization but different in daylight levels will be matched and compared.
- We hypothesize that higher natural light levels in these stations will reduce the number of medical mistakes, improve their mood, and reduce stress levels .

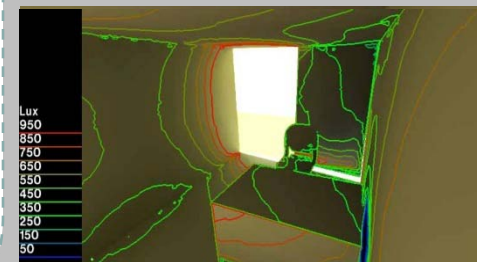
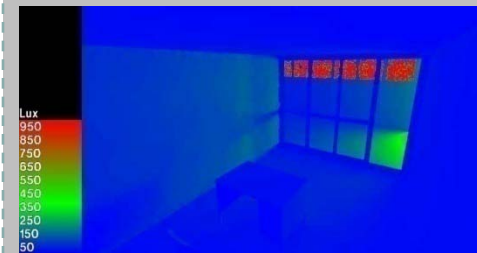
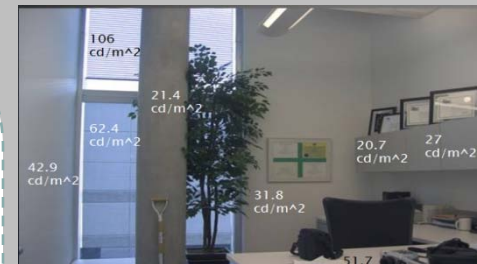


Courtesy of Zimmer Gunsul Frasca Architects, LLP; Photo Credit: (c) Eckert & Eckert

Staff Errors & Stress as Impacted by Natural Light

Methodology

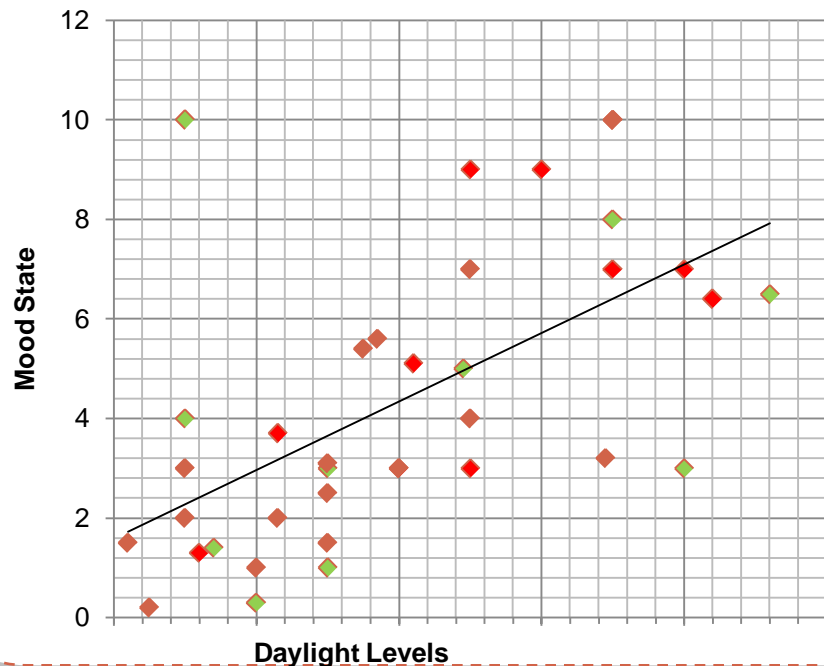
- A daylighting computer model of the nurses' working unit will be made by the software programs, Radiance & Daysim, to estimate the overall illumination levels.
- Furthermore, we utilize the *Profile of Mood States* tool (*Federal Aviation administration, 2009; Pollock et al, Gawrn, 2000, Shachem, 1983*) to record the mood states and stress of the participants in different daylight conditions.
- At the same time we will collect the medication errors recorded by hospitals.



Daylight Research, Attia, Zadeh, Wren, 2008
Supervised by Liliana Beltran

Methodology

- A statistical analysis will indicate if daylight levels and number of medical errors as well as stress levels are dependent. We will track any pattern between the increase of daylight and the decrease of medical errors and stress levels.



Courtesy of Zimmer Gunsul Frasca Architects, LLP; Photo Credit: (c) Eckert & Eckert

Research Constraints



- The best method to evaluate the effect of naturally lit work areas for healthcare staff would be measuring the outcomes before and after applying daylight to the working areas while keeping other variables such as location, staff, and materials the same. We have not found case studies that are modifying specifically daylight access via design changes.

Real Life Applications

- If the benefits of natural light in reducing errors and improving mood were documented, it can be used as a rigorous, cost-effective solution to economic, safety, and cultural concerns, besides obtaining LEED points.
- This research, although incomplete at this point, suggests that access to daylight should be possible for any occupied space, especially for critical and stressful professions like healthcare staff.



Courtesy of Zimmer Gunsul Frasca Architects, LLP; Photo Credit: (c) Basil Childers

Administrator and Staff Preference and Perceptions of Sustainable Design

Conclusion

1.

Subjects seem sufficiently sensitive to survey content to respond to questions

2.

Overall positive responses to the impact of sustainability

3.

This literature review and the proposed research address the multi-dimensional impact of natural light. Appropriate natural light exposure can create a healthy, efficient, productive and cost effective healthcare environment.