

New Codes and Standards 2023
39th FPC Annual Seminar + Expo
October 1-3, 2023

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Regulating Good Design: Research Matters

Course Number: AHCA 2023.10

Credit Designation: 1 LU/HSW

AIA CES Provider Number: E240

October 3, 2023



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1

OBJECTIVE

Identify at least three evolving topics related to healthcare design in the published research.

2

OBJECTIVE

Describe the relevance of the research in the context of improved physical, emotional, and social wellbeing of occupants and users.

3

OBJECTIVE

Discuss what research can be applied to the planning and design of facilities that protect users from harm.

4

OBJECTIVE

Understand how to be a better consumer of research



THE CENTER FOR HEALTH DESIGN®

- A 501(c)(3)
- Our Mission:
Built environments that optimize health
- Our Vision:
Maximizing health through informed design

Old Fashioned hands up poll!



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- What causes a designer (someone) to be satisfied that they have sufficient information?
- What prompts a designer (someone) to seek additional information and in turn, re-explore the problem-solution space?
- Can we actually regulate “good design”? Should we?



- Two types of thinking (dual processing theory)
 - Type 1: Fast and Intuitive driven
 - Solution conjecture
 - Feeling of rightness
 - Cognitive narrative based on available information
 - Type 2: Slow and deliberate
 - Problem exploration
 - Relies on fluency
 - Still involves creativity, judgement, and critical thinking

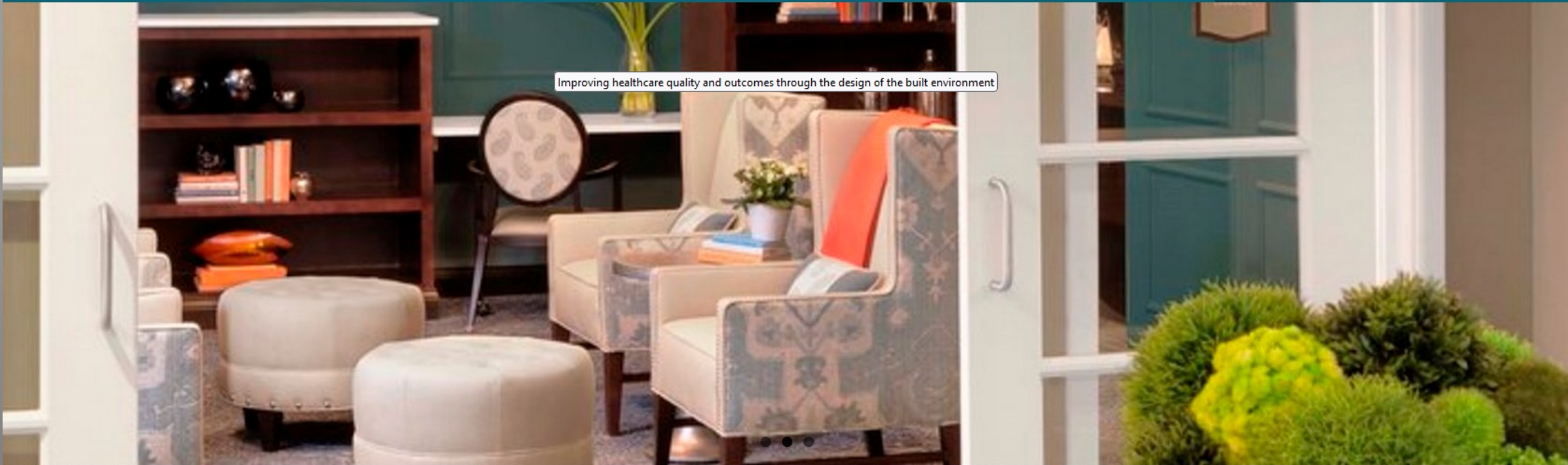
Osmólska, D., & Lewis, A. (2023). Architects' use of intuition in site analysis: Information gathering in solution development. *Design Studies*, 87, 101189.



1

OBJECTIVE

Identify at least three evolving topics related to healthcare design in the published research.



Improving healthcare quality and outcomes through the design of the built environment

INTERACTIVE DESIGN DIAGRAMS

A link between design strategies and outcomes



SAFETY RISK ASSESSMENT

A process to mitigate risk



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Theory (14)



Sort by: Date added ▾

Displaying 1 - 20 of 6001

Resilience room use and its effect on distress among nurses and allied staff

6/2023 Journal of Neuroscience Nursing Journal Article

Issue 3 , Volume 55 , Pages 80-85

Author(s): Prendergast, V., Elmasry, S., Juhl, N. A., Chapple, K. M.

SOURCE LINK

SAVE

ADDED SEPTEMBER 2023

Safety in health care: The impact of operating room design

2023 Anesthesiology Clinics Journal Article

Pages in press

Author(s): Heinke, T. L., Joseph, A., Carroll, D.

SOURCE LINK

SAVE

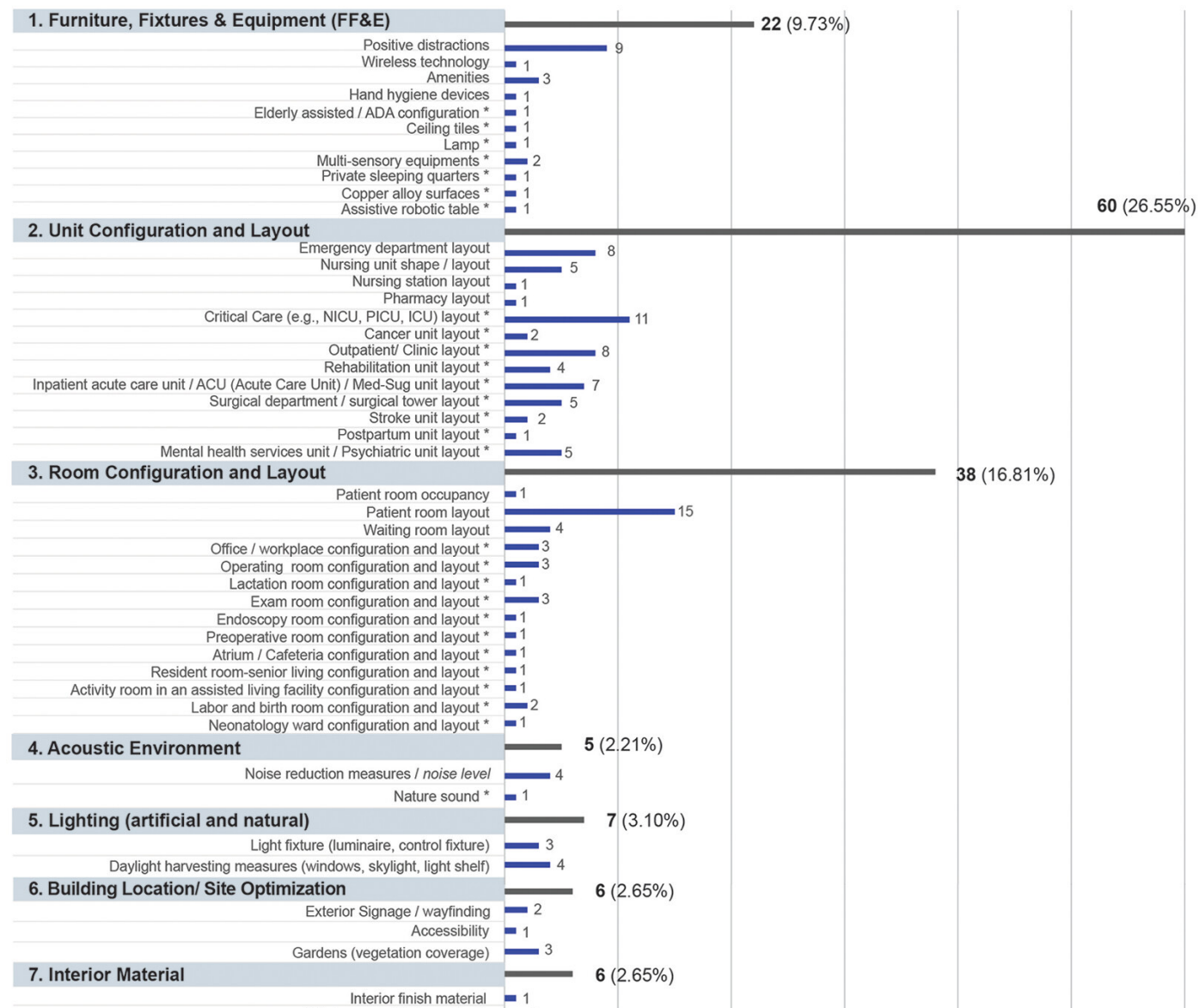
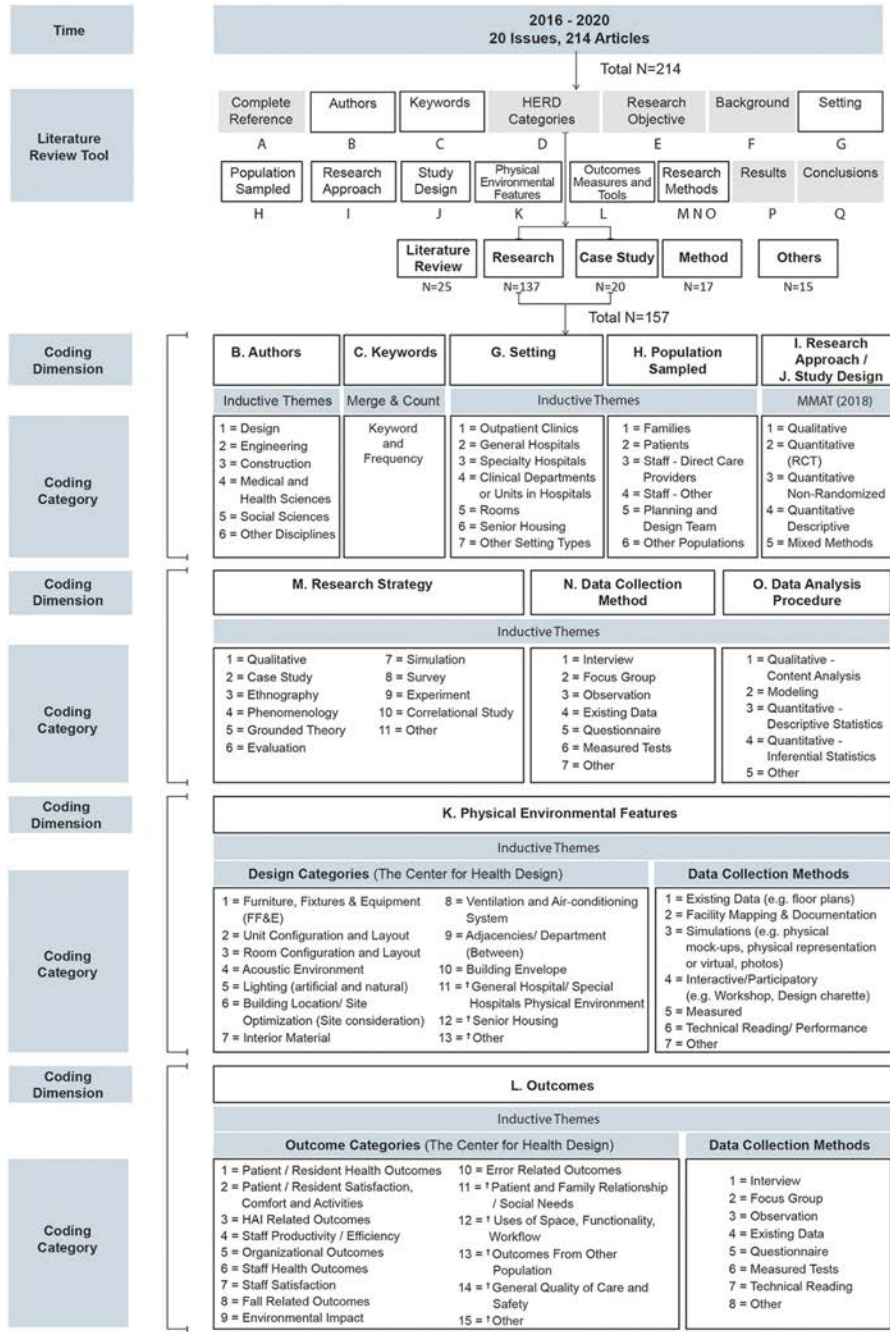
ADDED SEPTEMBER 2023

Heating, ventilation, and air-conditioning systems in healthcare: A scoping review

2023 Journal of Hospital Infection Journal Article

The Knowledge Repository

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Battisto, D., Li, X., Dong, J., Hall, L., & Blouin, J. (2023). Research methods used in evidence-based design: An analysis of five years of research articles from the HERD Journal. *HERD: Health Environments Research & Design Journal*, 16(1), 56–82

1. Infection outcomes (301 entries)
Includes COVID-19 (263 entries)
2. Literature reviews (157 entries)
3. Acoustics, Noise, Sound (75 entries)
4. Adult ICUs (58 entries, not including COVID-specific)
5. Wayfinding (54 entries)
6. Patient Experience (53 entries)
7. Lighting (34 entries)
8. NICUs (30 entries)
9. Staff Perspectives (26 entries)
Psychiatric (26 entries)
10. HVAC (41 total 18 not COVID-19)



2 OBJECTIVE

Describe the relevance of the research in the context of improved physical, emotional, and social wellbeing of occupants and users.

Today: 3 (+1/2) Topics

Acoustics/Noise, Lighting, Critical Care





Photo by Franco Antonio Giovanella on Unsplash

Noise, General (hospital, staff, influence of outdoor noise): 19

Regulatory: 3 (Europe, Middle East)

Setting Specific Studies

NICU: 14

Long-term care: 9 (3 dementia)

ICU: 8 (3 staff)

OR/Surgical: 7

Dental: 3

Maternity/LDR: 4

Pediatric: 2

ED: 2

Procedure spaces: 2

Outpatient (not surgery): 1



- Sleep
 - Cardiovascular dysfunction
 - Cognitive impairment
 - Pain Perception
 - Psychomotor Impairment
 - Psychological Disturbance
 - Metabolic Impairment
 - Immune Dysfunction and Pro-inflammatory Effects
 - Catabolic Propensity
- Speech Recognition, linked to impaired quality of communication

Hillman, D. R. (2021). Sleep Loss in the Hospitalized Patient and Its Influence on Recovery From Illness and Operation. *Anesthesia & Analgesia*, 132(5), 1314.

Vreman, J., Lemson, J., Lanting, C., van der Hoeven, J., & van den Boogaard, M. (2023). The effectiveness of the interventions to reduce sound levels in the ICU: A systematic review. *Critical Care Explorations*, 5(4), e0885.



- Medical personnel may be able to maintain the required productivity in certain noisy situations (at the expense of increased effort and fatigue)

Vreman, J., Lemson, J., Lanting, C., van der Hoeven, J., & van den Boogaard, M. (2023). The effectiveness of the interventions to reduce sound levels in the ICU: A systematic review. *Critical Care Explorations*, 5(4), e0885.



- Relationship between noise annoyance & health symptoms for ICU nurses
 - Auditory Fatigue (sound sensitivity, sound tiredness, tinnitus)
 - Mental Fatigue (tiredness, headaches, concentration difficulties, irritation)
 - Tension (pain in the neck, stress, difficulty motivating myself)

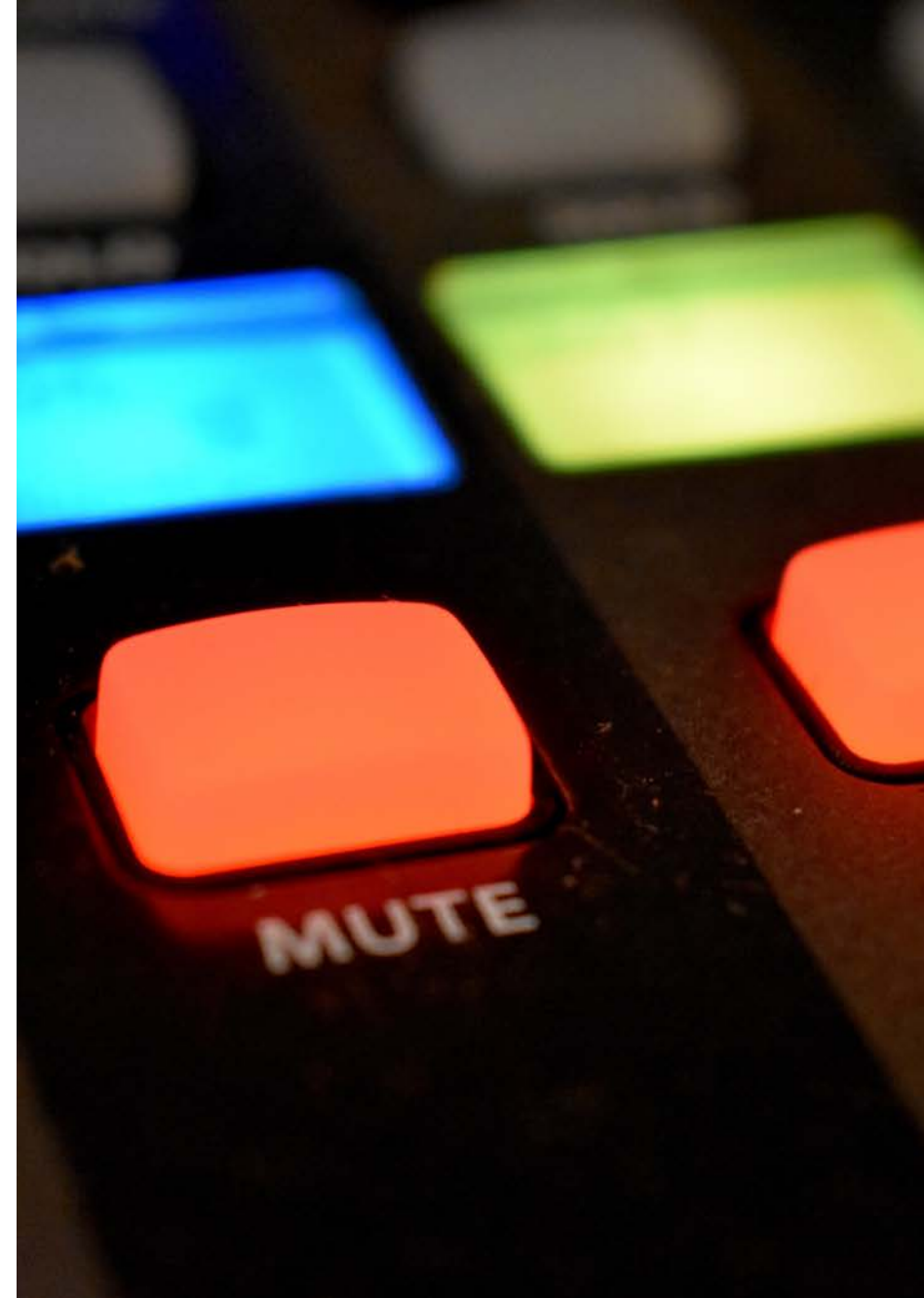
Hsu, T. Y., Ryherd, E., & Wayne, K. P. (2009). Evaluating the intensive care unit soundscape. *The Journal of the Acoustical Society of America*, 125(4_Supplement), 2685.



- Nurses reporting high noise exposure had medium size effects:
 - Lower Professional Quality of Life (ProQOL) total scores,
 - Higher burnout scores
 - Employment was stressful
- Also more likely to feel (small effect size):
 - Trapped by their job (a measure of burnout)
 - Less engaged with work
 - Having less support at work
- Respondents with higher noise exposure also reported higher generalized anxiety

McCullagh, M. C., Xu, J., Dickson, V. V., Tan, A., & Lusk, S. L. (2022). Noise exposure and quality of life among nurses. *Workplace Health & Safety*, 70(4), 207–219. Schmidt, N., Gerber, S. M., Zante, B., Gawliczek, T., Chesham, A., Gutbrod, K., Müri, R. M., Nef, T., Schefold, J. C., & Jeitziner, M.-M. (2020). Effects of intensive care unit ambient sounds on healthcare professionals: Results of an online survey and noise exposure in an experimental setting. *Intensive Care Medicine Experimental*, 8(34), 1–12.

- Sound intensity is measured using a logarithmic measure;
our hearing is logarithmic.
 - +3 dB = doubling of energy (not sound), baseline audible difference
 - +10 dB = 10-fold increase in energy, doubling perceived sound level
- L_{eq} , equivalent sound level, is the level for the sound energy average
- A-weighting matches our hearing
 - Better at predicting perceptions
 - Speech pitch range



- Subjective and Objective Measures
- Hospital Noise Standards
 - WHO daytime Leq < 35 dB(A), nighttime Leq < 30 dB(A)
 - Threshold for work characterized by a significant part of mental activity (decisions under time pressure, decisions with severe consequences): 55 dB(A)
- Reality
 - Daytime Leq: 37dB(A)-88.6 dB(A)
 - Nighttime Leq: 38.7 dB(A)-68.8 dB(A)

de Lima Andrade, E., da Cunha e Silva, D. C., de Lima, E. A., de Oliveira, R. A., Zannin, P. H. T., & Martins, A. C. G. (2021). Environmental noise in hospitals: A systematic review. *Environmental Science and Pollution Research*, 28(16), 19629–19642.

- In US, “Quiet at night” is still one of the lowest rated areas (HCAHPS): 62%
- Study in 5 hospital units
 - L_{eq} values did not correlate with patient perceptions of soundscape conditions (as measured by HCAHPS)
 - Absolute L_{min} values did correlate with HCAHPS survey data
 - Patient rooms with $L_{min} < 35$ dBA scored significantly higher on the quietness of hospital environment question
 - Specific occurrence rates correlated with HCAHPS data (LC_{peak} only); thresholds 70-75 dB(C)

Bliefnick, J. M., Ryherd, E. E., & Jackson, R. (2019). Evaluating hospital soundscapes to improve patient experience. *The Journal of the Acoustical Society of America*, 145(2), 1117–1128.



- What works?
 - Equipment enclosed in a walled space behind the bed: -2.8 dB(A)
 - Visual cues/alert systems: up to -3.6 dB
 - On or off didn't matter in some studies; may not be sustainable
 - Single-patient rooms created with only essential equipment and a separate nurses' station: -16 dBA
 - Partial renovation (ventilation ductwork, a carpet, and acoustic ceiling) followed a staff behavioral change intervention: -10 to -15 dBA
 - Closed door: -6.6 dBA (Bliefnick, 2019)
 - A service corridor (onstage/backstage): Perceptual – more quiet

Vreman, J., Lemson, J., Lanting, C., van der Hoeven, J., & van den Boogaard, M. (2023). The effectiveness of the interventions to reduce sound levels in the ICU: A systematic review. *Critical Care Explorations*, 5(4), e0885.

- **Interventions**
 - **Sound Source Control**
(e.g., limit cell phone use, quiet time)
 - **Sound Absorption**
(e.g., high performance ceiling tiles, panels)
 - **Sound Blocking**
(e.g., walls, closed doors)
- **FGI Tables**
 - **Table 1.2-4**
(Minimum Design Room-Average Sound Absorption Coefficients)
 - **Table 1.2-5**
(Maximum Design Criteria for Noise in Interior Spaces Caused by Building Systems)
 - **Table 1.2-6**
(Design Criteria for Minimum Sounds Isolation Performance Between Enclosed Rooms)

Evan Smogor on Unsplash

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Circadian/Tunable/Dynamic/Human-Centric/Biologic Lighting: 10

Mental/Behavioral Health & Dementia: 3,
Pharmacy: 1, LTC: 1, Maternity: 1,
Oncology: 1, Neuro: 1, ICU: 1, NICU: 1

Patient/ Resident room: 5

Blue-depleted/ Night-time: 4

Alerting/ Bright light: 3

Daylight: 2

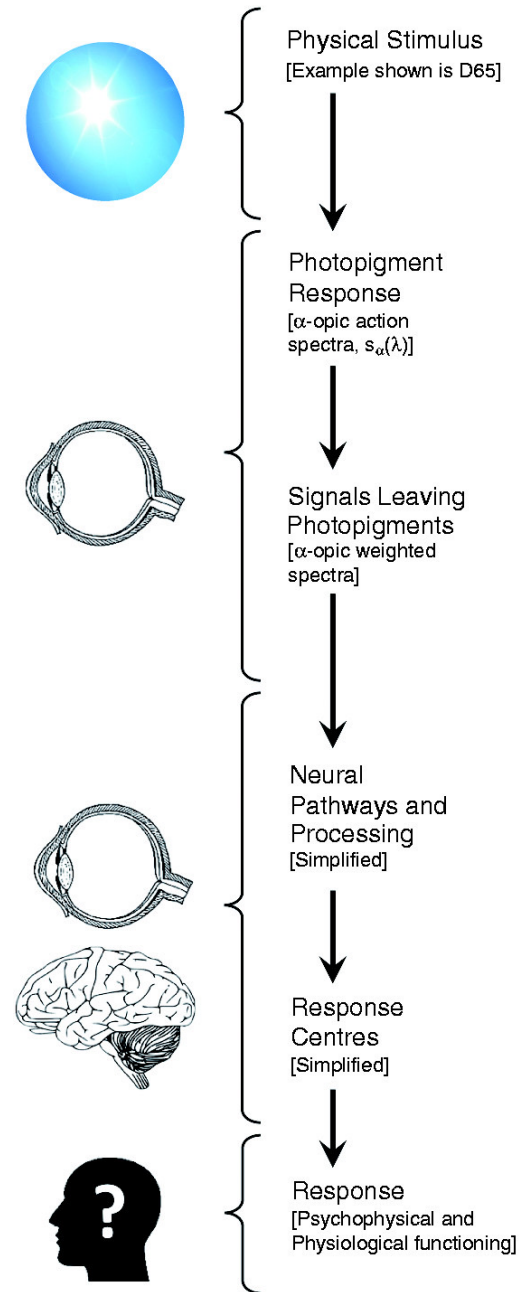
Multiple conditions: 2

Homes for senior living: 2

Hybrid UV-A/ White light in the NICU (1)



- Light is the strongest synchronizer for the circadian system
 - Visual outcomes: Rods and Cones
 - Non-visual: intrinsically photosensitive retinal ganglion cells (ipRGC)
 - Circadian, neuroendocrine, neurobehavioural
- Exerts acute effects on subjective alertness and cognitive performance (often blue light)
- Inhibits the secretion of melatonin
- Chronic low-intensity blue light exposure at bedtime: implications for sleep quality, circadian phase and cycle durations



Münch, M., & Bromundt, V. (2012). Light and chronobiology: Implications for health and disease. *Dialogues in Clinical Neuroscience*, 14(4), 448–453.

Houser, K., Boyce, P., Zeitzer, J., & Herf, M. (2021). Human-centric lighting: Myth, magic or metaphor? *Lighting Research & Technology*, 53(2), 97–118.

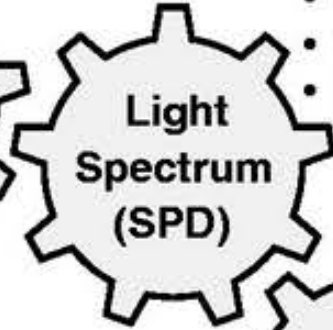
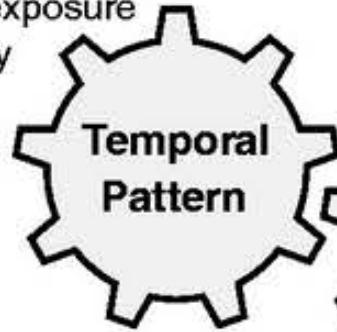
- Circadian rhythm misalignment can disrupt patient sleep, leading to:
 - End-organ dysfunction
 - Depressed immunity
 - Glucose dysregulation
 - Arrhythmias
 - Delirium
- Light is also associated with:
 - Pain levels
 - Length of stay
 - Anxiety
 - Fear
 - Interaction with care

Kamdar, B. B., Martin, J. L., & Needham, D. M. (2017). Noise and Light Pollution in the Hospital: A Call for Action. *Journal of Hospital Medicine*, 12(10), 861–862.
Jamshidi, S., Parker, J. S., & Hashemi, S. (2020). The effects of environmental factors on the patient outcomes in hospital environments: A review of literature. *Frontiers of Architectural Research*, 9(2), 249–263.

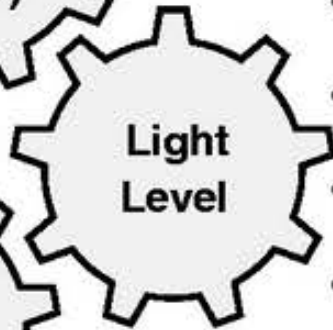
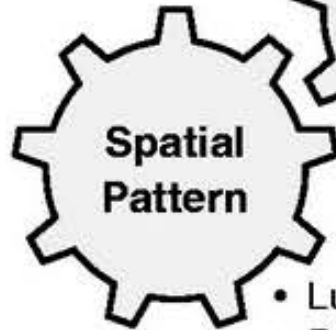
- Circadian rhythm misalignment and staff health:
 - Melatonin suppression associated with long-term night shift work
 - When accompanied by exposure to bright light, may lead to DNA damage
 - Cumulative effects of changes to cellular metabolism in shift workers:
 - Higher incidence of cancer and all-cancer mortality
 - Increases in all-cause and cardiovascular disease-related mortality
 - Other health problems:
 - Poorer sleep quality and reduced sleep duration,
 - Increased fatigue,
 - GI problems
 - Increased risk for IBS
 - Hormonal imbalance
 - Increased anxiety
 - Mood disorders

Querstret, D., in healthcare: A systematic scoping review of sleep-related/fatigue-management interventions for nurses and midwives. *International Journal of Nursing Studies*, 106, 103513.

- Timing of exposure
- Duration of exposure
- Photic history



- Chromaticity
- CCT, D_{uv}
- Color rendition (e.g., R_f , R_g)
- Hue and chroma shifts (e.g., gamut shape)



- Radiant flux (w), radiant intensity (w/sr), irradiance (w/m^2), radiant exitance (w/m^2), radiance ($w/sr/m^2$)
- Photopic, scotopic, and mesopic luminous flux (lm), luminous intensity (cd), illuminance (lx), exitance (lm/m^2), and luminance (cd/m^2)
- Alpha-opicequivalent daylight (D65) luminous flux (lm), luminous intensity (cd), illuminance (lx), exitance (lm/m^2), and luminance (cd/m^2)
- Dose (i.e., spectrally weighted radiant exposure, $Joule/m^2$)

- Luminance distribution in field of view
- Radiation pattern projected onto retina in consideration of the non-uniform spatial distributions of photoreceptors
- Consideration of relevant field of view for application

Houser, K., Boyce, P., Zeitzer, J., & Herf, M. (2021). Human-centric lighting: Myth, magic or metaphor? *Lighting Research & Technology*, 53(2), 97–118.

- Horizontal measures (“traditional”): Visual tasks (lux, fc)
- Vertical (developing, a little controversial): What is reaching the retina
 - **Circadian Action Factor**
 - Melatonin suppression actuated by various wavelengths of the light stimulus
 - Ideal combinations between individual activities, the Circadian activation factor acv and color temperature of light sources - a coefficient that roughly describes the circadian efficiency of various light colors (but not spectral opposition)
 - **Circadian Stimulus** (Rea & Figueiro, Lighting Research Center at RPI)
 - Spectral opposition makes it difficult to immediately connect intensity of luminous stimulus and melatonin suppression
 - Not possible to just add the contribution of the different individual lengths wave (i.e., circadian system reacts differently to blue light vs yellow-red components)
 - **Equivalent Melanopic Lux**
 - Suppression of melatonin based on spectral value of light weighted irradiance to cornea with respect to the 5 unique receptor types.

- Visual Outcomes
 - Glare
 - Light levels
 - Physical symptoms
- Non-visual outcomes
 - Sleep and sleep management
 - Cognitive ability
 - Wound healing
 - Well-being
 - Energy Efficiency
- Subjective and Objective Measures

Hadi, K., Du Bose, J. R., & Choi, Y. S. (2019). The Effect of Light on Sleep and Sleep-Related Physiological Factors Among Patients in Healthcare Facilities: A Systematic Review. *HERD: Health Environments Research & Design Journal*, 12(4), 116–141.

Perumal, S. R., Baharum, F., & Mohd Nawi, M. N. (2021). Addressing visual comfort issues in healthcare facilities using LED lighting technology—A review on daylighting importance, impact of correlated colour temperature, human responses and other visual comfort parameters. *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, 82(2), 47–60

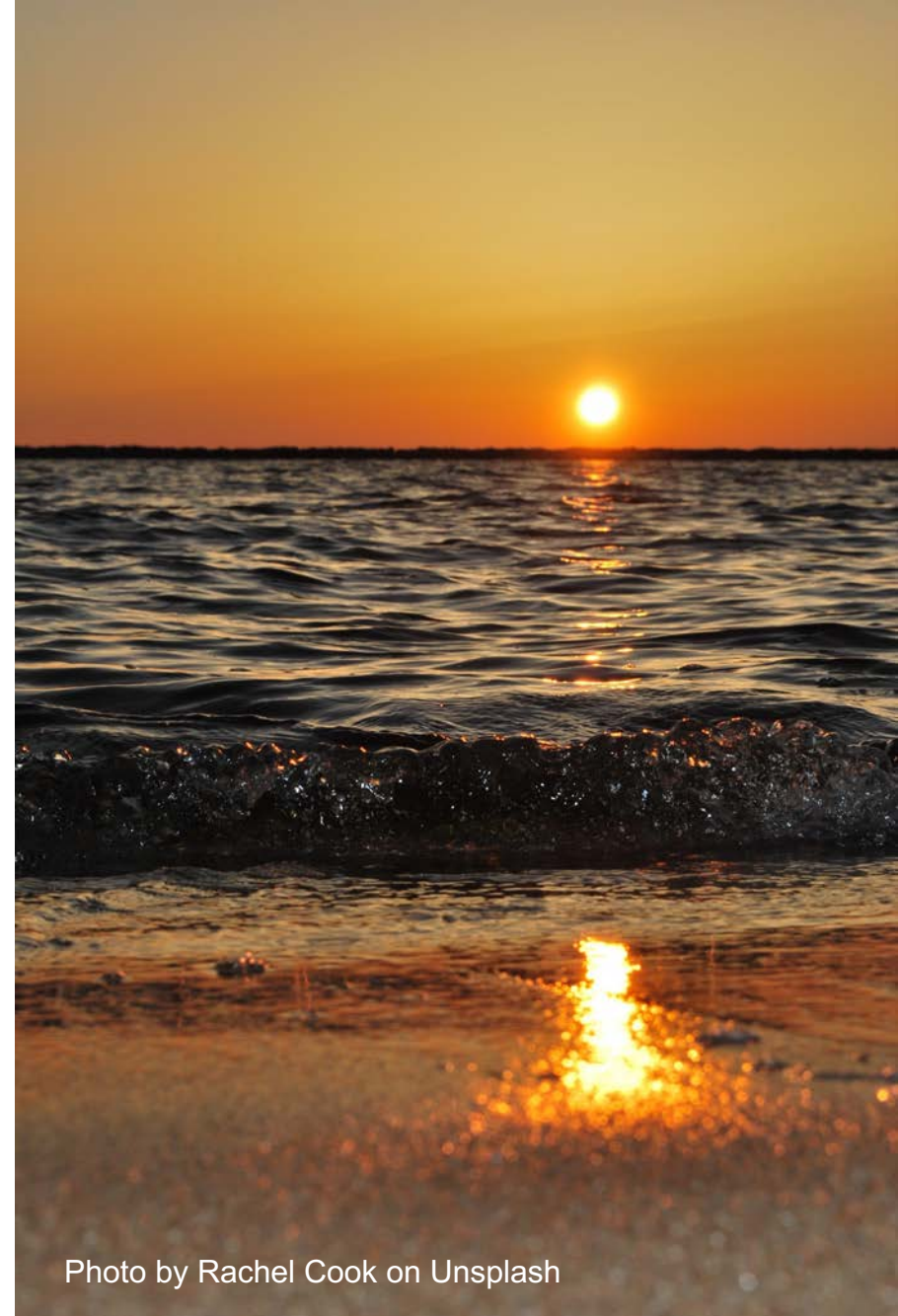
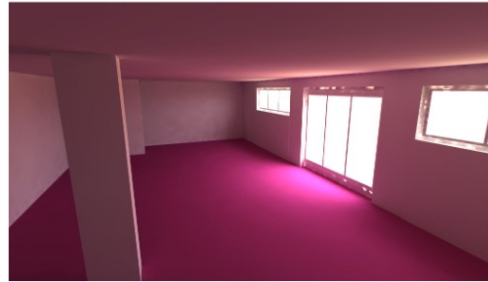
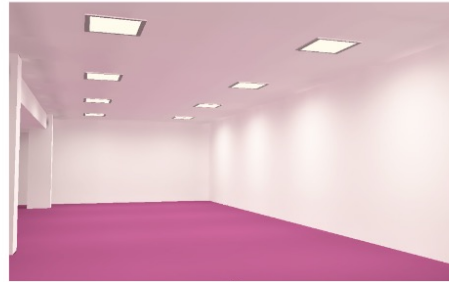


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- Long-term care/ nursing home settings
 - Material color and reflectance can influence circadian measures¹



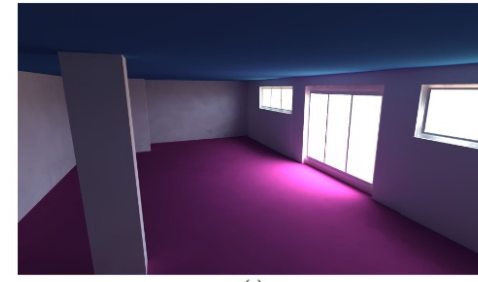
(a)



(b)

Illuminance (lx)= 195		Illuminance (lx)= 230	
Melanopic ratio = 1.3262		Melanopic ratio = 0.3760	
	Guideline benchmark literature		Guideline benchmark literature
CL _A = 344	Standard data not available	CL _A = 160	Standard data not available
a _{ev} = 0.91	> 0.7	a _{ev} = 0.59	> 0.7
CS = 0.32	0.3 – 0.7	CS = 0.21	0.3 – 0.7
EML = 258	>200	EML = 86	>200

Fig. 7. Gym room in current state: (a) overcast sky conditions and (b) electric light.



(a)




(b)

Illuminance = 195 lx		Illuminance = 251 lx	
Melanopic ratio = 1.3262		Melanopic ratio = 1.0159	
	Guideline benchmark literature		Guideline benchmark literature
CL _A = 344	Standard data not available	CL _A = 279	Standard data not available
a _{ev} = 0.97	> 0.7	a _{ev} = 0.79	> 0.7
CS = 0.32	0.3 – 0.7	CS = 0.31	0.3 – 0.7
EML = 258	>200	EML = 255	>200

Fig. 9. Gym room in improvement state: (a) overcast sky conditions and (b) electric light.

- Reduced agitation of 5 dementia residents in nursing home
 - 6-month pilot study for longitudinal cohort study
 - 71.2% reduction in the frequency of agitation-associated behaviors (Cohen-Mansfield Agitation Inventory)
 - Frequency of some behaviors reduced by 100%.

1. Busatto, N., Mora, T. D., Peron, F., & Romagnoni, P. (2020). Application of different circadian lighting metrics in a health residence. *Journal of Daylighting*, 7(1), 13–24.
2. Saidane, H. A., Rasmussen, T., Andersen, K., Iversen, H. K., & West, A. S. (2023). An explorative investigation of the effect of naturalistic light on agitation-associated behavior in nursing home residents with dementia: A pilot study. *HERD: Health Environments Research & Design Journal*, 16(2), 146–154..

- Daytime: Areas without windows?
- Basement pharmacy
 - Improved but not statistically significant:
 - Affective organizational commitment
 - Perceived productivity
 - Well-being
 - Satisfaction with the work environment
 - Circadian lighting not perceived as having strongly improved their levels of stress, concentration, mood or fatigue at work.
 - Challenge – n=8; installed 2016, measured 2018 – reliant on memory
 - No objective lighting measures 

McCunn, L. J., & Wright, J. (2019). Hospital employees' perceptions of circadian lighting: A pharmacy department case study. *Journal of Facilities Management*, 17(5), 422–437.



- Installations increasingly allowing control for of intensity (not CCT)
- Maternity ward: 4 morning hrs fixed (impact on mood, alertness, sleep), 20 hours adjustable¹
 - Activity indicates preferences for higher intensity at certain times of day
 - No statistically significant results for sleep quality, mood, melatonin, physical activity
 - Speculation: New moms align sleep patterns to newborn care/feeding
 - Incision pain (Caesarean delivery), restricted mobility
- Neuro ICU, PACU: Pre/Post staff responses to CLS²
 - Statistically significant satisfaction
 - Easier to use and adjust for individual patients, especially at night
 - Learning aspect (continuous adjustments to the settings for a success)

1. Canazei, M., Pohl, W., Weninger, J., Bliem, H., Weiss, E. M., Koch, C., Berger, A., Firulovic, B., & Marth, C. (2019). Effects of adjustable dynamic bedroom lighting in a maternity ward. *Journal of Environmental Psychology*, 62, 59–66.

2. Schledermann, K. M., Bjørner, T., West, A. S., & Hansen, T. S. (2023). Evaluation of staff's perception of a circadian lighting system implemented in a hospital. *Building and Environment*, 242, 110488.

- Quality of sleep in psychiatric inpatients
- 54 admitted patients received
 - Pre-set circadian lighting environment (intervention, n=27)
 - Lighting as usual (control group, n=27)
- Measures
 - Pittsburg Sleep Quality Index (PSQI) – primary: No significant change
 - Major Depression Inventory : No significant changes
 - WHO-5 Well-Being Index: No significant changes
- Challenge(s)
 - Missing data from self-reported questionnaires = 52.5%
 - Only in patient room

Okkels, N., Jensen, L. G., Skovshoved, L. C., Arendt, R., Blicher, A. B., Vieta, E., & Straszek, S. (2020). Lighting as an aid for recovery in hospitalized psychiatric patients: A randomized controlled effectiveness trial. *Nordic Journal of Psychiatry*, 74(2), 105–114.

- Tuning the tuning
 - Behavioral Health: Multiple sources and controls
 - All spaces, not just patient rooms
 - Specific transition times to align with patient activities to support behavioral cueing
 - Autonomy in patient rooms and staff spaces with multiple zones and luminaire types that could be turned on/ off or adjusted to increase/ decrease light levels
 - NICU: Quality of evidence generally low or not clinically significant
 - Lighting system control data from five patient rooms was collected over 25 weeks
 - Aligned to clinical schedule (7 am start); off 10 hrs (9pm)
 - Dawn and dusk settings, otherwise static with manual override (exam, off)
 - Evaluated actual vs imagined use: adjustments to the default control setting at night, re-labeling of the control stations, and adjustments to the nighttime fade rate
 - Anecdotal: Behavioral cueing for visitors

1. Banasiak, M., Wilkerson, A., & Safranek, S. (2023). Evaluating occupant light exposure and usage patterns in an inpatient behavioral health unit. *HERD: Health Environments Research & Design Journal*, 16(2), 89–108.
2. Wilkerson, A., Safranek, S., Irvin, L., & Tredinnick, L. (2023). Lighting System Control Data to Improve Design and Operation: Tunable Lighting System Data from NICU Patient Rooms. *LEUKOS*, 19(1), 94–109.

- Personalized non-pharmacological medicine?
- Fixture customized for disease
 - Multiple myeloma (rare blood cancer) with 2-3 week LOS for transplant
 - Tested customized freestanding fixture for reduced
 - Cancer-related fatigue
 - Depression
 - Sleep problems
 - Random assignment to light 7 am-10 am
 - Circadian-effective light (n=27)
 - Non-circadian light (n=28) Increase nocturnal melatonin levels (intervention)
 - Improvement in sleep length (intervention, “nearly” significant)
 - No change in self-reported fatigue, depression
 - Small preliminary study – clinical trials needed

Figueiro, M. G., & Thayer, A. (2020). Tailored lighting intervention to promote entrainment in myeloma transplant patients—A field study. *AIA AAH Academy Journal*, 22, 12–23.



Safety: 17

Infection: 15

air (5), preparedness (3), plumbing (2), copper,
size, renovations, curtains, multiple

Transport: 1

Medication safety: 1 (nurse priorities)

Ambient Environment (Noise and/or

Light): 13

ICU General: 7

ICU Experience: 8

ICU Staff-related: 8

Sub-Setting

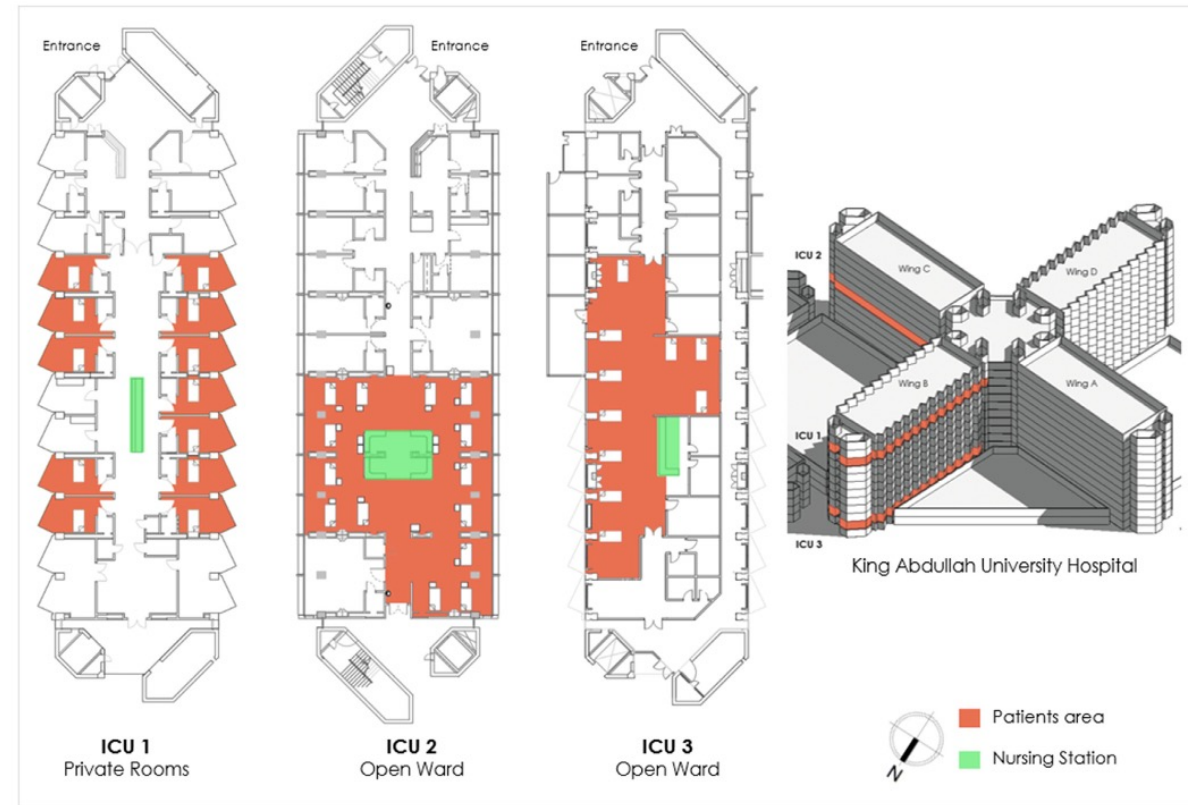
PICU: 7

CICU: 1

Delirium: 1



- Improve the work environment for ICU nurses to maximize:
 - Productivity
 - Collaboration
 - Satisfaction
 - Leads to improved patient care.
- 3 ICUs: University hospital
 - ICU 1 (private rooms, single corridor, central nursing station, close to supported services)
 - ICUs 2 and 3 (open wards with separate service zones)
 - 36 nurses
- 2 Studies



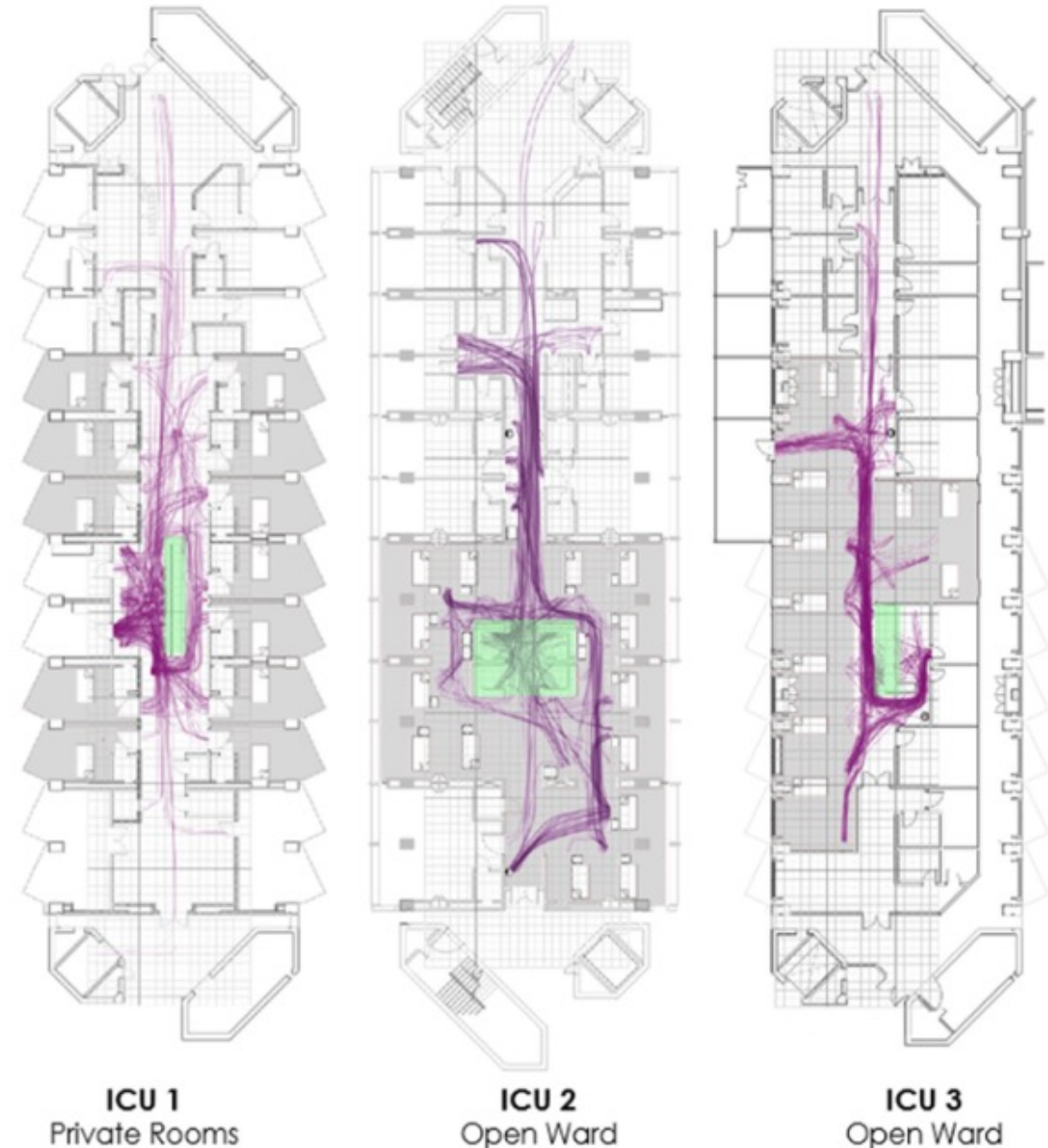
Obeidat, B., Younis, M. B., Al-Shloul, E., & Alzoubay, A. (2022). A study of workspace design characteristics exemplified by nurses' satisfaction within three intensive care units in a university hospital. *HERD: Health Environments Research & Design Journal*, 15(2), 49–62.

Obeidat, B., Younis, M. B., & Al-Shloul, E. (2022). Investigations into the impact of nursing unit layout on critical care nurses. *Heliyon*, 8(2).

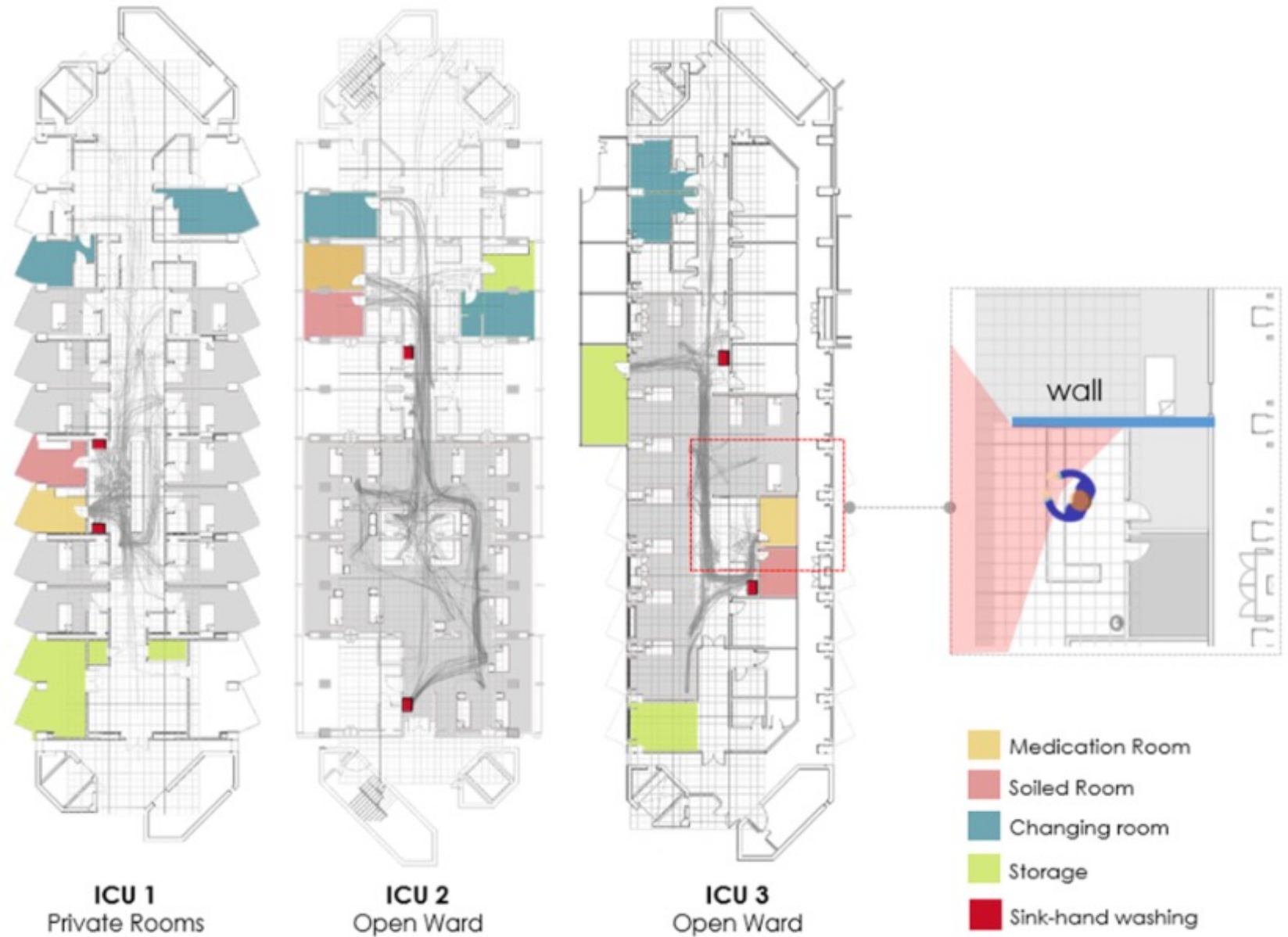
Study 2: Relationship between ICU and walking behavior

- ICU1 (private rooms; mean steps = 3237.08, 1.42 miles)
- ICU2 (open ward): mean steps = 4041.67, 1.78 miles
- ICU3 (open ward): mean steps = 4208.17, 1.83 miles

Obeidat, B., Younis, M. B., & Al-Shloul, E. (2022). Investigations into the impact of nursing unit layout on critical care nurses. *Heliyon*, 8(2).



- Generally, ICU 1 outperformed others due to accessibility to patients and support spaces



Obeidat, B., Younis, M. B., & Al-Shloul, E. (2022). Investigations into the impact of nursing unit layout on critical care nurses. *Heliyon*, 8(2).

NICUS



39th Annual FPC Seminar + Expo

Recommended Standards for Newborn ICU Design

Ninth Edition

Report of the Ninth Consensus Conference on Newborn ICU Design

Clearwater Beach, Florida

March 5, 2019

Findings

Table S1 Design specifications for an optimum acoustic environment

1. Recommended acoustic parameters:	
Infant rooms:	Continuous background and operation sounds not exceeding an hourly L_{eq} of 45dB (40 dB in UK ⁽²⁾) and an hourly L_{10} ¹ of 50dB (both A weighted slow response). ⁽³⁾ Transient sounds or L_{max} ² not exceeding 65dB (A weighted slow response). ⁽³⁾
Staff, family and lounge areas:	Continuous background and operation sounds not exceeding an hourly L_{eq} of 50dB and an hourly L_{10} of 55dB (both A weighted slow response). ⁽³⁾ Transient sounds or L_{max} not exceeding 70dB (A weighted slow response) ⁽³⁾
2. Adjustable volume control for announcing systems in sensitive areas ⁽³⁾	
3. Acoustic seals on doors to ensure speech privacy and reduce intrusive sounds ⁽³⁾	
4. Consideration of Speech Intelligibility ratings in infant, parent and staff areas ⁽³⁾	
5. Acoustically absorptive surfaces ⁽³⁾ and walls build at obtuse angles to	

High quality, family centered care (FCC) enabled design concepts have potential to impact early life development

- Improved breastfeeding
- Infection
- Noise control
- Reduced length of stay
- Hospitalization rates
- Potentially improved neonatal morbidity and mortality.

O'Callaghan, N., Dee, A., & Philip, R. K. (2019). Evidence-based design for neonatal units: A systematic review. *Maternal Health, Neonatology and Perinatology*, 5(1), 1–9.

- Four themes
 - Environment: Sound and Light
 - Lower ambient sound levels (still exceeded the AAP-recommendations)
 - More precise control of lighting, but complexity is increased room by room
 - Neurodevelopment outcomes:
 - Attention (higher); Physiologic stress, hypertonicity, lethargy, and pain (lower scores)
 - Follow-up study, no difference in development at 18 months of age
 - Lower language scores at 2 years; SFR infants = +1.9 hours silence/16-hours
 - Mixed results: Growth and feeding, infections
 - Parent outcomes
 - Increased time with infant; improved longer-term outcomes (higher cognitive and language composite scores, and receptive and expressive communication scores)
 - Satisfaction for privacy (e.g. breast feeding, skin-to-skin care) vs Isolation
 - No differences in lactation/breast feeding
 - Mixed results for stress (heterogeneous measures, acuity levels)
 - Staff Outcomes
 - Mixed satisfaction: Isolation from colleagues, Increased interactions with parents

- Probabilistic business case: Additional costs (\$F) justified with analysis of HAI, LOS, direct costs of care (Sadatsafavi, et al 2019)
- Specific Infant Outcomes:
 - No statistically significant change in morbidity and mortality (Jansen, et al., 2022)
 - Few differences pre/post, low SES: LOS, oral feeding, sepsis (Puumala, 2020)
 - No reduction in colonization rates with MDROs or 3G-CRB (van der Hoeven, 2022)
 - No differences in growth at 34 weeks (Tandberg, 2019b)
- Staff Outcomes/Perceptions:
 - Benefits: Communication with families, privacy, feasibility for skin-to-skin contact, reduction in noise levels and family access to their baby (Soni et al, 2022)
 - Concerns: Patient safety, isolation of staff, harder for breaks; physically and emotionally less supported (Soni et al, 2022)
 - Efficiency: Neighborhood unit design, standardized access to meds/supplies, proximity to supplies, rooms, workstations; Isolation – not solely the SFR? (Fay, et al., 2023)
- Parental outcomes
 - Lower depression and parental stress; more involvement (Tandberg, et al., 2019a,b)

3

OBJECTIVE

Discuss what research can be applied to the planning and design of facilities than protect users from harm.



INFECTION CONTROL

 DESIGN CONSIDERATIONS	 HISTORICAL DATA
 ICRA MATRIX OF PRECAUTIONS	



PATIENT HANDLING

 DESIGN CONSIDERATIONS	 HISTORICAL DATA
 FGI PHAMA WHITEPAPER	



MEDICATION SAFETY

 DESIGN CONSIDERATIONS	 HISTORICAL DATA
 USP 1066	



FALLS

 DESIGN CONSIDERATIONS	 HISTORICAL DATA
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BEHAVIORAL HEALTH

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SECURITY

 DESIGN CONSIDERATIONS	 HISTORICAL DATA
 SECURITY DESIGN GUIDELINES FOR HEALTHCARE FACILITIES	

- Recent Studies Looking at/Continuing to Look at:
 - Infection control: Contact, Airborne, Waterborne
 - Patient Handling: PHAMA update (2019); Factors of use
 - Medication errors: Noise, Lighting, Adequate Space
 - Falls: Impact of biomechanics of frail/elderly; mobilization
 - Behavioral Health: A move to evaluate healing not “just” safety
 - Security: Workplace violence

4

OBJECTIVE

Understand how to be a better consumer of research

- Research vs research
- Google is great, but...
- Go beyond the the headline
- Read the abstract, then more
- Check the references
- Learn to love gray
- Leverage literature reviews

- Don't just trust AI to get it right



Every time I sit down to write one of these columns, my cat comes up and nuzzles my leg. Before you begin to think fondly of my cat (e.g., "Ohhhhhh, that is so cute!"), be advised that his nuzzling is motivated purely by self-interest. My cat is selfish. He doesn't want my love. He wants food. And he knows that, by showing me love, he is more likely to get fed. He is using affection to get the

with my writing time. So this association is not causal, but due to a third variable.

Consider this fun fact: Ice cream sales and violent crime are statistically related. As ice cream sales increase, so does violent crime. When ice cream sales decrease, so does violent crime. So it seems pretty clear that eating ice cream causes people to be violent, right? But that seems ridiculous.¹ That can't possibly be

McMahan, E. A. (2021). Eating Ice Cream Does Not Lead to Murder: Association, Correlation, and Causation. *Eye on Psi Chi Magazine*, 26(2), 24–27.

Phase 1: Learning on the fly

- Transmission
 - Surfaces
 - Air
 - Water
- Temporary facilities

Phase 2: Understanding implications

- Modeling, CFD
- Adaptations

Phase 3: Reviews, recommendations, and results

Also: AR and VR



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Resilience room use and its effect on distress among nurses and allied staff

6/2023 ◉ Journal of Neuroscience Nursing ◉ Journal Article

Issue 3 , Volume 55 , Pages 80-85

Author(s): Prendergast, V., Elmasry, S., Juhl, N. A., Chapple, K. M.

SOURCE LINK

SAVE

ADDED SEPTEMBER 2023

Safety in health care: The impact of operating room design

2023 ◉ Anesthesiology Clinics ◉ Journal Article

Pages in press

Author(s): Heinke, T. L., Joseph, A., Carroll, D.

SOURCE LINK

SAVE

ADDED SEPTEMBER 2023

Heating, ventilation, and air-conditioning systems in healthcare: A scoping review

2023 ◉ Journal of Hospital Infection ◉ Journal Article



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Wall

DESIRABLE OUTCOME

Reduced risk of contamination



DESIRABLE OUTCOME

Efficient delivery of care



DESIRABLE OUTCOME

Improved job satisfaction



DESIRABLE OUTCOME

Reduced patient stress, anxiety



DESIRABLE OUTCOME

Enhanced patient sense of control



DESIRABLE OUTCOME

Can We “Regulate” Good Design? Should we?

Use research to optimize “good” design

Use research to guide regulatory language, where there is a body of knowledge, with a preponderance (i.e., not 100%) of evidence (sometimes research is ahead, sometimes behind)

FGI: Substantiation, Benefit-Cost

“Statistics are like bikinis.
What they reveal is suggestive,
but what they conceal is vital.”

Aaron Levenstein

STYLES
For the
BEACH

by Hester Winthrop

A Suit of Pink Brocade with an Embroidered Rose on the Waist

Daring Swimming Costumes Must Have Big Wraps To Cover Them On Shore - Palm Beach Costumes That Set the Style For This Summer - For the Woman of Quiet Taste.

tunic cut off four the knee and w black swimming portable affair to is only for little a ures. There are tures about the time worn by t canoe paddle. becoming to any combination of t ers is perfectly n cause it is well a to which it ha

Thank you for your attention!

