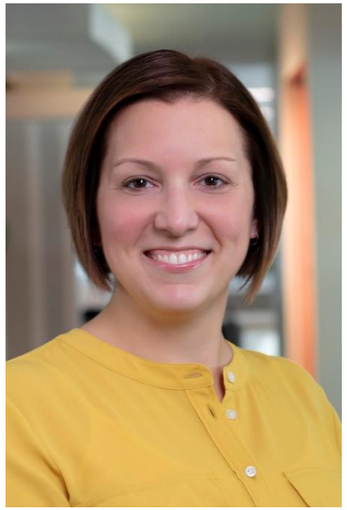
Lean and Evidence Based Design: Where to Begin

Donna Deckard, Center for Health Design - Andrea Sponsel, BSA LifeStructures - Terri Zborowsky, HGA

May 27, 2020

Who We Are

Donna Deckard
The Center for Health Design
Director of Strategic Projects



Andrea Sponsel
BSA LifeStructures
Director of Lean Strategy

Terri Zborowsky
HGA
Design Researcher

Agenda

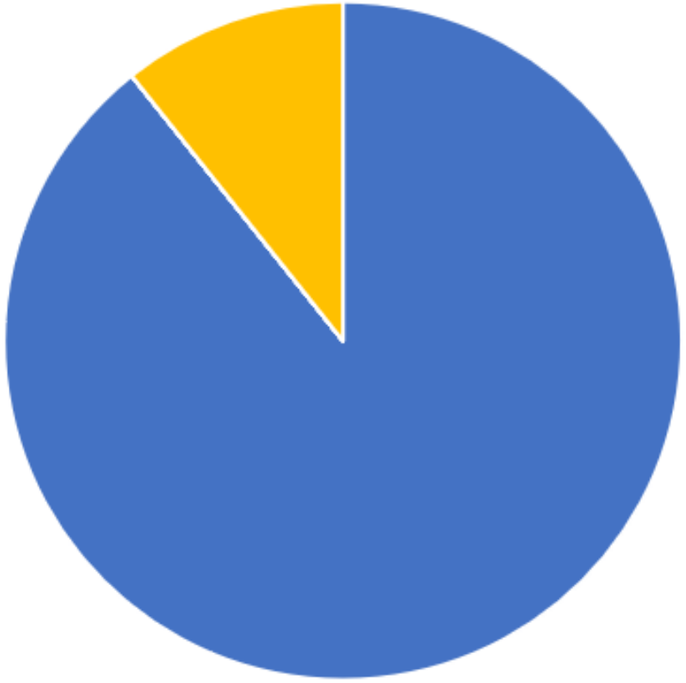
- What is Lean + EBD? Definition of EBD
- How do I know Lean + EBD is right for the project?
- Create Alignment
- Know Your Audience
- Why do they work together?
- Case Study
- Lean + EBD Toolkit

Who You Are

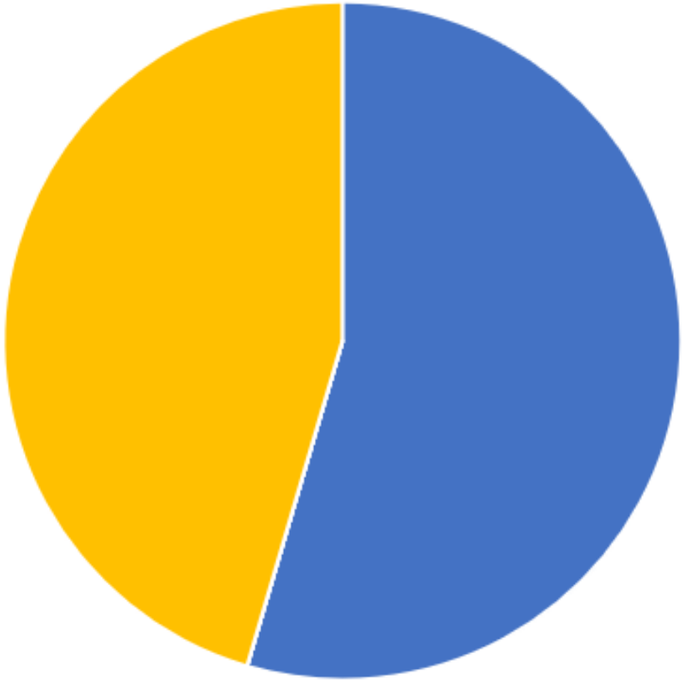
- Architect
- Interior Designer
- Engineer
- Researcher
- Contractor
- Trade Partner
- Consultant
- Other

The Opportunity

Manufacturing



Design/Construction



Productive

Waste

Why should our industry care?

The concept and design phase is where the most project value can be gained… or lost

- Build only what is needed
- Maintain a life-cycle perspective
- Strengthen scenario planning
- Optimize around site constraints
- Think modular design and standardization*
- Consult construction and procurement teams
- Optimize engineering processes and choices

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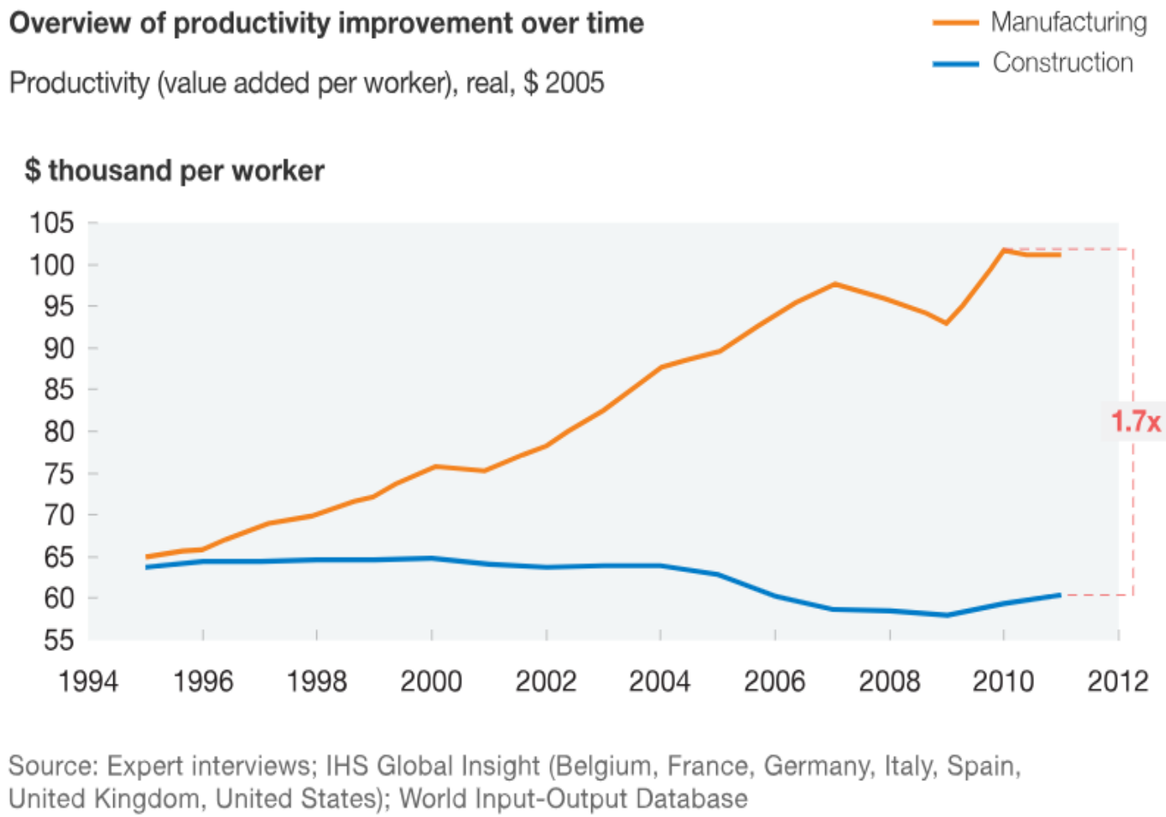


Traditional vs. Integrated

Traditional Design and Construction

- *Jumping in without Defining the Problem*
- *Surprises*
- *Design Schedule Defined by Arbitrary Milestones*
- *Waiting for Bids before you know the Cost of the Project*
- *Siloed Communication*
- *Value Engineering*

Integrated (EBD + Lean) Design and Construction

- Alignment with Client Goals
- Relevant Research Utilized to Improve Challenges
- Stability/Predictability of Projects
- Identifies and Removes Waste
- Safer Projects
- More Collaboration and Innovation
- Continuous Improvement – New Insights Gained
- Makes the project **FUN** again!

What is Lean + EBD?

Enhanced Design with **Maximum** Value and →minimized← Waste

How do I know Lean + EBD is right?

- Your client is ready to look at their **processes** and how they **inform design**.
- Your client is willing to spend **time up front** with data gathering **to produce a better design**.
- You're ready to invest time into **linking design to measurable outcomes**.
- You're ready to **prove** your designs are good.

Evidence Based Design

EVIDENCE-BASED DESIGN

IS THE PROCESS OF BASING

DECISIONS ABOUT THE BUILT

ENVIRONMENT ON CREDIBLE

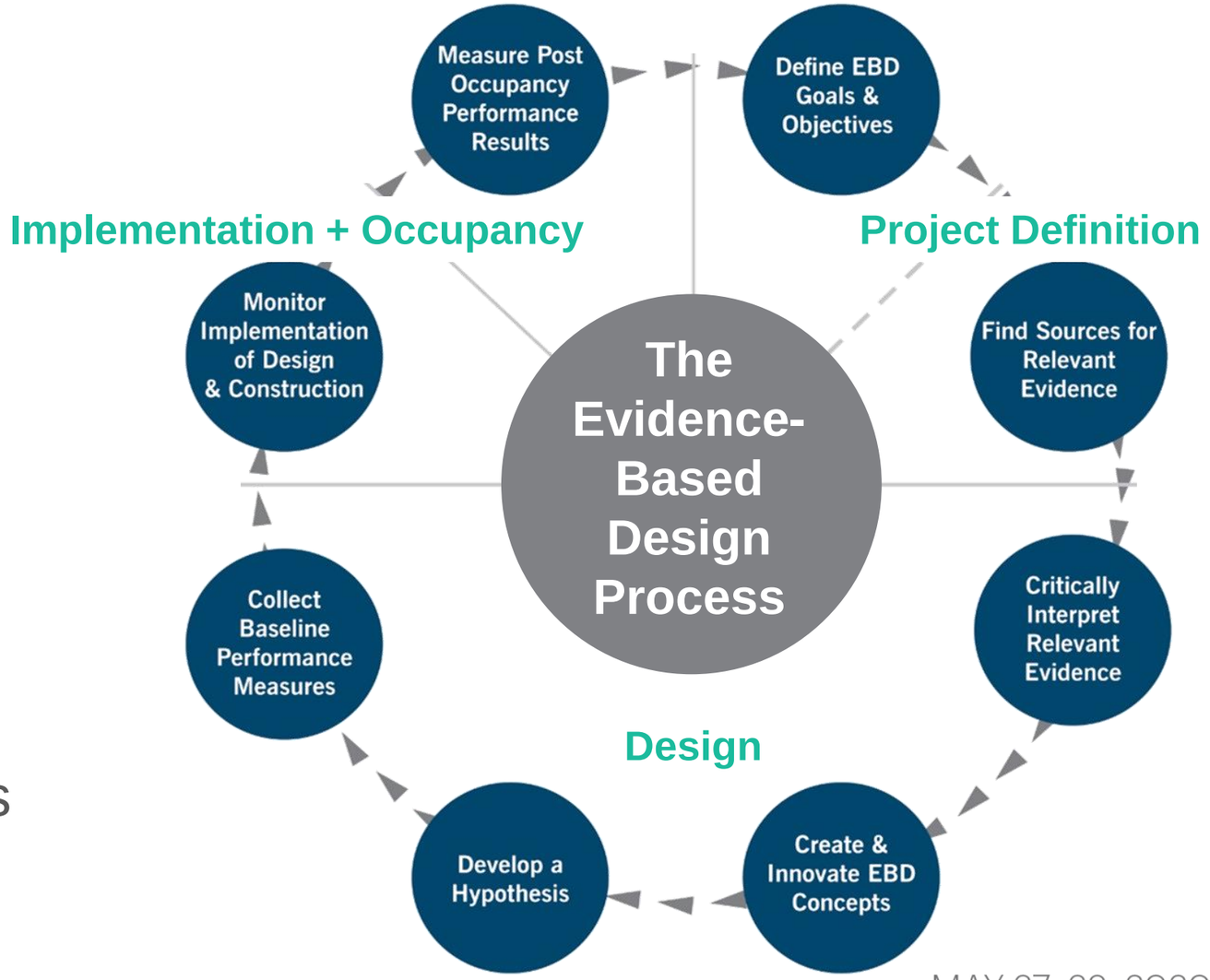
RESEARCH TO ACHIEVE THE

BEST POSSIBLE OUTCOMES

Evidence-Based Design Process

8 Steps integrated into Design/ Construction/Occupancy

- **Process** helps designers understand issues our clients face and can show needs they didn't know they had
- **EBD** practices can prioritize and create measures of success for outcomes based on those needs



Step 1 - EBD:
Define EBD Goals and Objectives

Uncover Challenges.

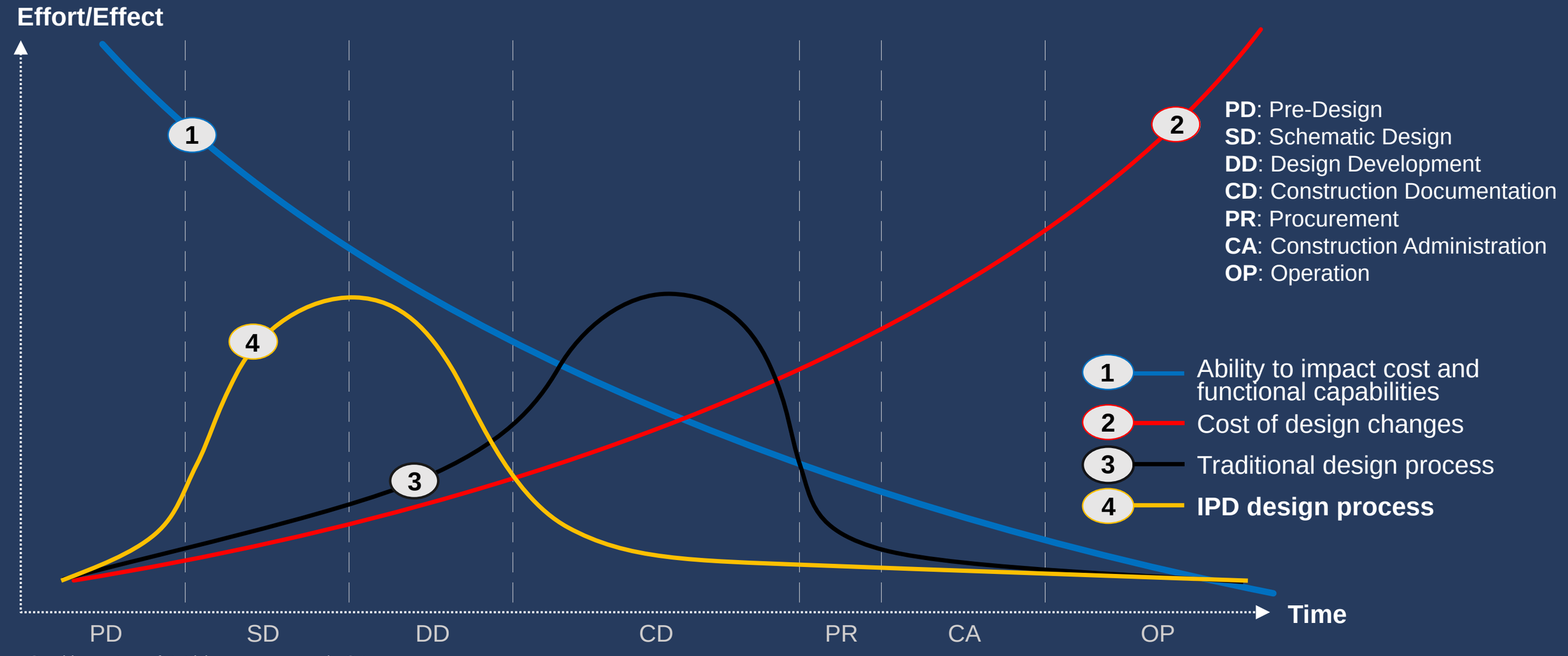
Collect Relevant Insights.

Define the Why.

Get Buy In

- Appeal to what keeps them up at night
- Gear your message towards your audience – Hospital Administration, Providers, Clinicians, Facilities, Design+Construction
- Build a Business Case they can’t ignore

Early Engagement

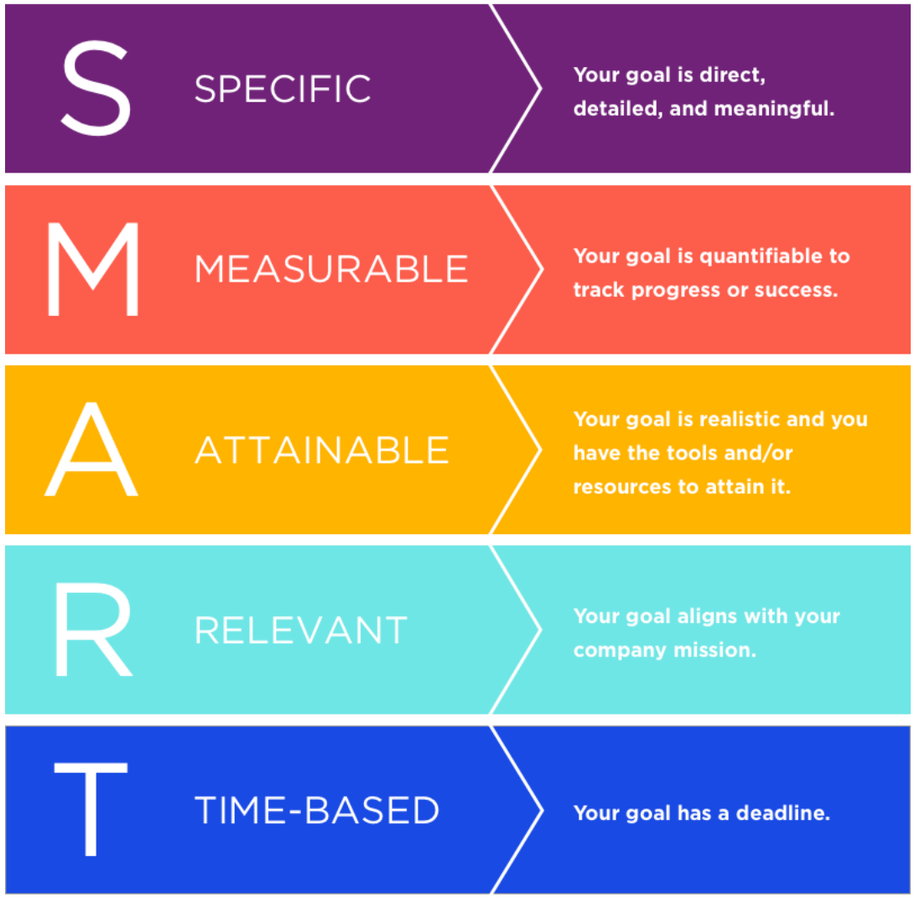


Graphic courtesy of Patrick MacLeamy AIA / HOK

Create Alignment

- **Make the effort inclusive of all team members and observation + research based**

- Take time for project and team alignment
  - Establish **Values**
  - **Define Success for every Stakeholder** (Owner, User, Researcher, Designer + Builder, Community)
  - Talk about the **Driving Forces** (opportunities) and the **Restraining Forces** (risks)
  - Create **SMART** goals

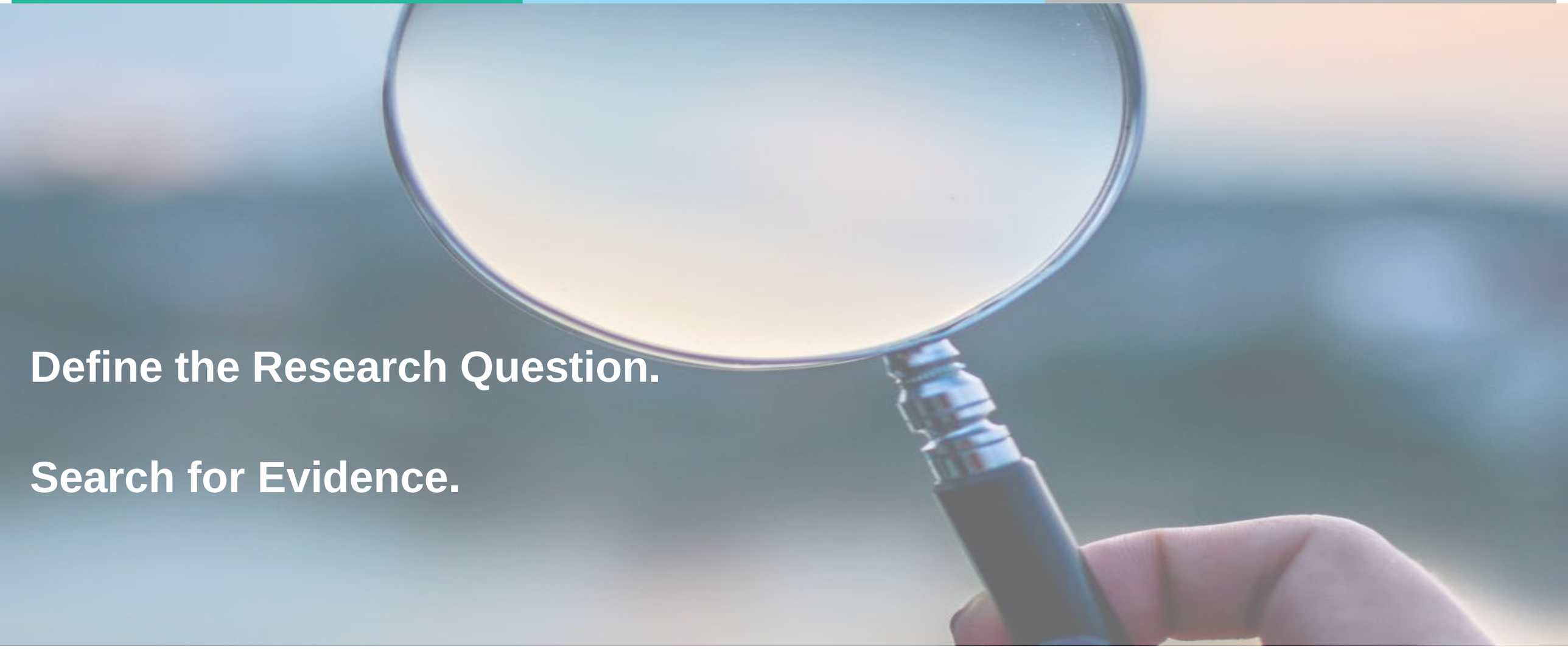


Research Context

- **Linking research and design is at the core of EBD.**
- Research can support design decision making.
- Research can evaluate the success of design innovations.
- Research aims to add to the body of knowledge.

The goal is to use facility design to help improve outcomes.

Step 2 - EBD: Find Sources for Relevant Evidence



Define the Research Question.

Search for Evidence.

Where to Look

The Knowledge Repository

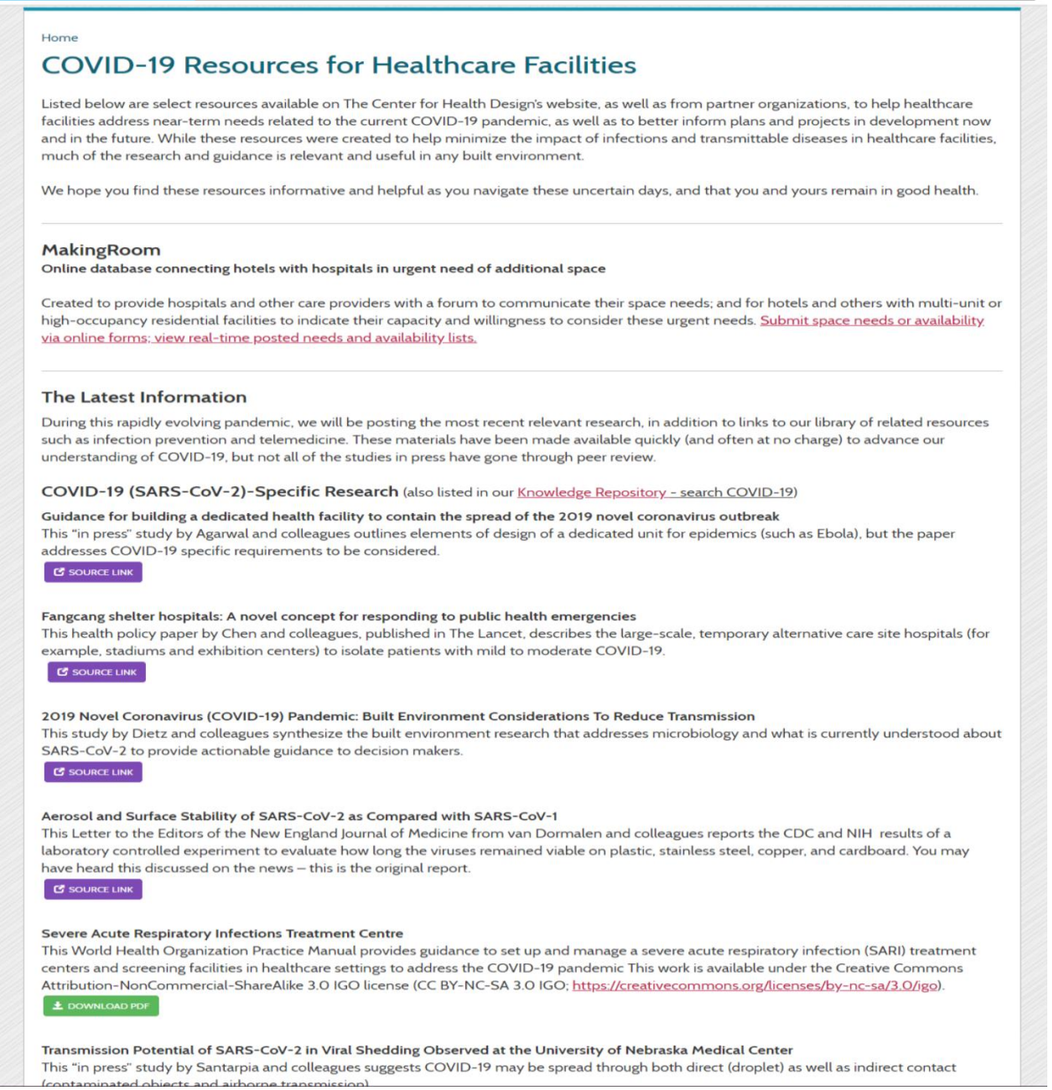
A complete, user-friendly library of healthcare design resources that continues to grow with the latest research.

- Online decision-making tool
- 4700+ citations
- 839 key point summaries (KPS)
- Acute, Residential & Ambulatory Care citations
- 76 full articles available
- 54 CHD produced articles available

https://www.healthdesign.org/knowledge-repository

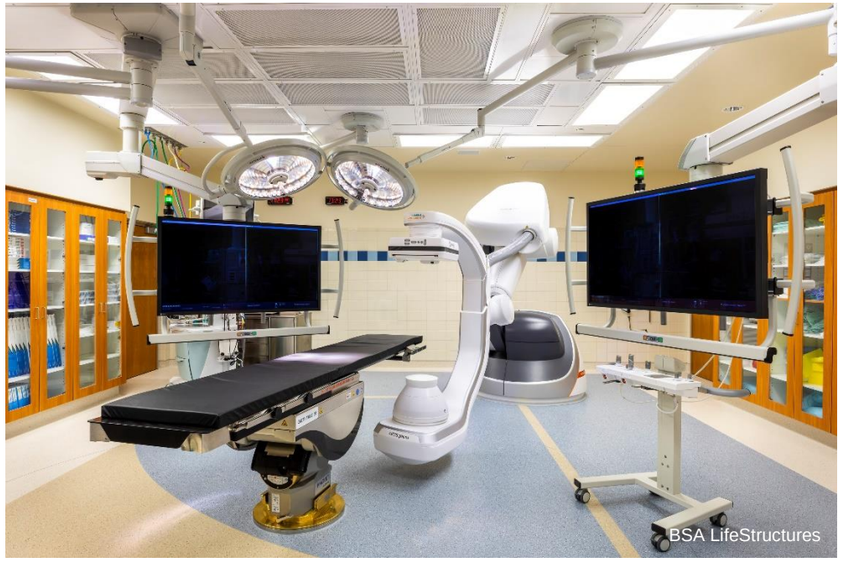
Resources

www.healthdesign.org



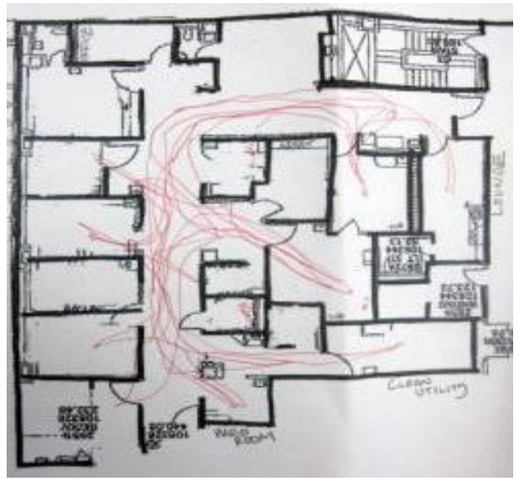
Other Research

- Benchmarking
- Case Studies
- Site Visits



Go to the Work

- Problem solving is more effective at the place and with the people having the problem
- Track the people, product and information flow



A3 #	Title	Revision	Champion	Date Started:	Collaborators/Participants	Approved by:	Approved Date:	Status
CA201	Cancer Center Gemba – Inpatient Areas	0	Rachel Knox	12-17-15	Chris Finch, Erin Laurenzi, Lisa Barton, Lauren Reeves, Shiela Hall, Tony Bernardini, Lauren Hegger, Jennie Evans, Brent Willson, Kristy Venrick, Rachel Knox			✓ Development ❑ Collaborative review ❑ Implementation

BACKGROUND:

Methodist University Hospital is building a new patient care tower, that will expand or replace several services including, surgery, imaging, sterile processing, pharmacy, patient beds, cancer center, and transplant center.

CURRENT CONDITION:

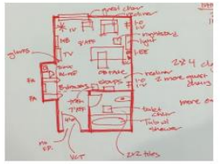
The inpatient cancer beds for ages 18 to 90 years of age are located in several areas of the hospital:

Surgical Oncology - 2nd Crews – 23 bed unit, recently renovated
- Patients are direct admit to Oncology
- Pod B – 10 – preparing for telemetry beds -

Medical Oncology & Malignant Heme
- 4 Crews, A pod, 1:5 ratio
- Includes telemetry and central monitoring
- Room 452 is a suite for room 453 – VIP, end of life, etc

BMT unit – 41 allogenics / autologous / have some 2 mismatche
- 12 beds, 1:4 ratio, but trying to get to 1:3
- ALOS is 14.5 to 30 days. Trying to decrease to 10 days.
- All positive pressure; 1 room is negative with ante room

- Staff includes mid-level for regular oncology, each MD has a mid-level assigned, a case manager and social worker are assigned to Pod A and B. Unit coordinator for both pods.

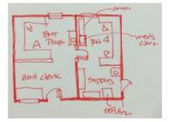


GOAL (TARGET CONDITION): GOAL STATEMENT (3-6 months, measurable goal , align with Problem Statement)

The goal of the gembas is to use current state observations to provide a frame of reference for the design team, and identify opportunities for improvement in the departments' future state spaces and operations.

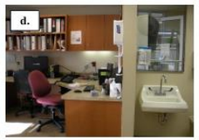
ROOT CAUSE ANALYSIS: *(Problem Cause)*
- Patients are direct admit to Oncology, from ED or clinic
- Clean Supply – no charge system; supplies charged to unit; patients charged flat rate; special requests are made through Cerner
- Nourishment – Coffee, Micro, countertop Ice, sink, ref/frz, some snack storage. Room has locked door with small vision panel.
- Equipment – not enough storage; using corridors and repurposed patient rooms
- Meds – exchange cart (daily), plus hourly delivery, single omnicell, UC ref, and disposable storage

BMT unit
- All visitors asked to wash up in a handwashing sink at entrance to unit
- Physicians conference room – 2 computers and 1 table; used by physicians
- 12 beds, 1:4 ratio, but trying to get to 1:3



- 1 small supply room
- Family room

a) **Patient Bed**
b) **Clean Supply Room**
c) **Equipment Storage**
d) **BMT Nurse Work**



Homework/Follow-Up

	What	Who	Promise Date
1.	*Return HKS information request*	*MUH*	*1/5/16*
2.			
3.			
4.			
5.			
6.			

HKS, Inc.

Step 3: Critically Interpret Evidence

Relevant

Low Credibility

High Credibility

Irrelevant

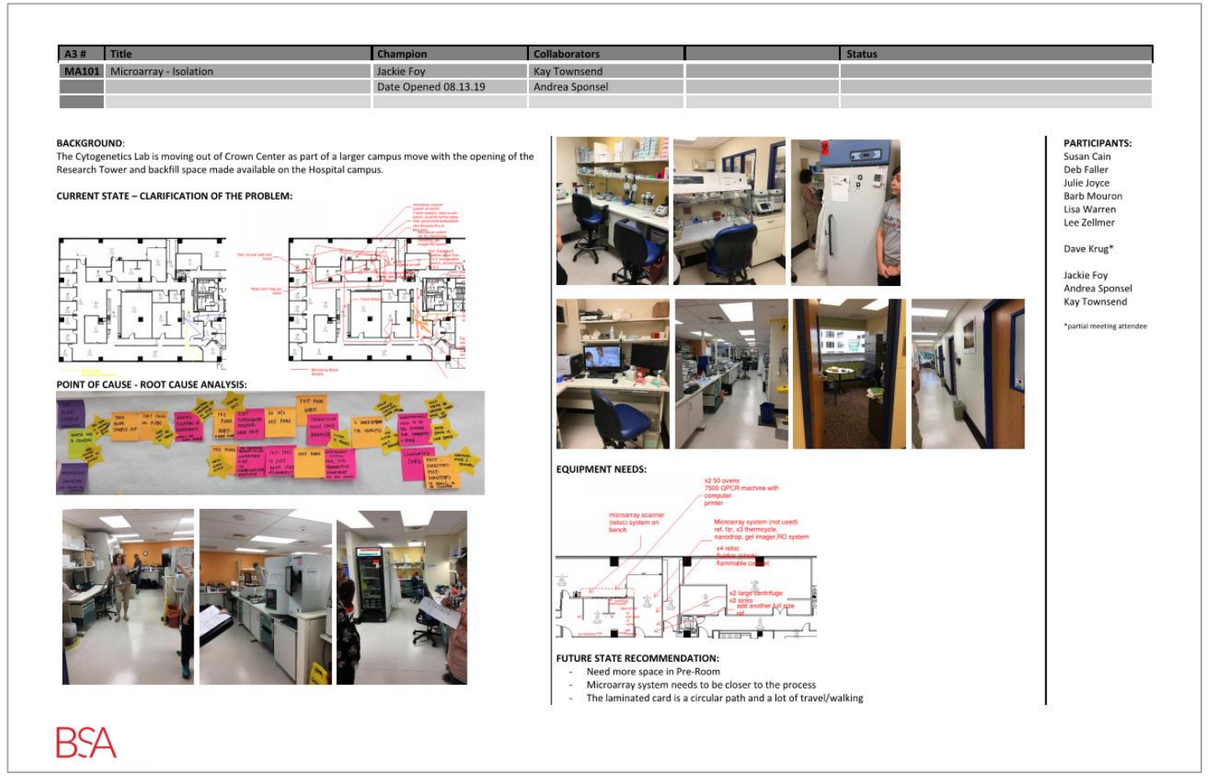
Step 4: Create and Innovate Design Concepts

Evaluate the Strategies against Project Goals, Vision and Research Questions.

Some will be better than others.

Map the Experience or Process

- Understand the experience or process and where improvements can be made
- Identify waste and improve it with operations and/or space
- Document the Current State with an A3 to start the problem solving process



A3 #	Title	Champion	Collaborators		Status
MA101	Microarray - Isolation	Jackie Foy	Kay Townsend		
		Date Opened 08.13.19	Andrea Sponsel		

BACKGROUND:
The Cytogenetics Lab is moving out of Crown Center as part of a larger campus move with the opening of the Research Tower and backfill space made available on the Hospital campus.

CURRENT STATE – CLARIFICATION OF THE PROBLEM:

POINT OF CAUSE - ROOT CAUSE ANALYSIS:

EQUIPMENT NEEDS:

FUTURE STATE RECOMMENDATION:
- Need more space in Pre-Room
- Microarray system needs to be closer to the process
- The laminated card is a circular path and a lot of travel/walking

PARTICIPANTS:
Susan Cain
Deb Faller
Julie Joyce
Barb Mouron
Lisa Warren
Lee Zellmer

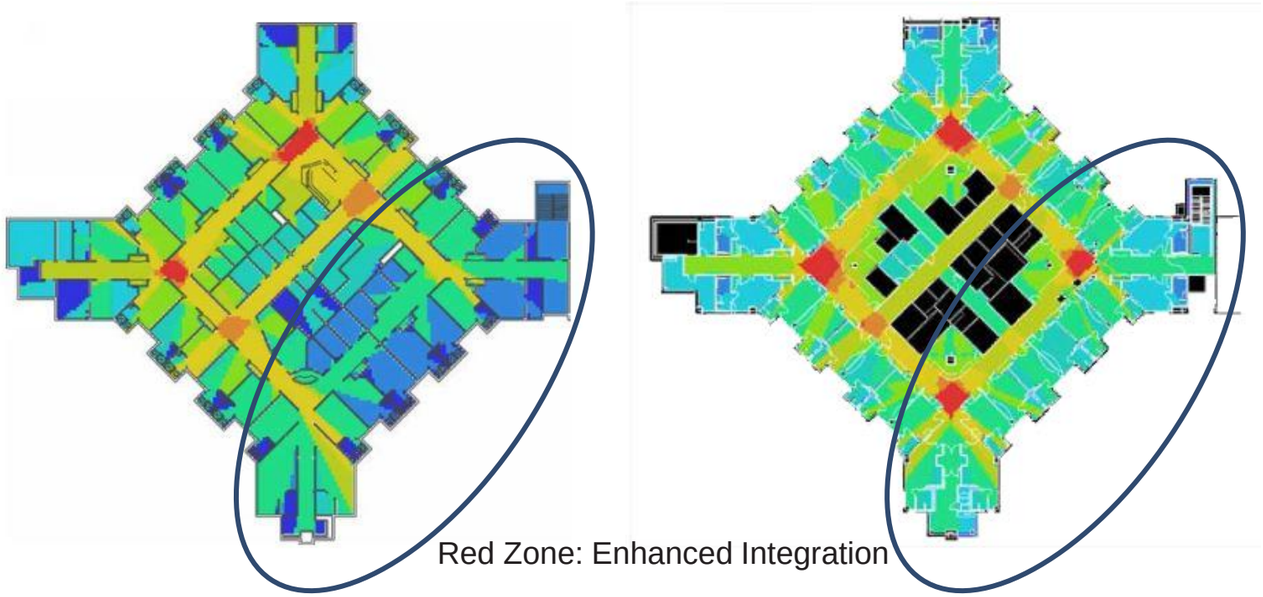
Dave Krug*

Jackie Foy
Andrea Sponsel
Kay Townsend

*partial meeting attendee

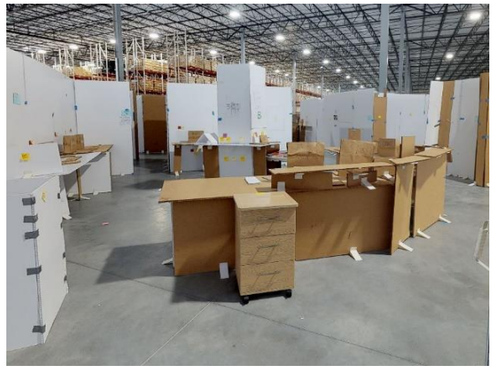
BSA

Design - Test It - Prototyping



Red Zone: Enhanced Integration

- Enables design team to bridge the gap of understanding with end users
- Allows end users to test operations to improve functionality, decrease square footage of rooms and optimize layout within rooms
- Allows the entire team to work out details in the room before construction commences or continues

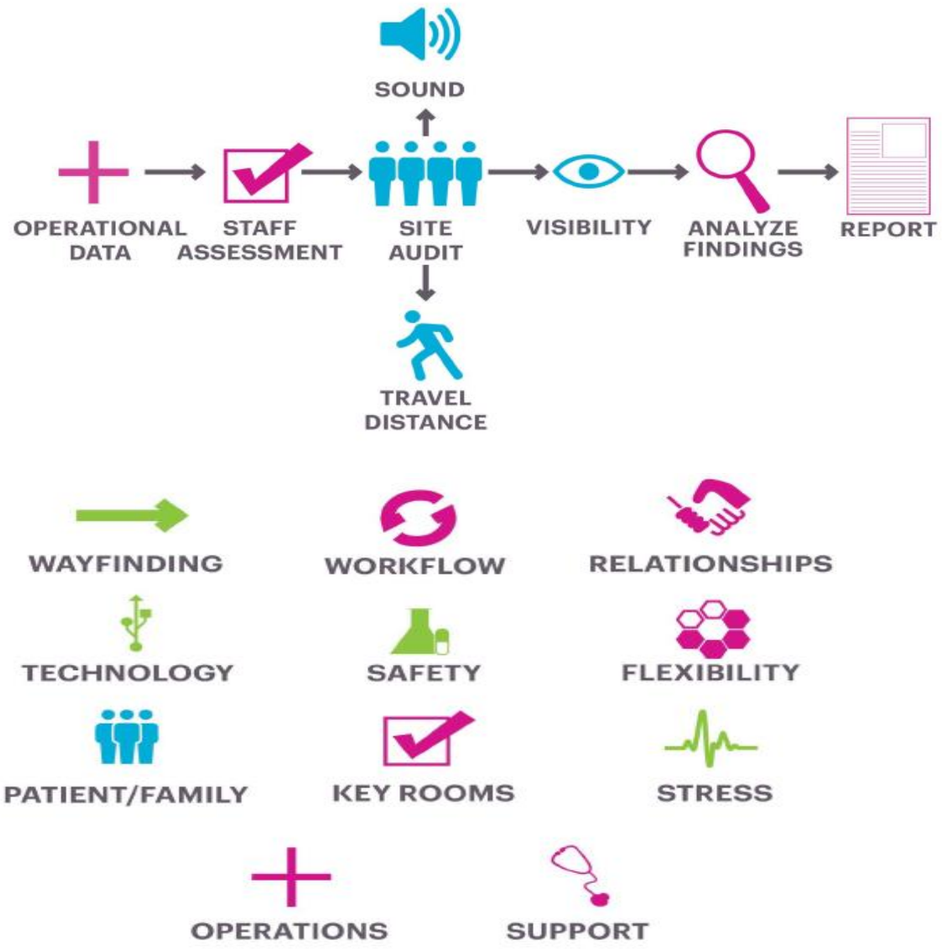


Step 5 - EBD: Develop a Hypothesis

- Hypotheses indicate or predict the **relationship between the design strategy** (independent variable) **and the outcome** (dependent variable).

- **Define your metrics.**

Step 6: Collect Baseline Metrics



Source: Functional Performance Evaluation, HKS, 2014

Step 7: Monitor Implementation of Design and Construction

Step 8: Measure Post Occupancy Results

The objectives of a POE are to:

- Provide feedback to design teams
  - Clarify programming issues and fine tune a facility
- Research effects of buildings on their occupants
- Provide information to support future designs and repetitive facilities
- Verify effectiveness of prototypes and innovations
- Justify design decisions and expenditures

Photo credit: Tim Gouw

Merging Methods

	Pre-Design	Schematic	Development	Documentation	Post-Occupancy
Lean	• Go to Gemba • Develop Data-Driven Metrics	• Develop Future-State Operational Models • Rapid Prototyping • Strategic Space Program	• Evaluate and Assess Prototypes and Mock-ups with Metrics	Set Optional Standards & Goals Special Project Support (Missing Link)	• Metrics Evaluation • Performance Report of Improvements and Continuous Improvement
EBD	• Gather Baseline/ Current-State Data with Valid Methods (shadowing, surveying, focus groups, & clinical data)	• Use Baseline Data to Develop Future-State Value Streams, Prototypes & Program • Apply EBD Concepts from Existing Literature	• Test & Predict Improvements of Future-State Models with Baseline Data	Hypothesize Outcomes Verify Application of Evidence & Metrics	• Collect Data with Same Pre-Design Methods • Compare Post-Occupancy Data with Baseline Data • Identify if Hypotheses are Supported
Change Management	**Step 1: Create a Sense of Urgency** • Share findings with staff to highlight potential improvement	**Step 2: Build a Coalition** • Engage and empower staff to influence design **Step 3: Form Operational and Design Goals** • Created an evidence-based design matrix **Step 4: Enlist & Empower Frontline Staff in Decisions**	**Step 5: Enable Staff Voice through Mock-up and Simulations** • Staff assesses the room/plan's performance **Step 6: Generate Consensus through Data** • Data is shared with staff to show workflow predictions	**Step 7: Sustain Success by having Staff Set Future-State Workflows** • Staff participates in day-in-the-life events to work through operational changes	**Step 8: Institute time to lament, then change** • Staff were able to provide continued feedback, which turned their frustration into flexibility and acceptance

Critical Needs

Quality Outcomes

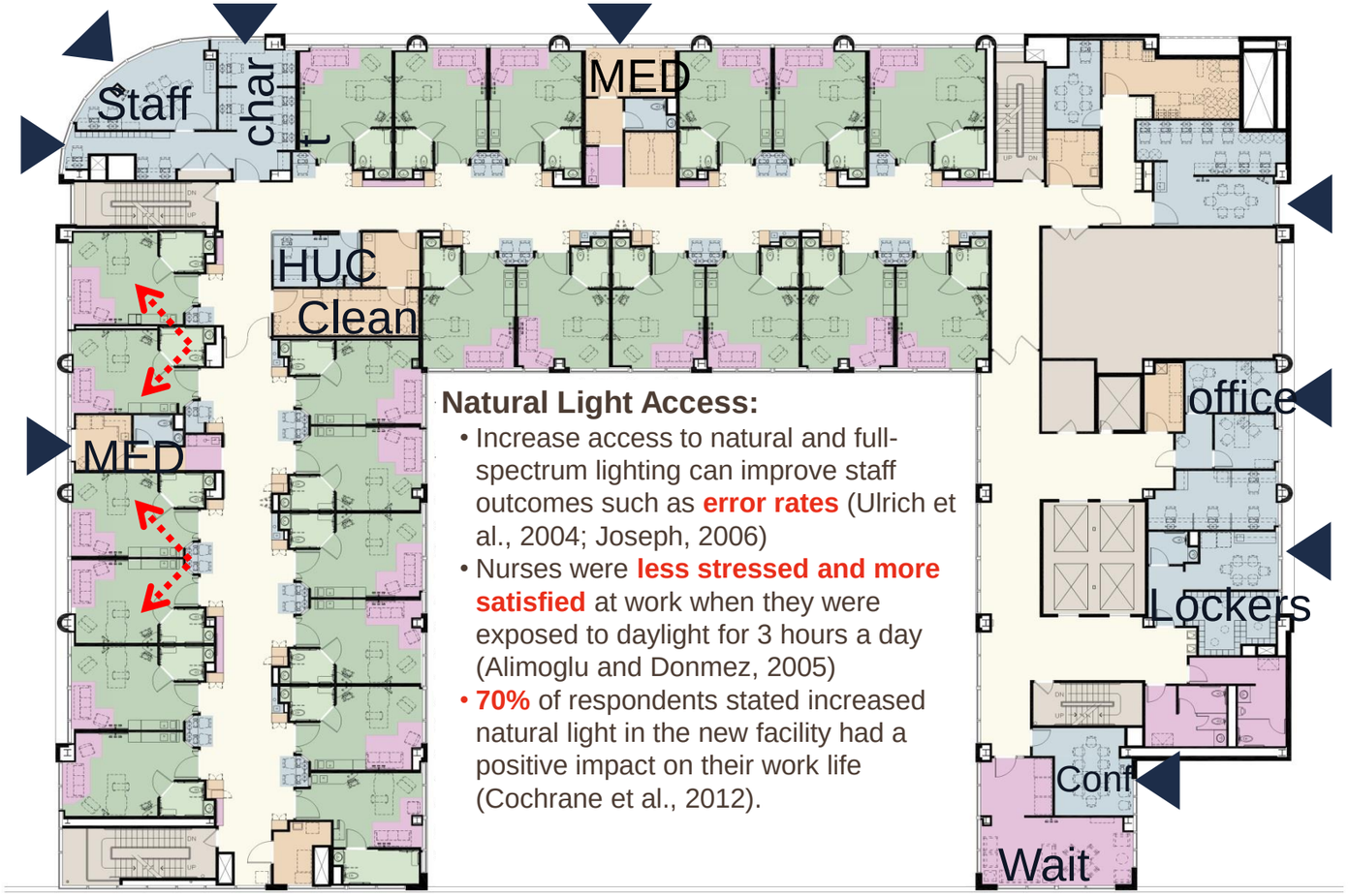
Critical Need	Quality Driver	Performance Requirement
 Great donuts	Fresh	Stagger production based on consumption.
		Use bags/boxes that preserve freshness
	Variety	Develop regular menu of 12 donuts
		Rotating manu of premium donuts
		Seasonal special donuts

Froedert Hospital, Milwaukee, WI

Final Floor Plan: 24 Bed Unit

Surveillance:

- Significantly reduced patient falls when direct visibility from commonly occupied workstations versus no visibility ($p<0.000$); (Calkins, 2012).



Natural Light Access:

- Increase access to natural and full-spectrum lighting can improve staff outcomes such as **error rates** (Ulrich et al., 2004; Joseph, 2006)
- Nurses were **less stressed and more satisfied** at work when they were exposed to daylight for 3 hours a day (Alimoglu and Donmez, 2005)
- **70%** of respondents stated increased natural light in the new facility had a positive impact on their work life (Cochrane et al., 2012).

Decentralization

HGA Research (Freihoefer, 2012):

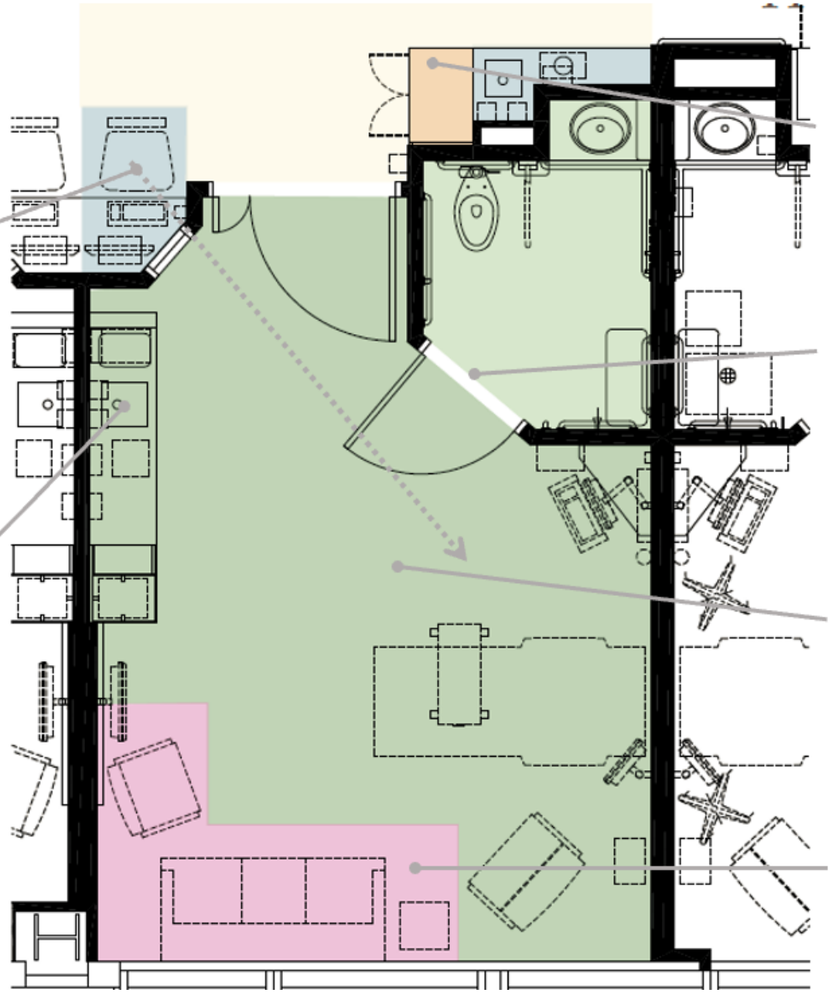
- An 8-hour day shift nurse spends roughly 2.4 hours at charting stations (in this floor plan, that is a 6.66% usability among the 6 charting stations with 3 RNs).
- Nurses only spend roughly **45 minutes of their day hunting and gathering** for supplies and medications.
- Roughly **50%** of nurses' visits to decentralized charting stations involved face-to-face interaction.

Final Floor Plan: 405 SQ FT

Surveillance:
Rooms with low visibility had a **30% higher mortality rate** for high acuity patients (Lu, Ossman, & Leaf, 2014)

Rooms not visible from work areas had **31% higher fall rate** (Choi, 2012)

Hand Hygiene:
Placing the sink upon entry encourages immediate hand washing, also positioning it with a line-of-sight to the patient so caregivers can greet patients and patients can observe good hygiene practices (Freihoefer, 2013).



Deployed Supplies:
Deploying supplies has shown to significantly **reduce staff travel by 1 to 1.5 miles a day** and significantly increased time spent in patient room by 6 to 10% (Freihoefer, 2013).

Fall Reduction:
Doors that can remain open and have direct access from the bed, shows nearly **50% reduction in fall** (Calkins, 2012).

Acuity-adaptable Rooms:
Acuity-adaptable rooms and universal room with ample space can reduce the risk of patient and staff injuries and patient dissatisfaction with a **90% reduction in patient transfers**. (Hendrich, Fay, & Sorrells, 2004).

Family Space:
Patient rooms with a designated family space had **nearly half the patient falls** than compared to those without (Calkins, Biddle, & Biesan, 2012).

POE Results

Nurses' Time Spent

	Existing Unit Current State	Benchmark Decentralized Studies	Decentralized Prototype Prediction	Post-Occupancy Results
Patient Rooms	39%	45-54%	+5-15%	**45%*** **
Charting Stations	43%	32-39%	-4-8%	39%
Medication & Supply Rooms	5%	1-5%	-0-3%	6%
Support Rooms	1%	2-5%	-0-2%	3%
Traveling	13%	5-8%	-4-8%	**7%*** **

- 36 minutes more time spent in patient room per nurse
- 6-7 dayshift nurses = Roughly 3.5 to 4 hours more time spent in patient rooms

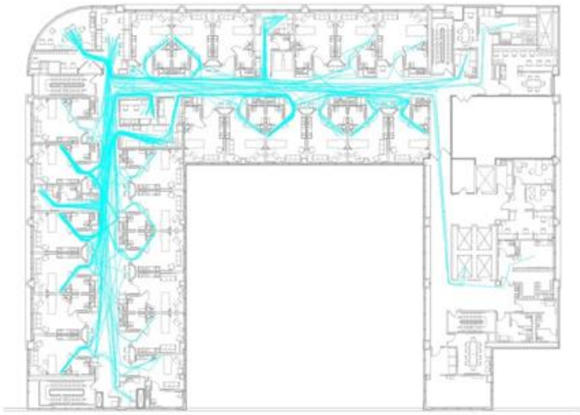
Travel Distances

	Post-Occupancy @ 3-months	Post-Occupancy @ 8-months	Post-Occupancy @ 12-months	Overall Average
Distance Traveled	2.89 miles	2.04 miles	1.64 miles	2.08 miles

3-Months

8-Months

12-Months



Significant reduction over time ($p < 0.001$***)

Approximately 1.25 miles more efficient overtime

Efficiency Calculation

6% of 1 FTE = 0.06

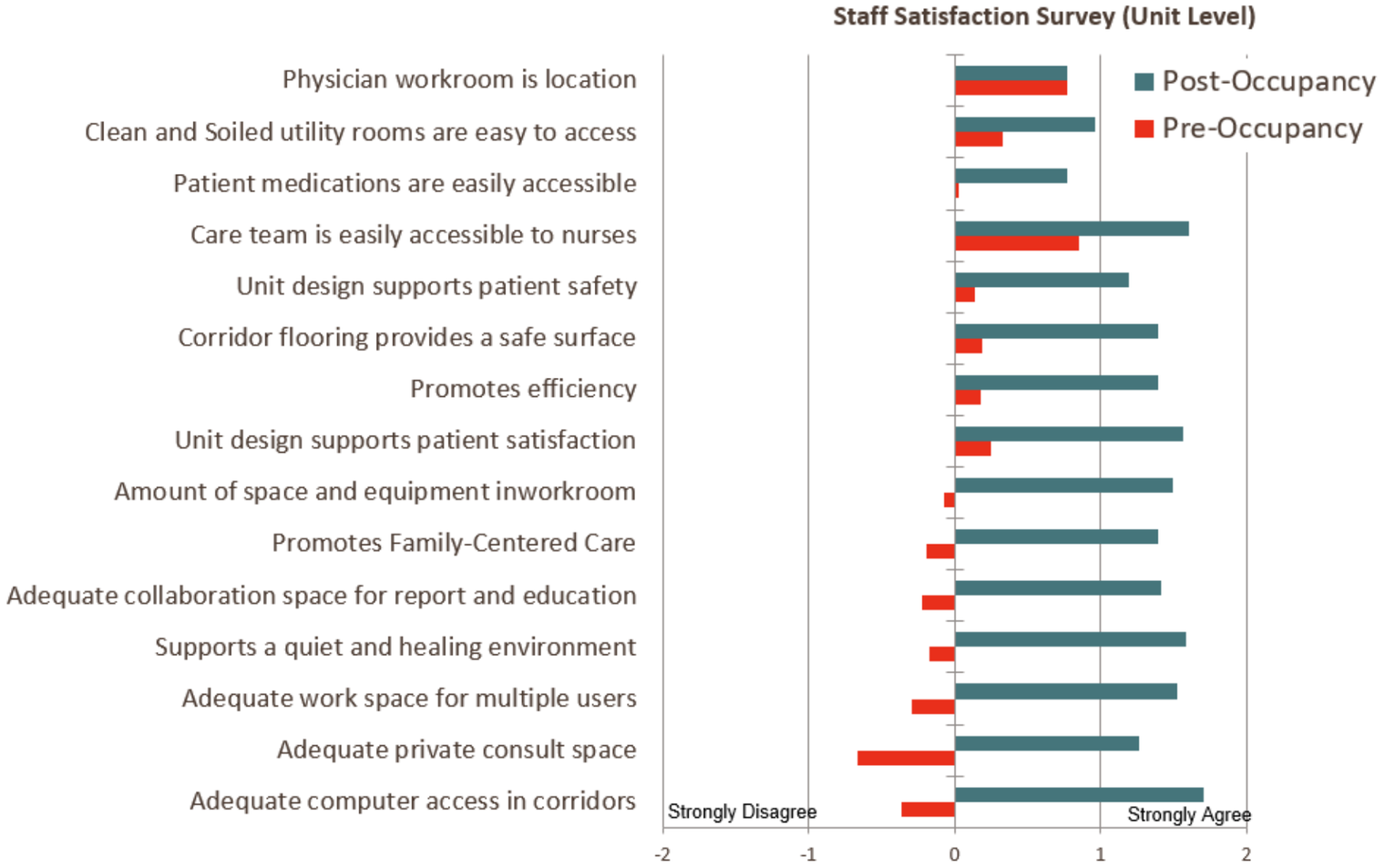
0.06 FTE X 32.9 FTEs = 1.97 FTEs

1.97 FTE x 80 hrs x 26 payperiods =4,106 hours

4,106 hours X ($34.65/hr*28% benefits package) =

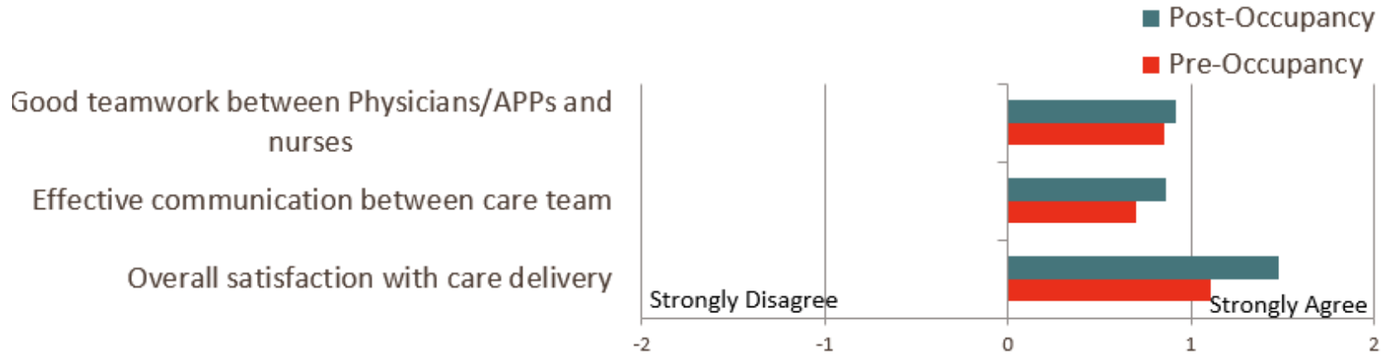
Annual productivity cost savings of $182,097.55 per year

POE Results: Staff Satisfaction

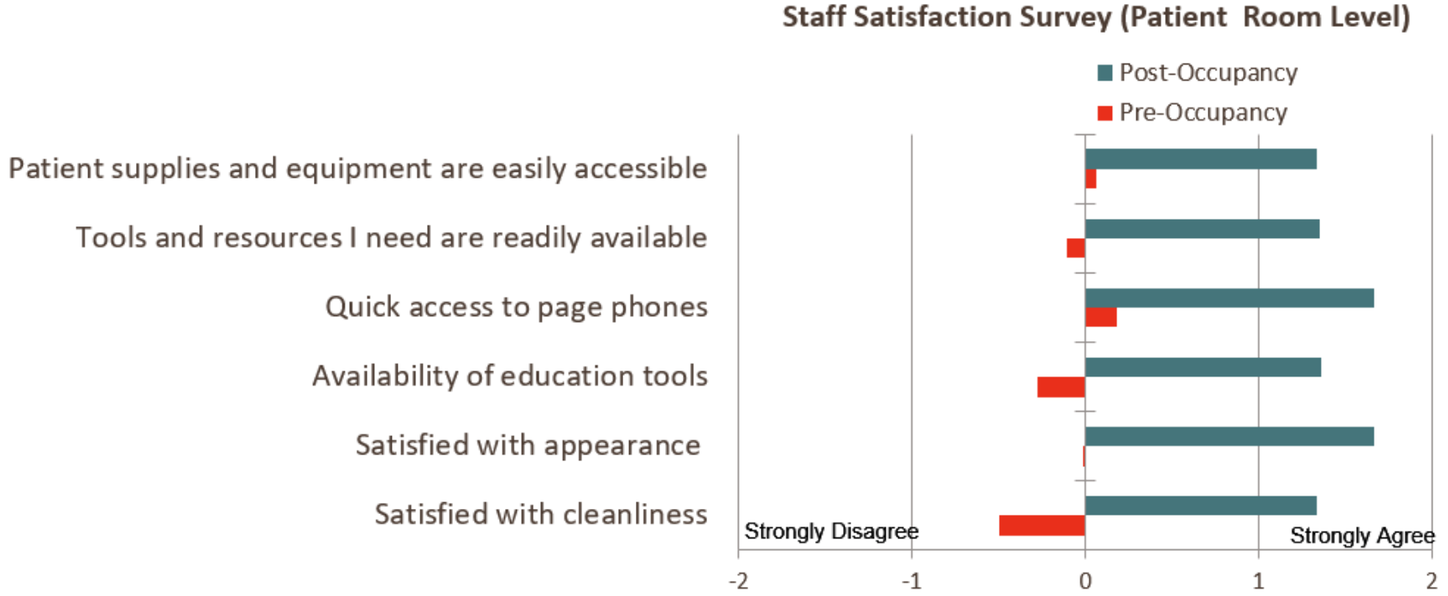


Overall Unit Design a 31%* increase in staff satisfaction**

POE Results: Staff Satisfaction



Job Performance a 5%* increase in staff satisfaction



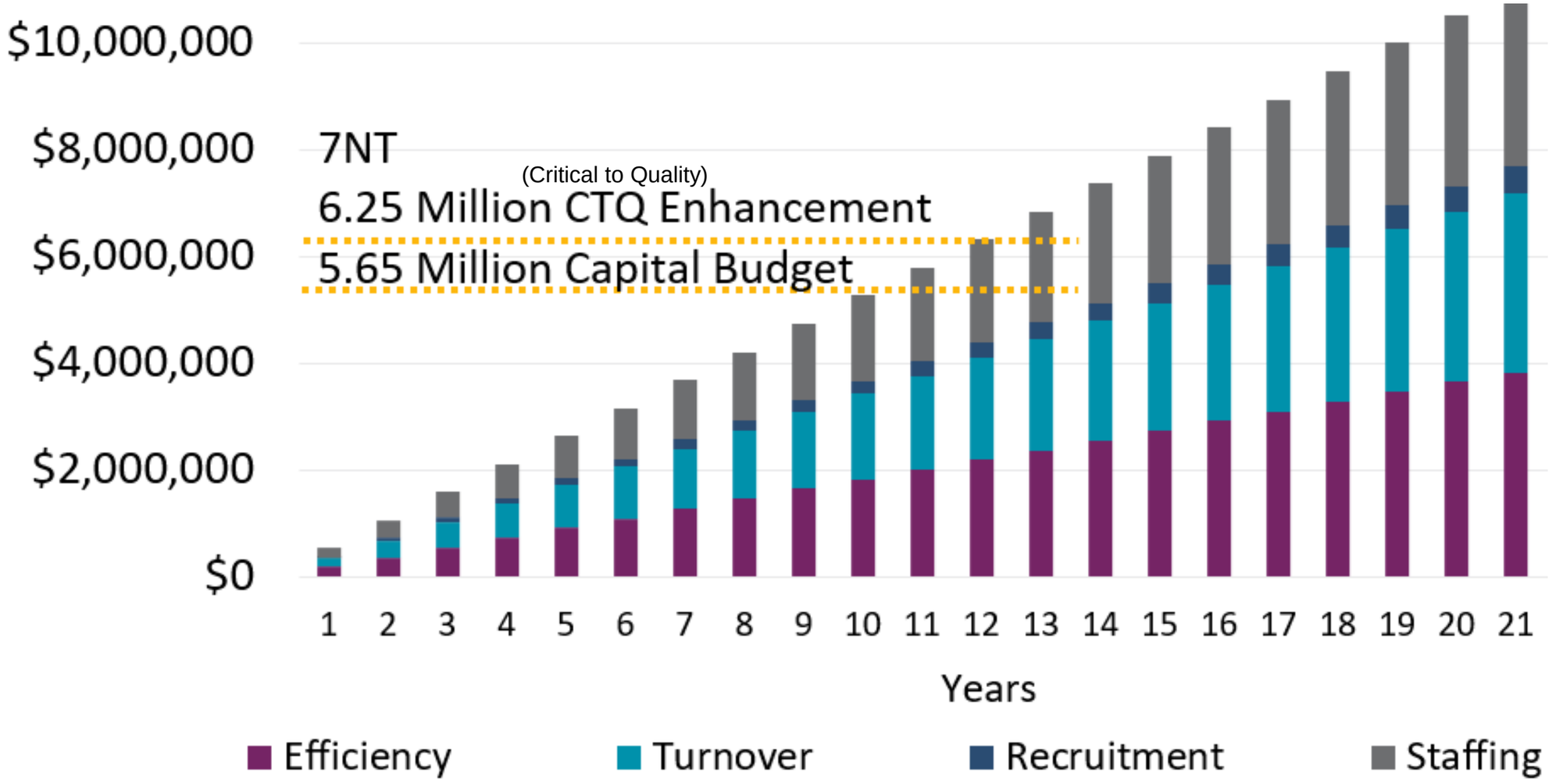
Overall Patient Room a 40%* increase in staff satisfaction**

Total Annual Cost Savings

Efficiency	182,097.55
Turnover	160,025.50
Recruitment	23,949.24
Staffing	160,200.26

$526,272.55 in annual cost savings

ROI



ROI

PATIENT METRICS

In 2017, there were 5.2 FEWER STAGE 2 AND ABOVE PRESSURE ULCER INCIDENCES with a ROI of

$224,536 yearly

Significantly less ALOS, approximately 30 less patient days yearly with a ROI of $93,765 yearly

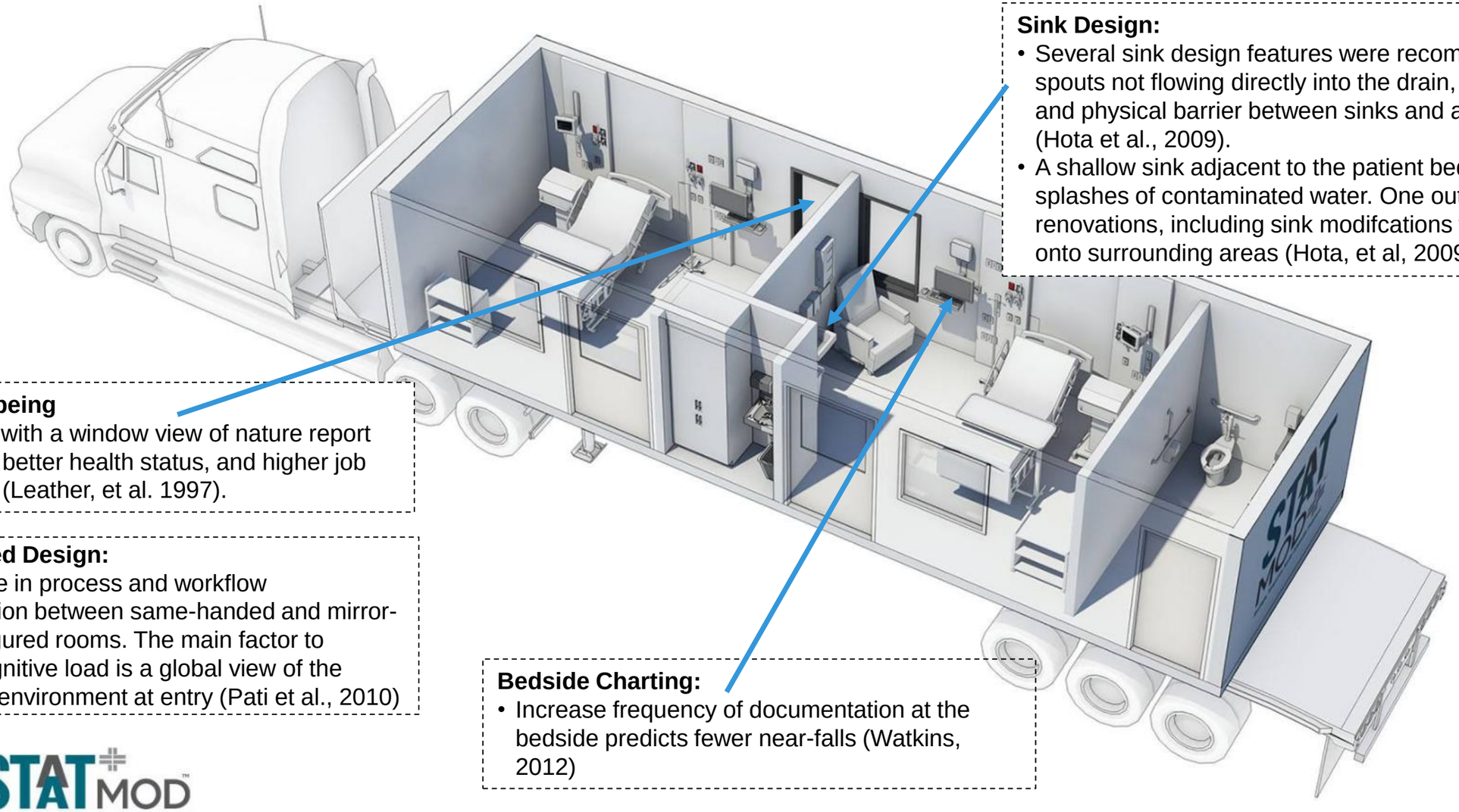
35% reduction

in falls (per 1,000pt/days); 5.75 fewer falls with injuries yearly with a ROI of $53,667 yearly

Significant increase in key HCAHPS items:

- **15%** in Quietness (p<0.000***)
- **7%** in Cleanliness (p<0.000***)
- **7%** in Overall Care (p<0.000***)
- **4.5%** in Likelihood to Recommend (p=0.003**)
- **3.5%** in Communication with Nurses (p=0.024*)

STAAT MOD



Staff Well-being
Employees with a window view of nature report less stress, better health status, and higher job satisfaction (Leather, et al. 1997).

Standardized Design:
No difference in process and workflow standardization between same-handed and mirror-image configured rooms. The main factor to reducing cognitive load is a global view of the patient care environment at entry (Pati et al., 2010)

Sink Design:
- Several sink design features were recommended by research: faucet spouts not flowing directly into the drain, decreased water pressure, and physical barrier between sinks and adjacent preparatory spaces (Hota et al., 2009).
- A shallow sink adjacent to the patient bed resulted in exposure from splashes of contaminated water. One outbreak was eliminated by renovations, including sink modifcations that prevented splashing onto surrounding areas (Hota, et al, 2009).

Bedside Charting:
- Increase frequency of documentation at the bedside predicts fewer near-falls (Watkins, 2012)

STAAT MOD
Strategic, Temporary, Acuity-Adaptable Treatment

STAAT MOD

Have you ever experienced a roadblock with Lean +/or EBD?

- No – it's always been great
- Never worked with both at the same time
- Yes with Lean
- Yes with EBD
- Yes with Both

Lean + EBD Toolkit

Practice Based Research (PBR)	Evidence Based Design (EBD) Steps/Toolkit	Lean Integration Toolkit
Pre-Design Activities	**EBD Step 1:** Define EBD Goals and Objectives	**Plan**
Define CTQs (Customers and Requirements)	Challenges and Trends	Project Alignment - Conditions of Satisfaction
		Community Engagement
Define Outcome Metrics	Use Facility Design to Help Improve Outcomes	
Collect/Identify Baseline Data		Gemba* - Waste Walk
Current State Investigation		Mapping - Value, Process, Experience, Journey
Determine Root Causes		5 Whys
		Fishbone Diagram
Develop Problem Statements and Goals - for Design and Operations		A3s*
Develop Project Plan and Milestones		Last Planner System™ * (LPS)
	EBD Step 2: Find Sources for Relevant Evidence	
Design Insights/Trends Discussion	Focus on Addressing a Design Challenge	
Research Collection	Develop the Question before you Search for Relevant Evidence	
Future State Development		3P Event
Visioning/Imaging - Project Vision		
Design Activities	**EBD Step 3:** Critically Interpret Relevant Evidence	
Secondary Research Collection/Review		
	EBD Step 4: Create and Innovate EBD Concepts	**Do**
Develop Potential Solutions		Target Value Delivery*
		Set Based Design
Mock-Up Development/Testing	Evaluate the Strategies	Paper Dolls
Material Research		Evaluation - Sound Decision Making*
		Choosing by Advantages (CBA)
Discuss Prefabrication Opportunities		Big Room
		Trades engaged early

	EBD Step 5: Develop a Hypothesis	
	Indicate or Predict the Relationship between the Design Strategy and the Outcome	PDCA - A3 with follow-up
	EBD Step 6: Collect Baseline Performance Measures	**Check**
Evaluate-Correct-Re-evaluate Potential Solutions	Reference Existing Metrics	Plus/Delta* - Retrospectives*
Scenario Testing		Rapid Prototyping - VR*
Preparing Staff for Process Changes		
Change Management		Stakeholder Engagement
Construction Activities	**EBD Step 7:** Monitor Implementation of Design and Construction	**Act/Adjust**
Transition Planning		Standardized Work - LPS
Activation Planning		5S - LPS
Education		
Modular Construction		
Occupancy	**EBD Step 8:** Measure Post Occupancy Performance Results	
(Phased) Post Occupancy Evaluation	Compare outcome metrics to pre-design phase	
Continuous Improvement	Provide feedback to Design+Construction Teams	Retrospectives
Sustain the Changes	Clarify Programming Issues and Fine Tune Facility	5S

***This thinking or tool will be used through the life of the Project**

https://tinyurl.com/LEANEBDforum2020

Lean + EBD Integration

Basic Services

- Organizational Goals
- Clinical Outcomes
- Scholarly Evidence
- Project Success Measures

Additional Services

- Customized to the Project
- In Depth Evaluation and Recommendation

Focused Research

- Select topic you want to study

Start small, but start.

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LEAN IN DESIGN FORUM

MAY 27–28, 2020

In the spirit of continuous improvement, we would like to remind you to complete this session's survey! We look forward to receiving your feedback.

Lean Construction Institute
Transforming the Built Environment

AIA

P2SL