Evaluating the Quality of Hospital Design

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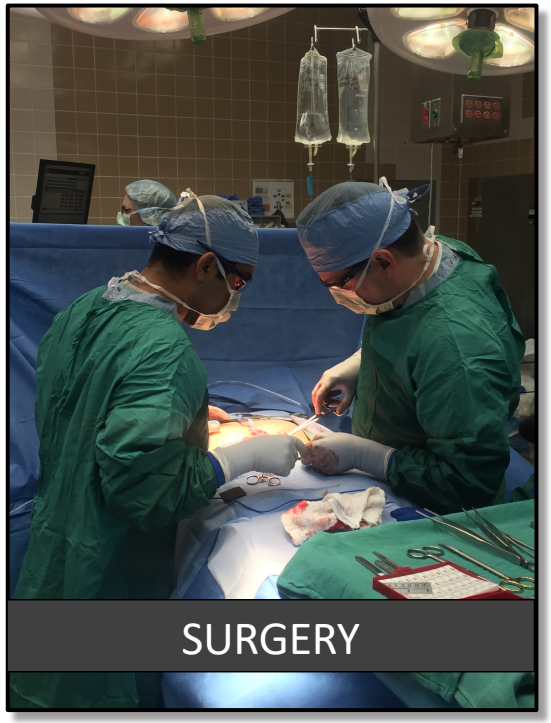
Co-Director, Center for Healthcare Outcomes & Policy

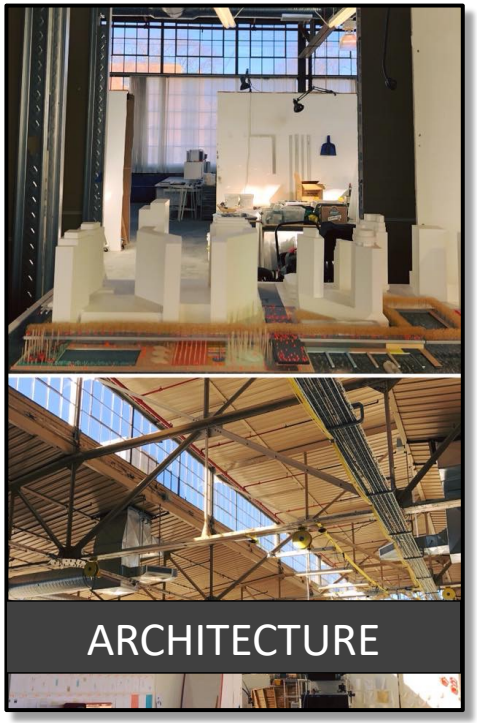
M·TQIP

Michigan Trauma Quality Improvement
Virtual Meeting

October 12th, 2021

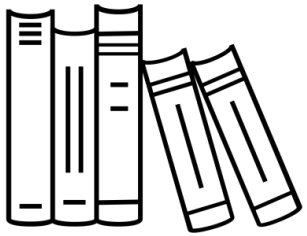
Three Perspectives





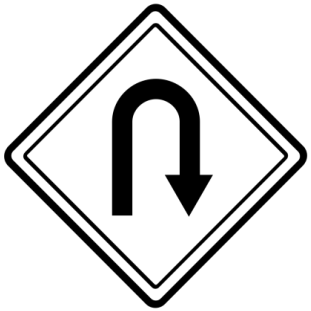
Evaluating the Quality of Hospital Design

Quality?
Since When?



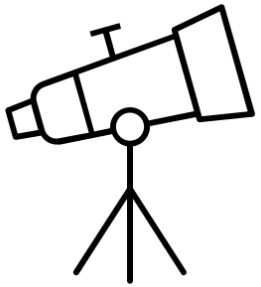
Context for
Surgery & Architecture

Quality Design
Gone Wrong



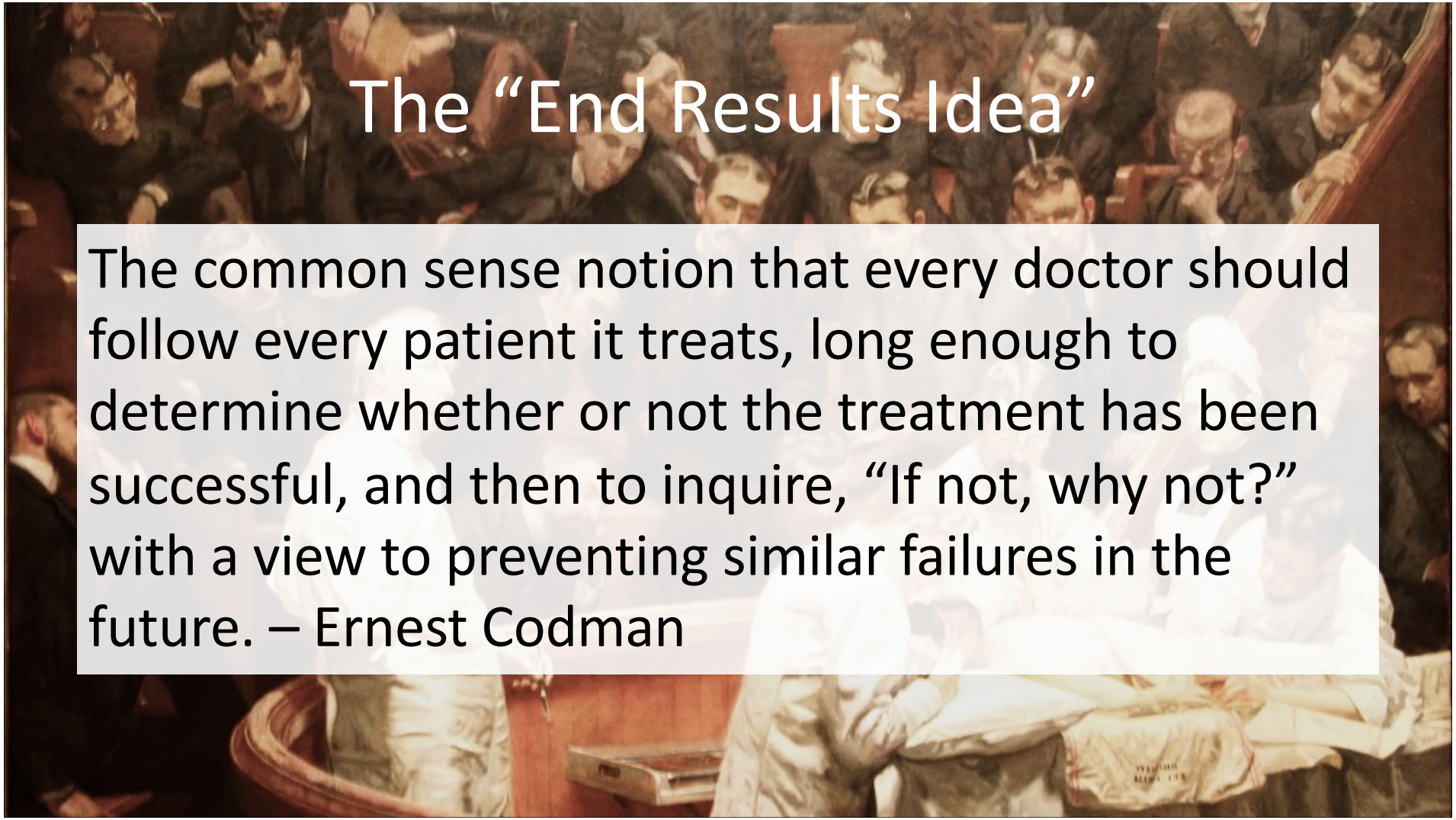
Right Idea,
Wrong Results

Evidence for
Better Design



Leveraging Surgical
QI in New Context

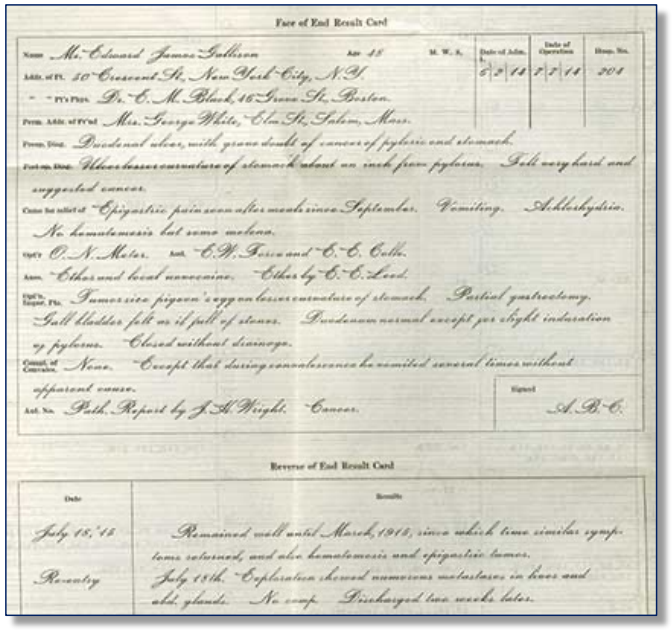
The Era of Ernest Codman (b. 1869)



The “End Results Idea”

The common sense notion that every doctor should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire, “If not, why not?” with a view to preventing similar failures in the future. – Ernest Codman

The “End Results Idea”



Face of End Result Card

Name Mr. Edward James Gallivan Age 45 M. W. S. Date of Adm. 6/2/14 Date of Operation 7/7/14 Hosp. No. 204

Add. of Pt. 50 Crescent St. New York City, N.Y.

Pt's Phys. Dr. C. M. Black, 16 Grove St. Boston.

Pers. Add. of Pt's Rel. Mrs. George White, Elm St. Salem, Mass.

Pres. Diag. Duodenal ulcer, with grave doubt of cancer of pylorus and stomach.

Post-op. Diag. Ulcer-bearing curvature of stomach about an inch from pylorus. Felt very hard, and suggested cancer.

Chief Sub. related to Epigastric pain soon after meals since September. Vomiting. Achlorhydria. No hematemesis but some melena.

Op'rs O. N. Meier. Asst. C. W. Force and C. C. Cobb.

Anes. Ether and local anaesthesia. Ether by C. C. Lord.

Op'n, Surgical Pic. Tumor size pigeon's egg on lesser curvature of stomach. Partial gastrectomy. Gall bladder felt as if full of stones. Duodenum normal except for slight induration of pylorus. Closed without drainage.

Compl. of Convales. None. Except that during convalescence he vomited several times without apparent cause.

Signed A. B. C.

Aut. No. Path. Report by J. A. Wright. Cancer.

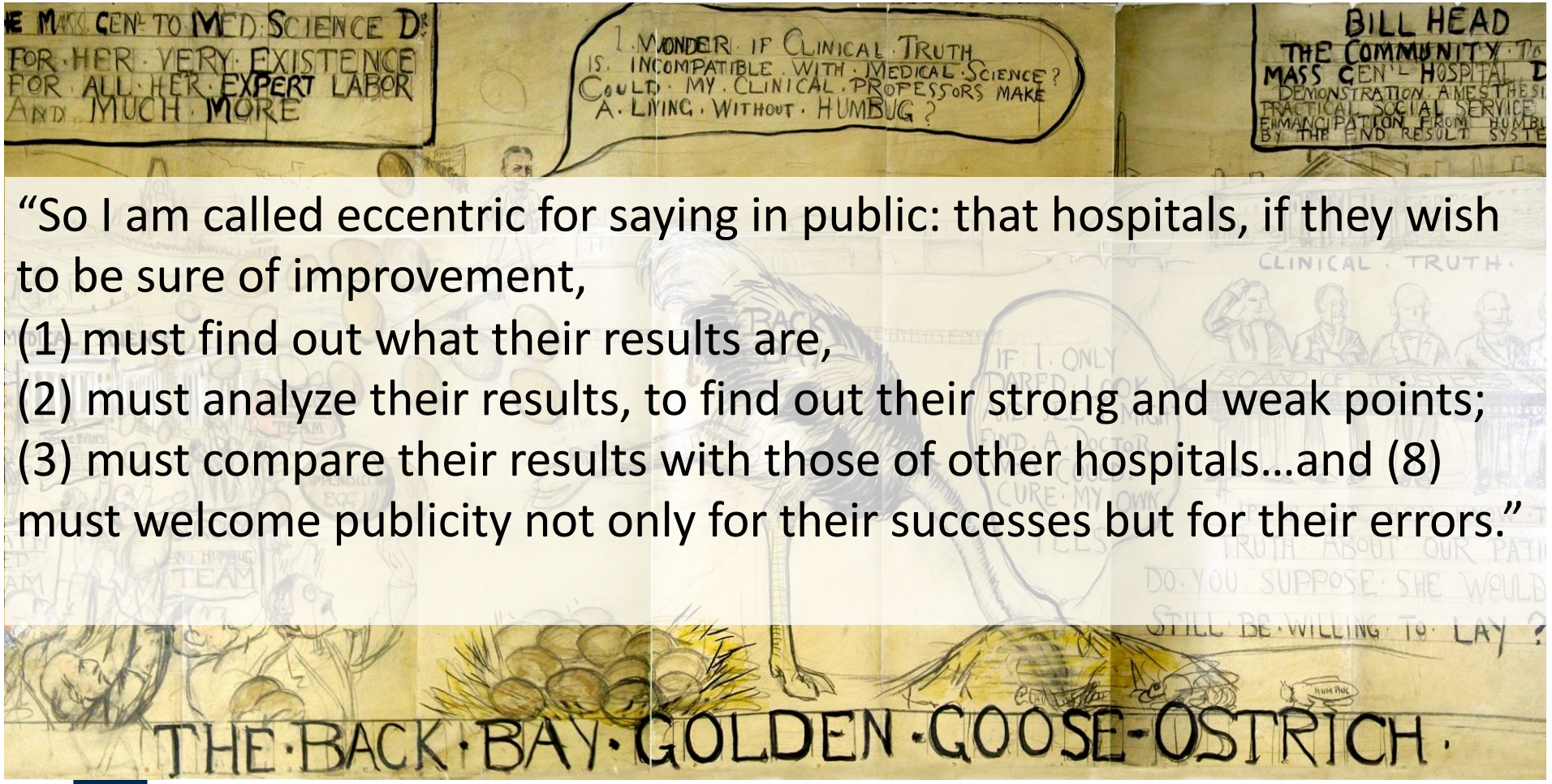
Reverse of End Result Card

Date	Results
July 15, '14	Remained well until March, 1918, since which time similar symptoms returned, and also hematemesis and epigastric tumor.
Recently	July 18th. Exploration showed numerous metastases in liver and abd. glands. No comp. Discharged two weeks later.

Complications due to:

“Lack of Judgement”

“Lack of Technical Skill”

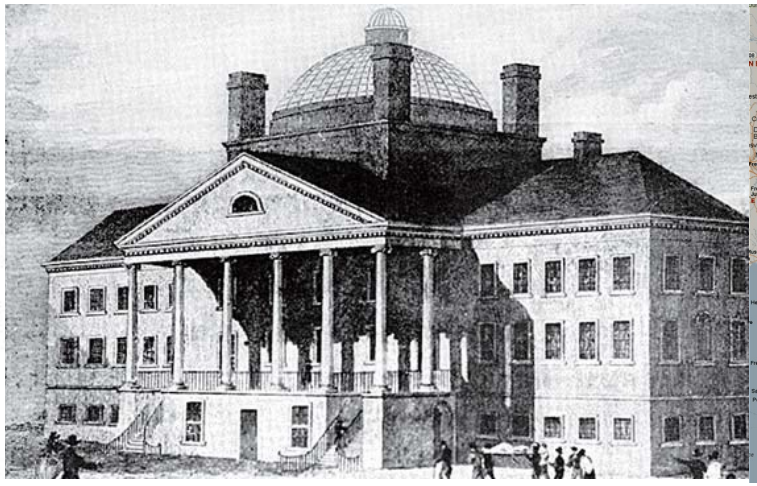


"So I am called eccentric for saying in public: that hospitals, if they wish to be sure of improvement,
(1) must find out what their results are,
(2) must analyze their results, to find out their strong and weak points;
(3) must compare their results with those of other hospitals…and (8) must welcome publicity not only for their successes but for their errors."

Not So Popular….

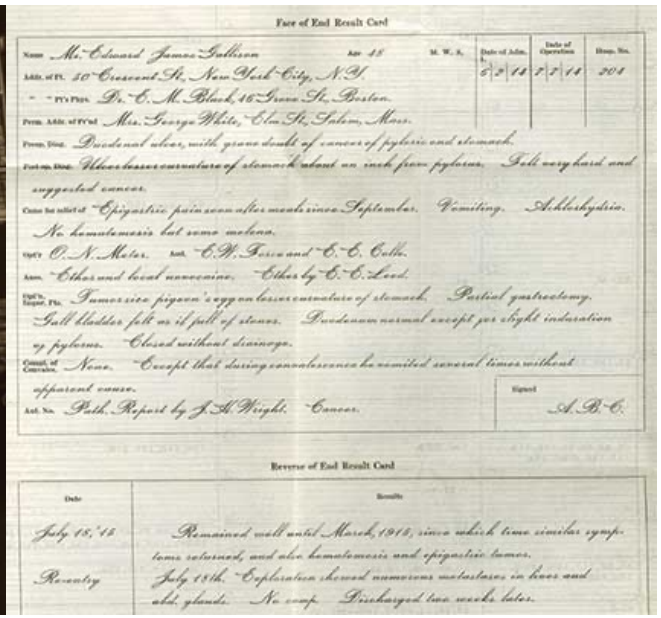

CARTOON BY PHYSICIAN MAKES STIR

Medical Society Is Divided Over Action



It may take 100 years for my ideas to be accepted.

First Cancer Registry in the United States (1924)



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Reverse of End Result Card

Date	Results
July 18, '18	Remained well until March, 1919, since which time similar symptoms returned, and also hematemesis and epigastric tumor.
Recently	July 18th. Exploration showed numerous metastases in liver and abd. glands. No comp. Discharged two weeks later.

Establishing Standards…

"…regular staff meetings to review cases"

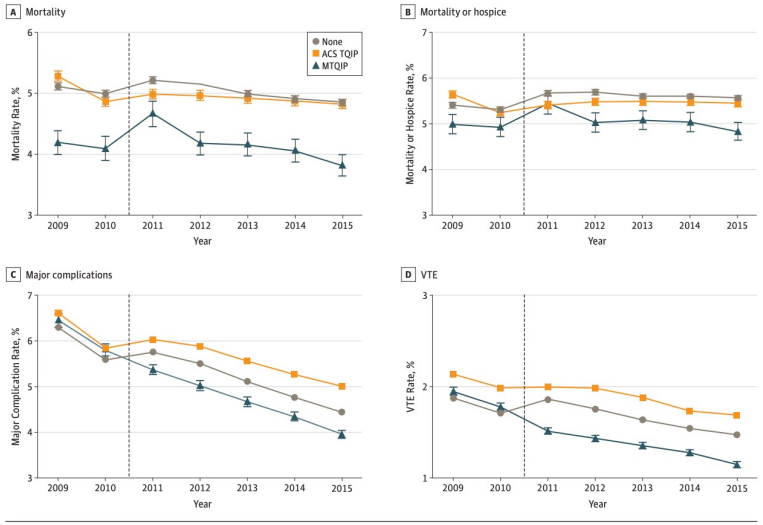
- Committee for Hospital Standardization

Morbidity & Mortality Conference

When Surgeons Embraced Measuring Outcomes….

The Power of Evidence to Change Practice

Figure 2. Adjusted Rates of Outcomes



The dotted line indicates the transition from the preintervention period to the postintervention period, and the error bars indicate 95% CIs. ACS TQIP indicates American College of Surgeons Trauma Quality Improvement Program; MTQIP, Michigan Trauma Quality Improvement Program; VTE, venous thromboembolism.

Research

JAMA Surgery | Original Investigation

Association of Hospital Participation in a Regional Trauma Quality Improvement Collaborative With Patient Outcomes

Mark R. Hemmila, MD; Anne H. Cain-Nielsen, MS; Jill L. Jakubus, PA-C, MHSA, MS; Judy N. Mikhail, RN, PhD; Justin B. Dimick, MD, MPH

"…hospital participation in a regional collaborative quality improvement program is associated with improved patient outcomes beyond benchmark reporting alone while promoting compliance with processes of care."

The ‘End Results Idea’ Beyond Surgery…

The common sense notion that every doctor should follow every patient they treat, long enough to determine whether or not the treatment has been successful, and then to inquire, “If not, why not?”
with a view to preventing similar failures in the future.

If Codman was an Architect Talking to Clients

The common sense notion that every [hospital architect] should follow every [hospital they build], long enough to determine whether or not the [hospital] has been successful, and then to inquire, "If not, why not?" with a view to preventing similar failures in the future.

Modified from Codman's "End Results Idea" (1925) where he advocated (to much controversy) that surgeons track patient outcomes after an operation.

Do You Consistently & Systematically Measure the Outcomes of the Buildings You Design?

(awkward silence is okay)

The uncomfortable truth about post-occupancy evaluation

21 JULY 2020 . BY PHILIP WATSON

Philip Watson, director at HLM Architects, is shocked to discover architects don't seem to care what people think or feel about their buildings

The "Post-Occupancy Evaluation"

Despite US Healthcare Construction
Totaling **$48 BILLION ANNUALLY**

<5% of Architecture Firms Routinely
Perform a Post-occupancy Evaluation

It may take 100 years for my ideas to be accepted.

Problems with OR Design…

"Identifiable hazard in the operating room include infection… faults in equipment, inaccessibility of necessary items, problems in communication, inefficient handling of materials, unconscionable delays … that are an expression of a hazardous environment."

Problems with OR Design…

Harold Laufman MD
(1912 – 2010)

"Identifiable hazard in the operating room include infection… faults in equipment, inaccessibility of necessary items, problems in communication, inefficient handling of materials, unconscionable delays … that are an expression of a hazardous environment."

Laufman H, Arch Surg, 1973.

Better OR Design Gone Wrong
(some infection control examples)

The OR Corridor…

ISOLATE CLEAN CORE

- **Only 2 doors**
- **“Hard to Get Through”**

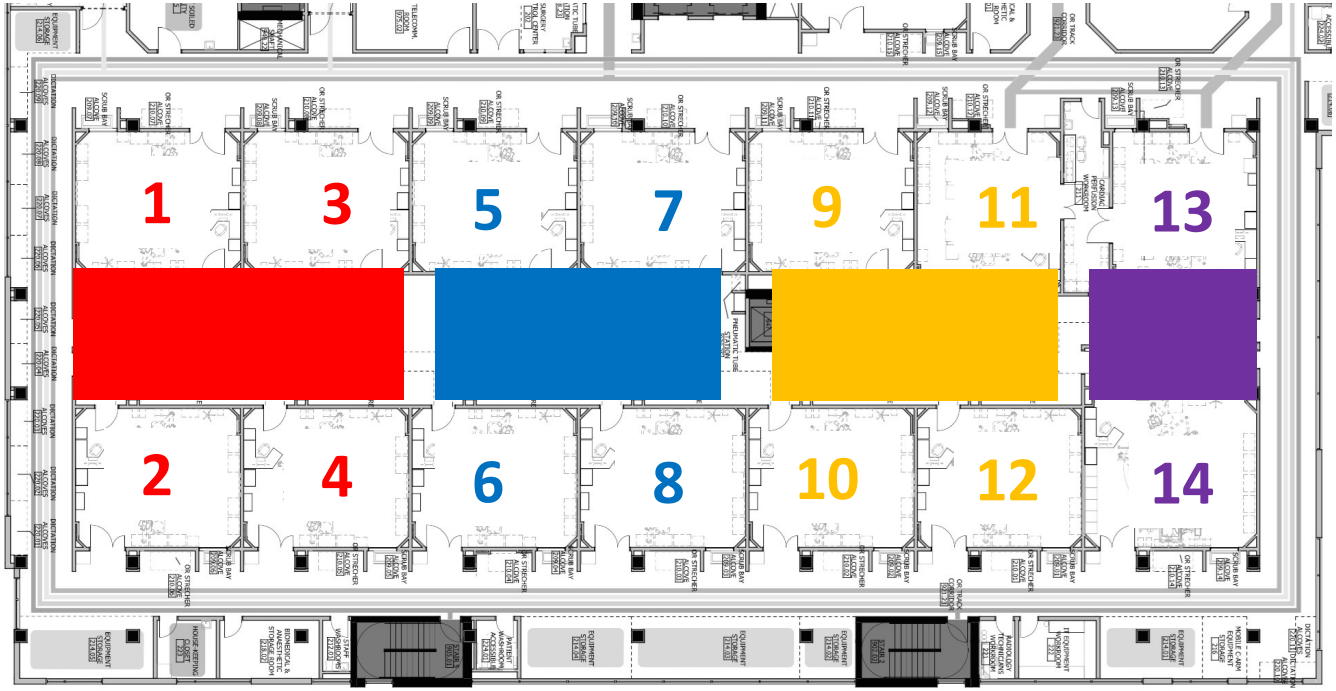
The OR Corridor…

LIMIT OR ACCESS

The OR Corridor…

GROUP ORS by CLEAN CORE

The OR Corridor…



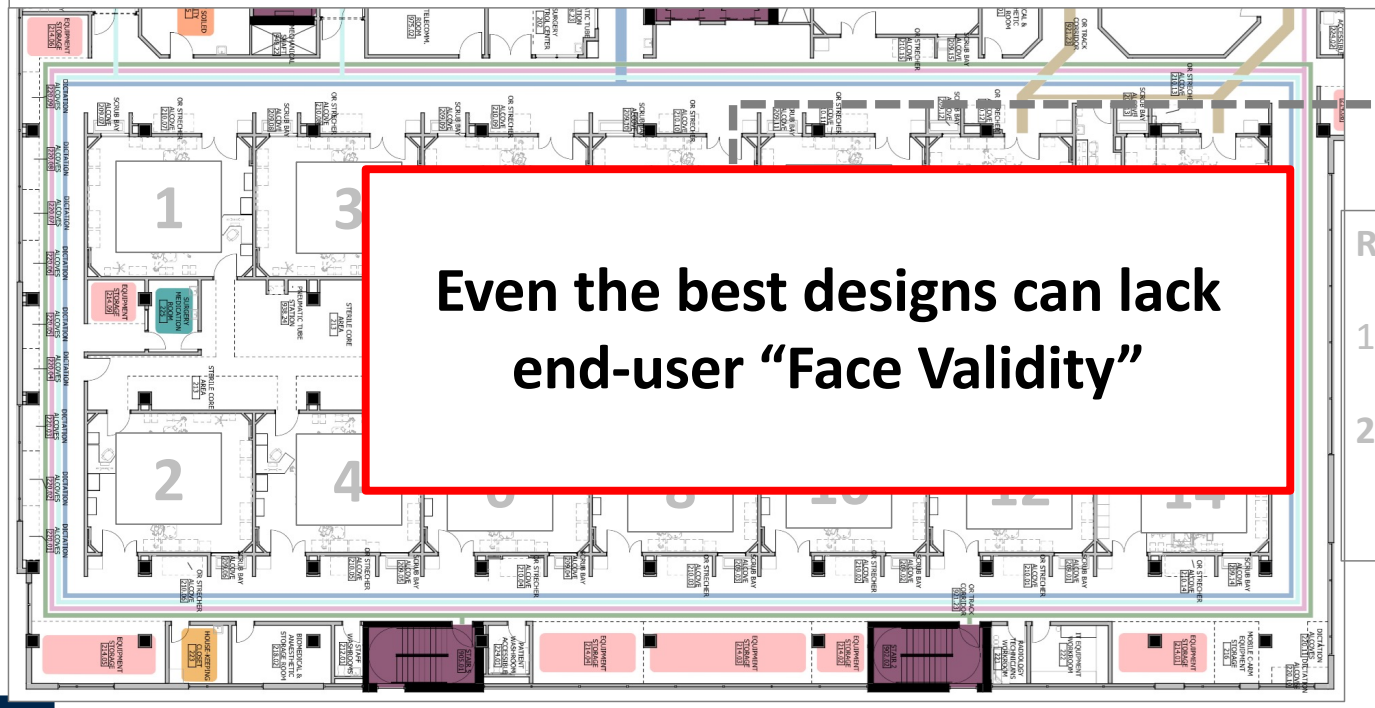
GROUP ORs by CLEAN CORE

Did it Work? Not really.

Result? MORE TRAFFIC

1. More Outer Traffic Large Door Use
2. **More "Cross OR" Traffic**

Did it Work? Not really.



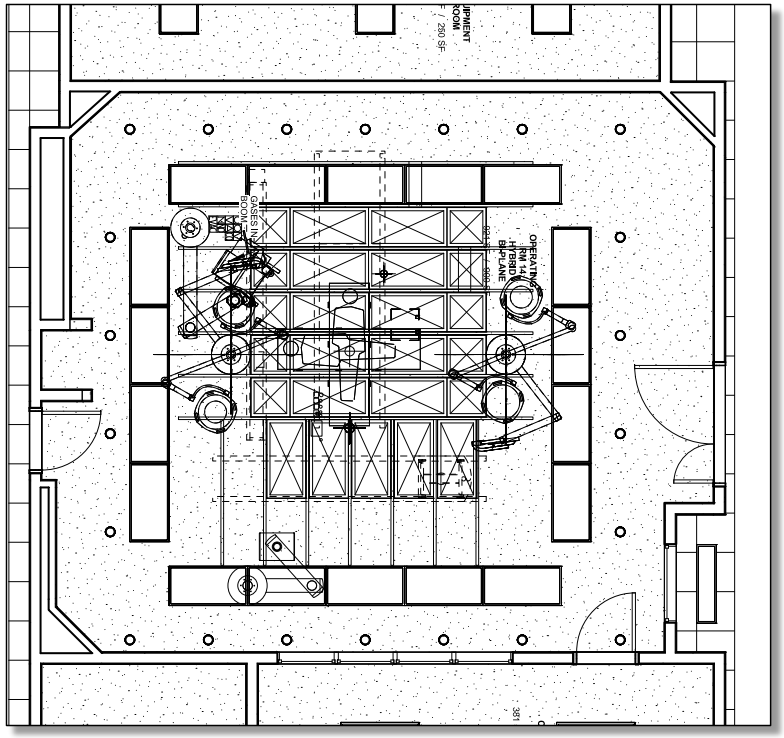
Even the best designs can lack end-user "Face Validity"

Result? MORE TRAFFIC

1. More Outer Traffic Large Door Use
2. **More "Cross OR" Traffic**

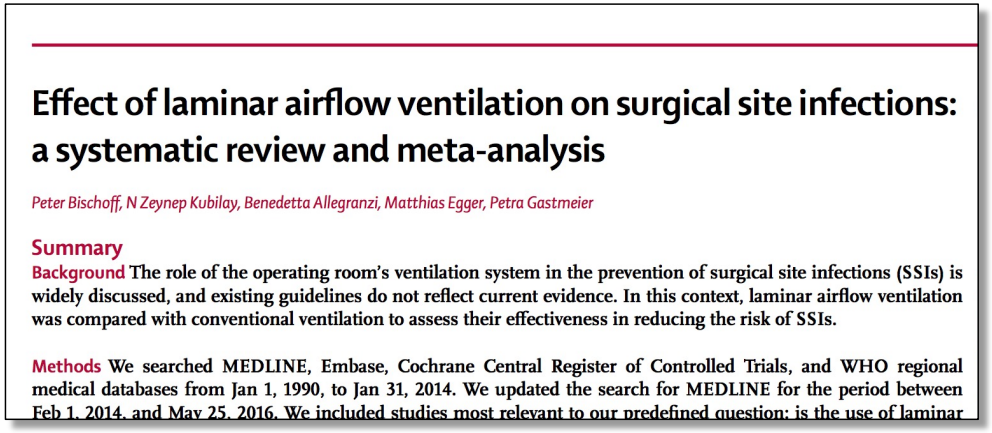
Should We Use Laminar Flow?

Should We Use Laminar Flow?



It’s not easy
(or inexpensive)

Should We Use Laminar Flow?



Effect of laminar airflow ventilation on surgical site infections: a systematic review and meta-analysis

Peter Bischoff, N Zeynep Kubilay, Benedetta Allegranzi, Matthias Egger, Petra Gastmeier

Summary

Background The role of the operating room's ventilation system in the prevention of surgical site infections (SSIs) is widely discussed, and existing guidelines do not reflect current evidence. In this context, laminar airflow ventilation was compared with conventional ventilation to assess their effectiveness in reducing the risk of SSIs.

Methods We searched MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and WHO regional medical databases from Jan 1, 1990, to Jan 31, 2014. We updated the search for MEDLINE for the period between Feb 1, 2014, and May 25, 2016. We included studies most relevant to our predefined question: is the use of laminar

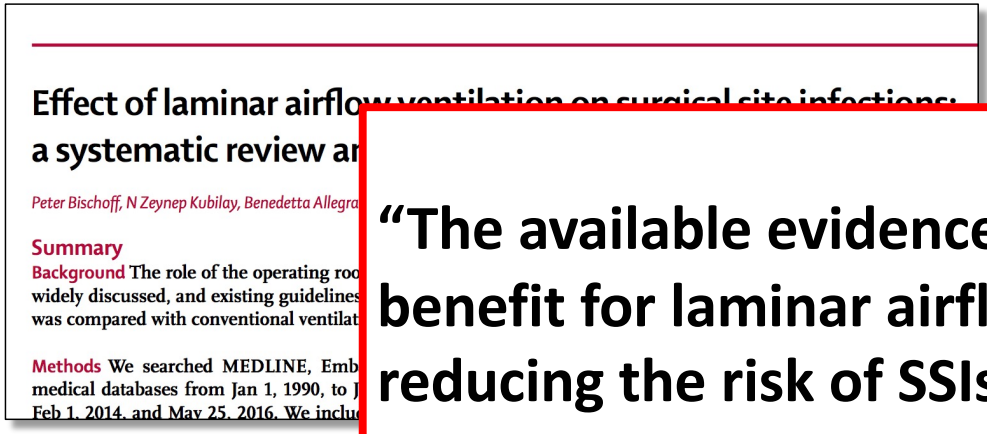
Screened >1900 Studies

12 Highest Quality Trials

>500,000 Procedures

Bischoff et all. *Lancet Infec Dis* 2017

Should We Use Laminar Flow?



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"The available evidence shows no benefit for laminar airflow …in reducing the risk of SSIs"

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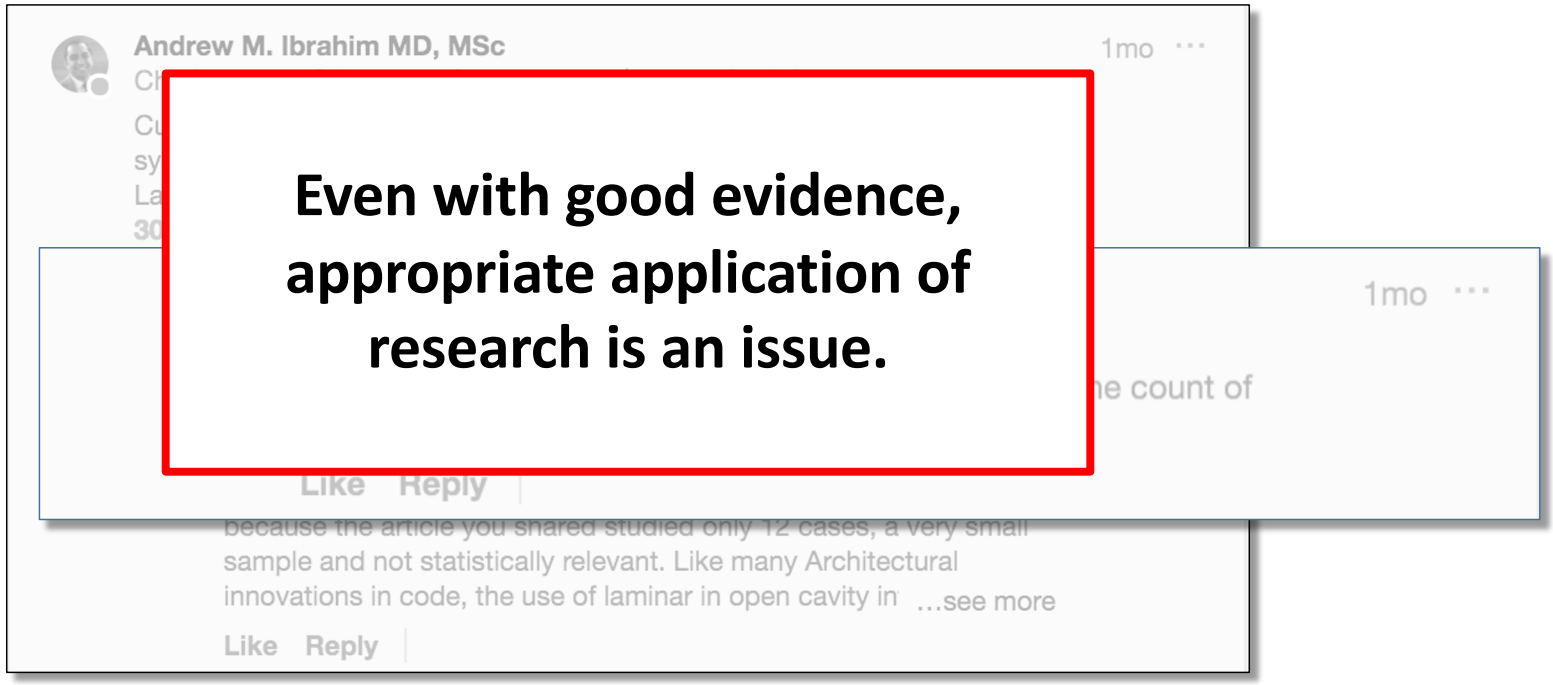
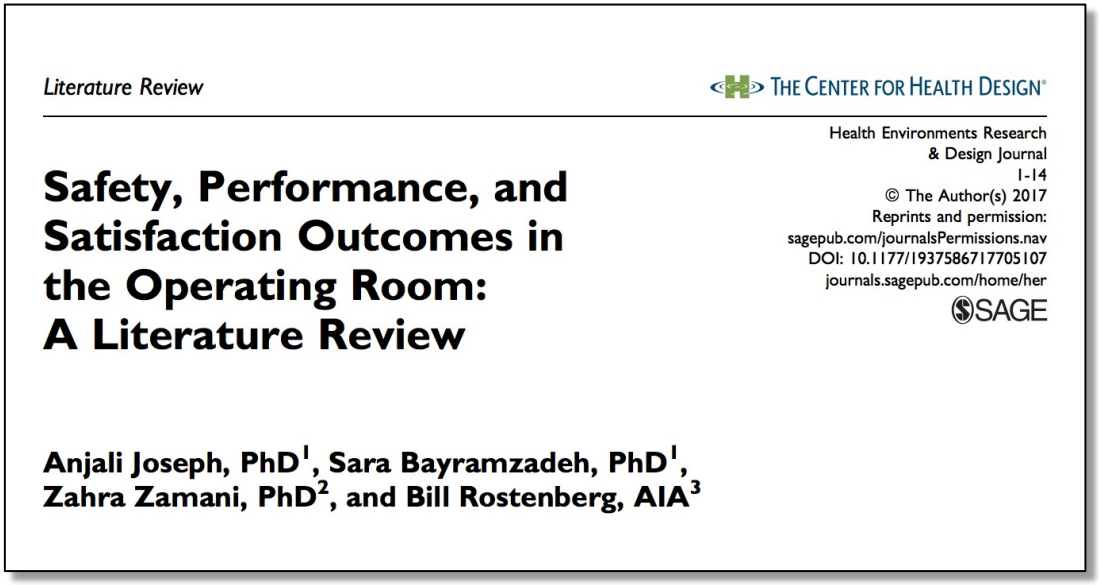
Procedures

Bischoff et all. *Lancet Infec Dis* 2017

Should We Use Laminar Flow?



What IS there Evidence For?



Literature Review

THE CENTER FOR HEALTH DESIGN®

Health Environments Research & Design Journal
1-14
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DOI: 10.1177/1937586717705107
journals.sagepub.com/home/her
SAGE

Safety, Performance, and Satisfaction Outcomes in the Operating Room: A Literature Review

Anjali Joseph, PhD[1], Sara Bayramzadeh, PhD[1], Zahra Zamani, PhD[2], and Bill Rostenberg, AIA[3]

211 Articles

<u>Domains:</u>

- Ventilation
- Temperature
- Acoustics
- Lightings
- Materials

What IS there Evidence For?

"…this review highlighted the paucity of research in areas that are of critical importance from a design and planning perspective [of ORs]…"

rticles

ins:
ntilation
mperature
oustics
htings
aterials

HSR and the OR Design Quality

Measuring and Improving the Design Quality of Operating Rooms

Sarah A. Brownlee,[1] Paul J. Whitson,[2] and Andrew M. Ibrahim[2,3]

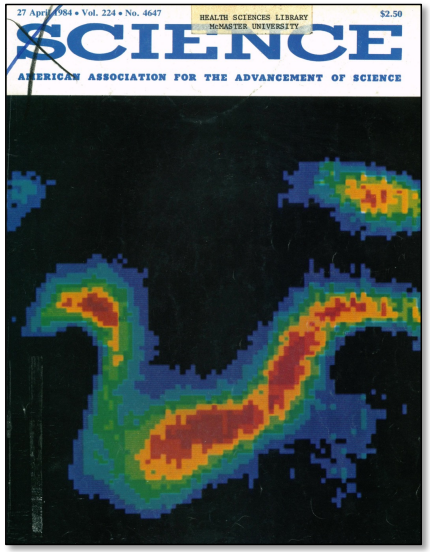
TABLE 1. STRUCTURE, PROCESS, OUTCOMES FRAMEWORK TO EVALUATE OPERATING ROOM DESIGN QUALITY

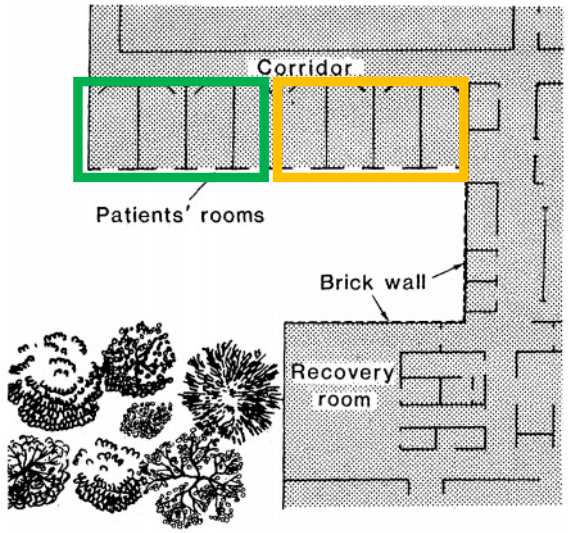
What is it?	*Example measures*	*Benefits and drawbacks*
Structure		
The actual built space	OR square footage	Easy to measure
	Use of laminar flow ventilation	May not necessarily reflect better quality
Process		
Steps involved in care	HVAC system functioning	Highly actionable when deficient
	Adequate lighting in working order	Few process measures correlate to better care
Outcomes		
The end result of care	Surgical site infection rates	Face validity as the bottom line
	Room turnover time	Need risk-adjustment to make comparisons fair

OR = operating room; HVAC = heating, ventilation, air conditioning.

Brownlee et al. SIS, 2019.

Hospital Room Design…





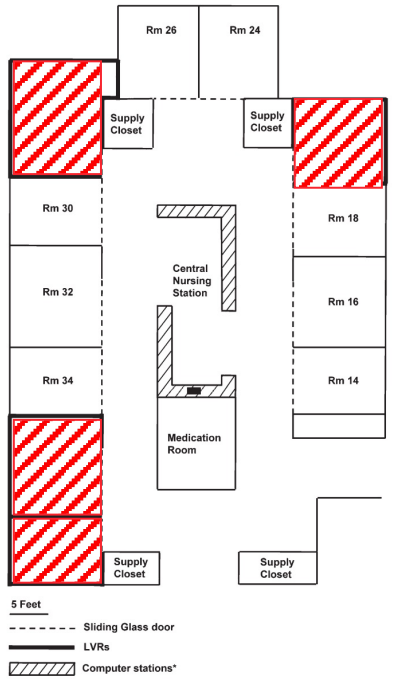
View Through a Window May Influence Recovery from Surgery

24 January 1983; accepted 1 November 1983

- 23 patients undergoing open cholecystectomy
- Half had a view, half didn't…
- *View of Nature:*
  - *less pain medication*
  - *complained less*
  - *went home earlier*

CITED >5,300 TIMES!

ICU Room Design



CHEST Original Research
CRITICAL CARE MEDICINE

Relationship Between ICU Design and Mortality

David E. Leaf, MD; Peter Homel, PhD; and Phillip H. Factor, DO, FCCP

"Severely ill patients may experience higher mortality rates when assigned to ICU rooms that are poorly visualized by nursing staff and physicians."

(only for most severe patients)*

Barriers to Better Hospital Design

Inadequate
End-User Input
("Face Validity")

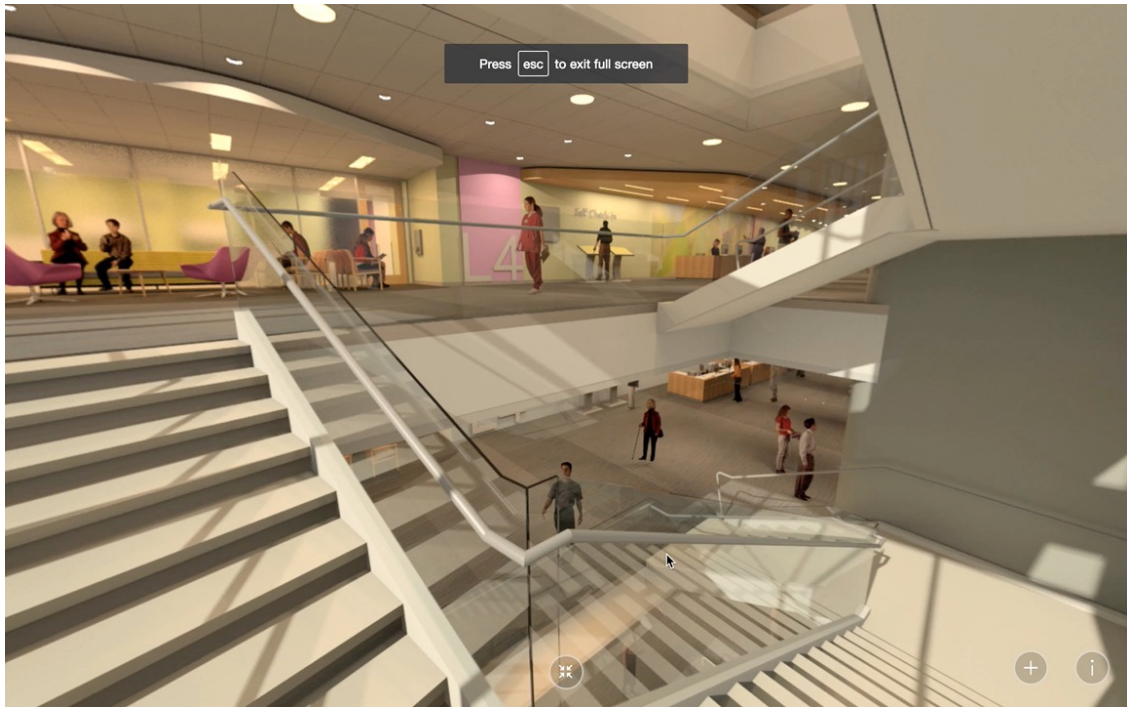
Lacking
Evidence Base
for Design

Way Forward to Better User Input

(reasons to be hopeful)

1. Better User Input (Virtual Reality)

1. Better User Input (Virtual Reality)



2. Improving Shared Research Literacy

Upcoming Modules (2021)

- ❑ Principles of Research and Public Health
- ❑ Evaluation Quality of Research

3. Anticipating Design Before it's Built

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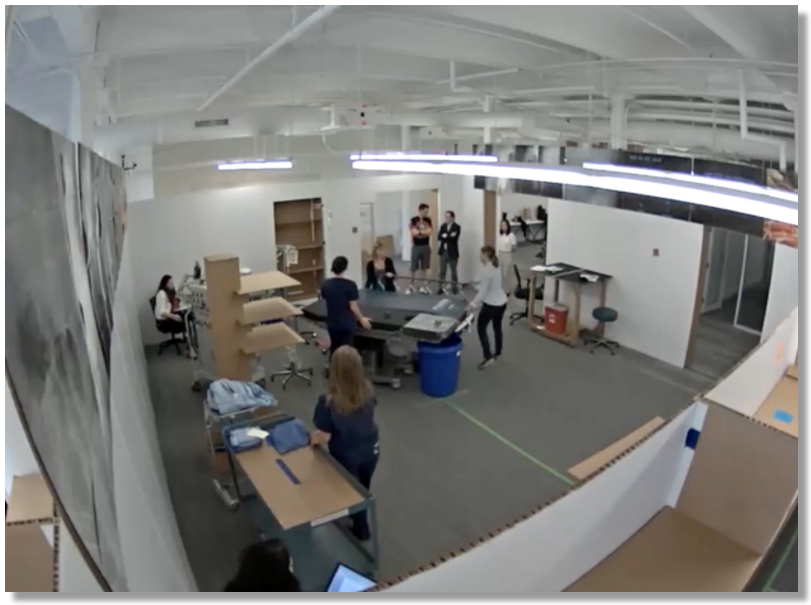
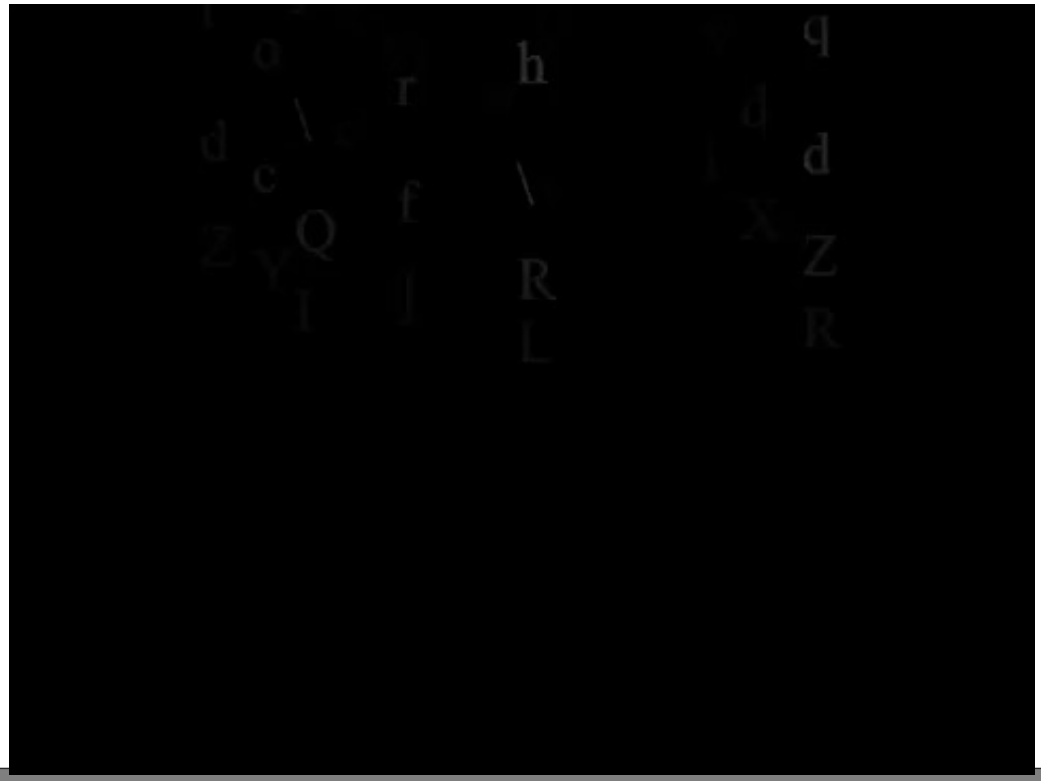
Clemson School of Architecture

3. Anticipating Design Before it's Built



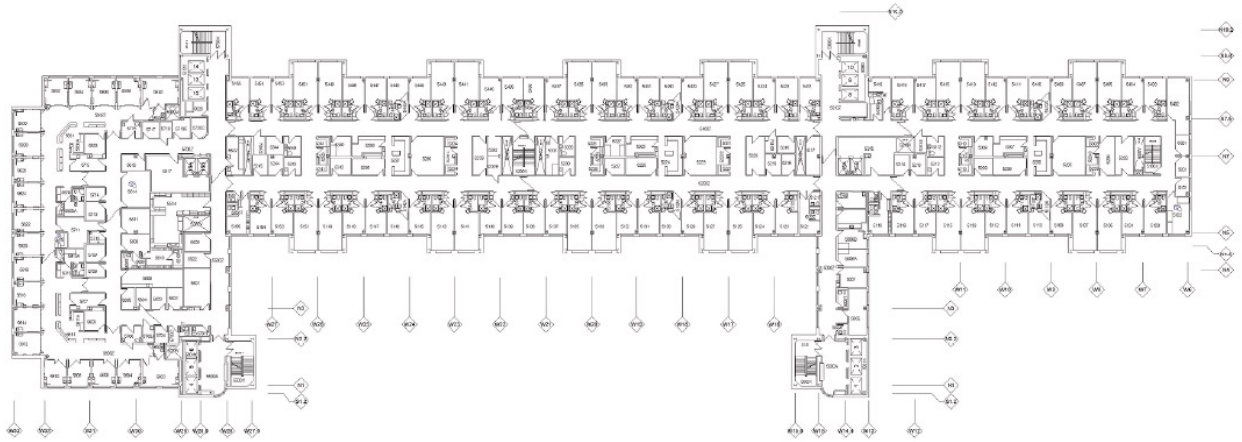
Clemson School of Architecture

3. Anticipating Design Before it's Built



Applying Our Q.I. Toolkit to Hospital Design…

Measuring Our Own Design…



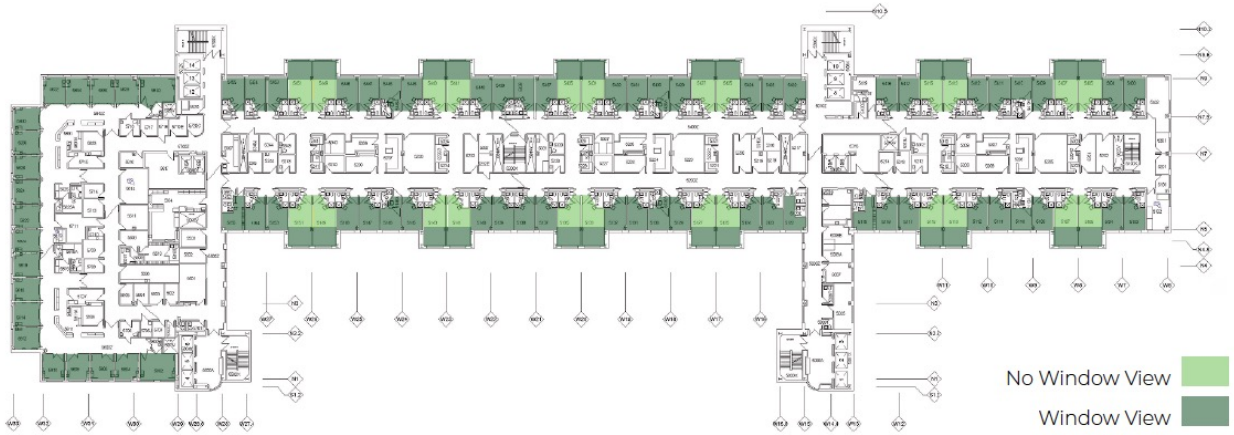
HOSPITAL FLOOR PLAN

The “Race Track”

Measuring Our Own Design…

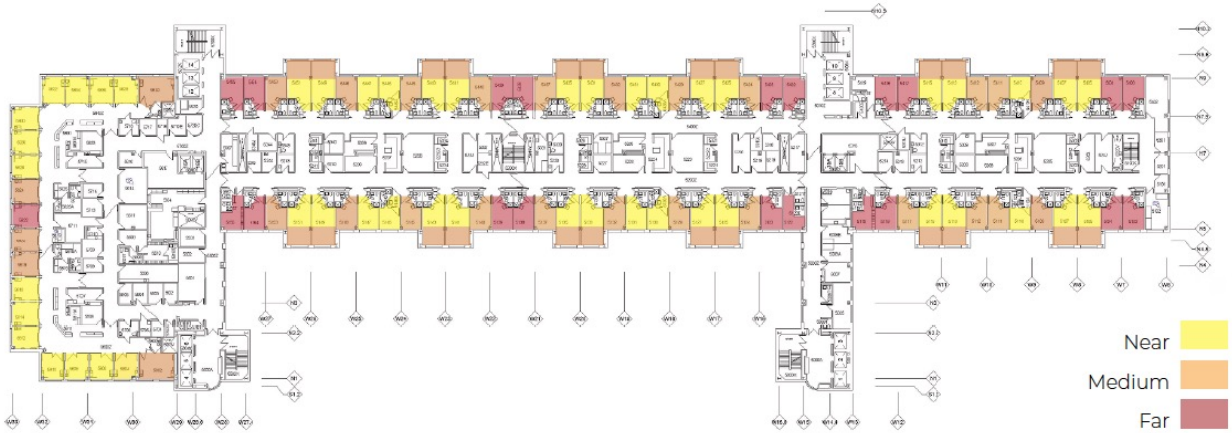
ROOM TYPE

Measuring Our Own Design…



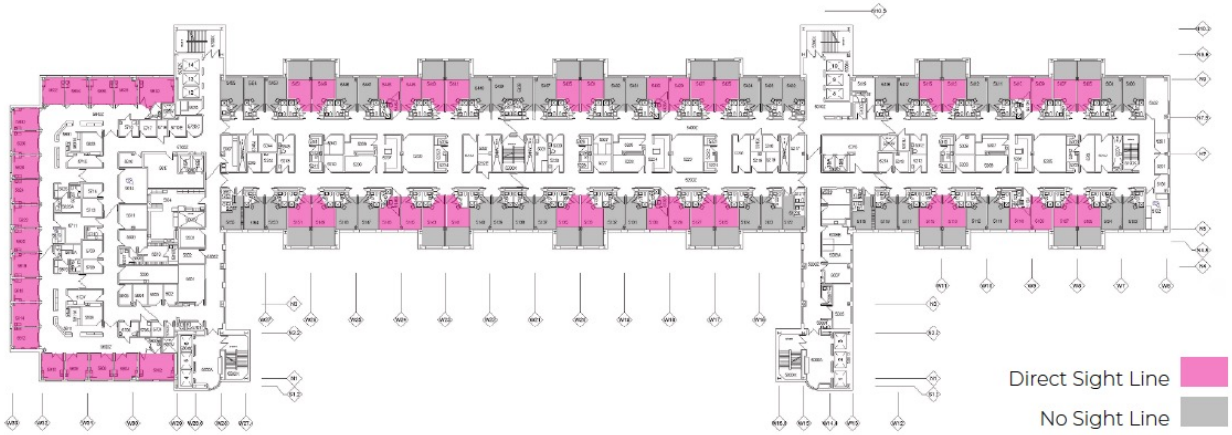
WINDOW VIEW

Measuring Our Own Design…



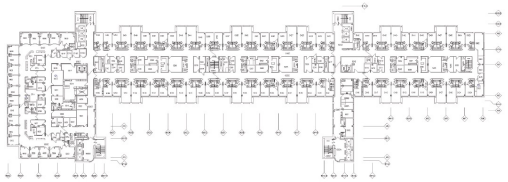
DISTANCE TO MAIN NURSING STATION

Measuring Our Own Design…



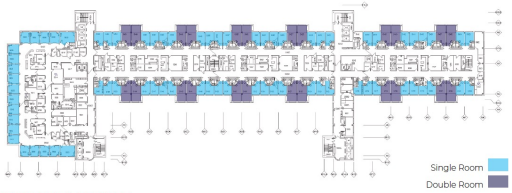
DIRECT SIGHT LINE

Measuring Our Own Design…

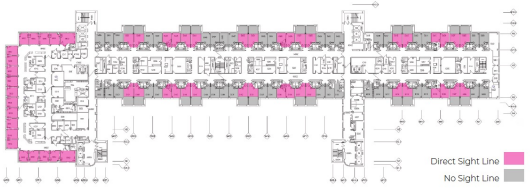


HOSPITAL FLOOR PLAN

DISTANCE TO MAIN NURSING STATION

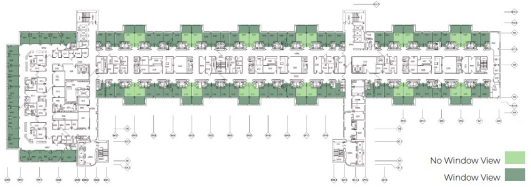


ROOM TYPE



DIRECT SIGHT LINE

DISTANCE TO ANY NURSING STATION



WINDOW VIEW

Measuring Our Own Design…

	Single Room	Window View	Direct line of Site	Near Main Nursing Station
Room A	●	●	●	●
Room B	●	●		●
Room C	●	●		
Room D			●	●
Room E		●		

Nursing Knows Design Matters…

	Single Room	Window View	Direct line of Site	Near Main Nursing Station
Room A	●	●	●	●
Room B	●	●		●
Room C	●	●		
Room D			●	●
Room E		●		

Sickest Patients

Design Matters for Experience…

	Single Room	Window View	Direct line of Site	Near Main Nursing Station
Room A	●	●	●	●
Room B	●	●		●
Room C	●	●		
Room D			●	●
Room E		●		

Patient Satisfaction?
Patient Falls?
ICU Transfers
Failure to Rescue

The Team, The Team, The Team…

Project Manger

Ester Oh, MPP

Research Assistant

Mitch Mead, BA

Analyst

Nick Kunnath, MS

Health & Design Fellow

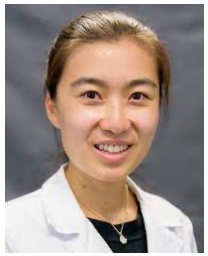
Kimberly Rollings, PhD

Masters Fellows

Adrian Diaz, MD, MPH

Valeria Valbeauna MD, MSc

Alisha Lussiez MD, MSc



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16

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