Hospitals for the Next Gen

Relevance of Evidence Based Design

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HOSPITAL PLANNING

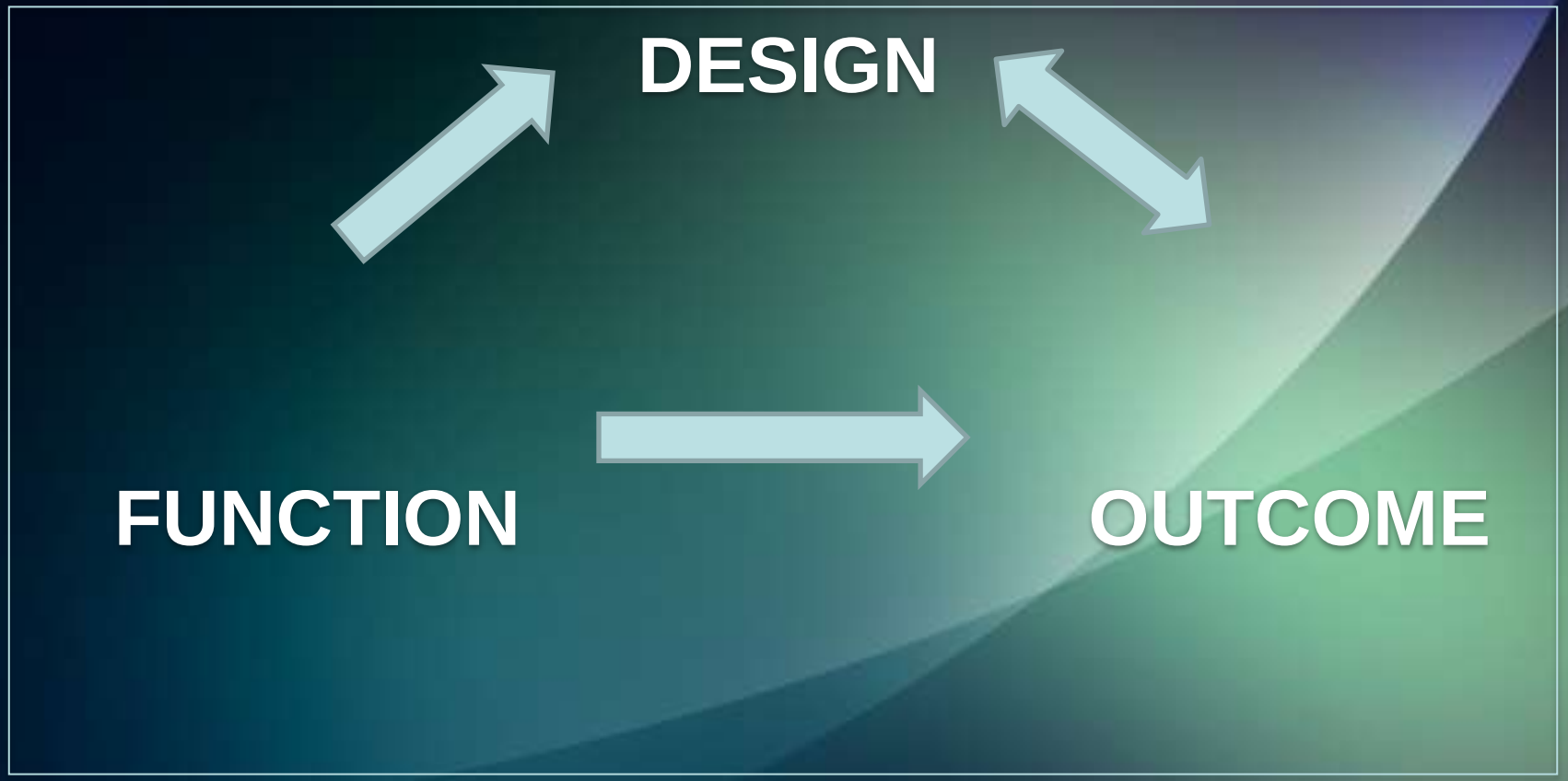
Points to Ponder

- ***Are we making Hospitals or Monuments?***
- ***Are we making good hospitals or beautiful hospitals?***
- ***Hospital for architect's delight or for patient's delight?***
- ***Technology as a DRIVER – what is the optimal level***

Design follows function

but

Outcome follows design



Evidence Based Design

----------A Road Map

What is Evidence-Based Design (EBD)?

Center for Health Design (CHD) defines EBD as:

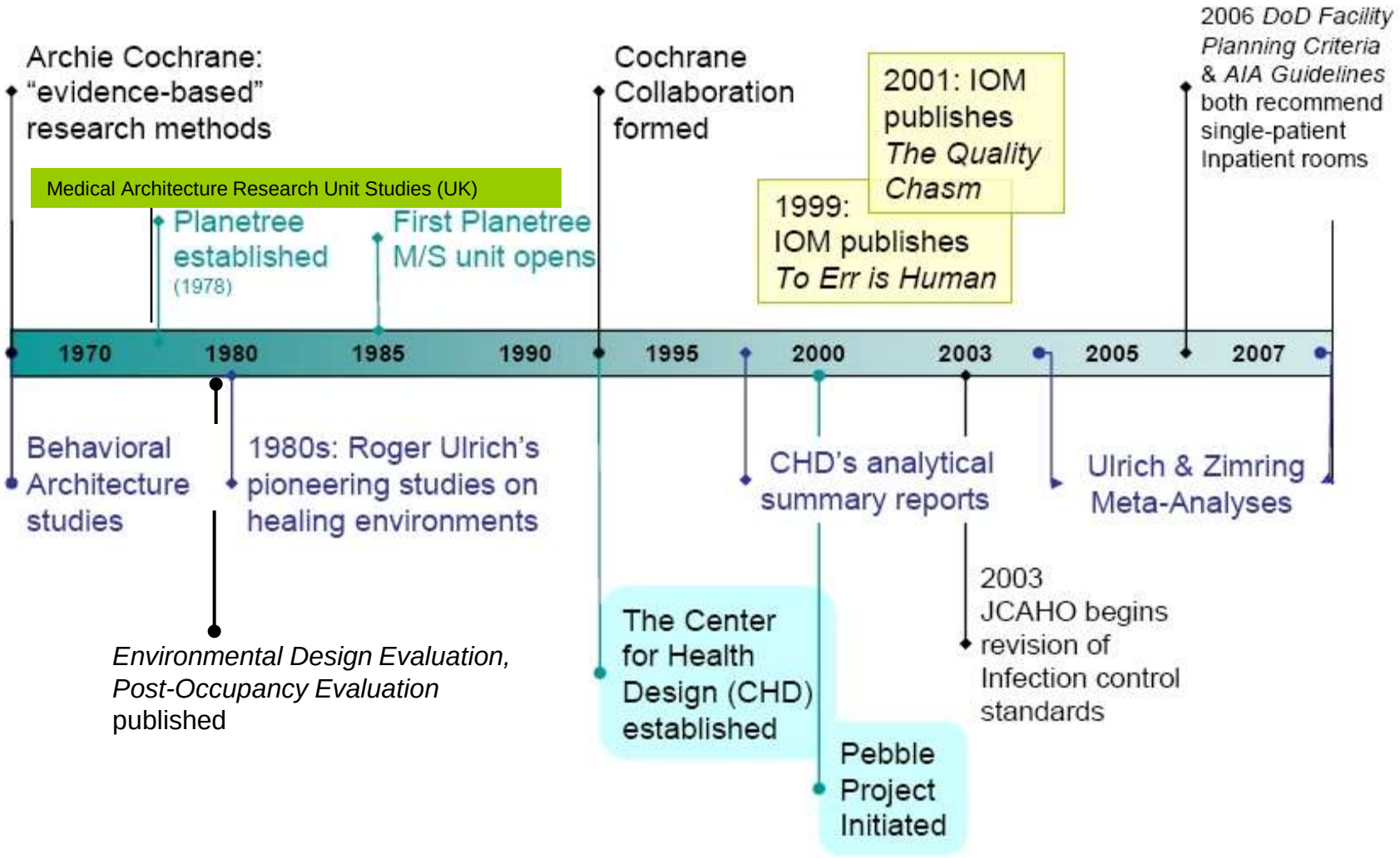
"The deliberate attempt to base building decisions on the best available research evidence with the goal of improving outcomes and of continuing to monitor the success or failure for subsequent decision-making."

(Ulrich et. al. 2004)

What is EBD ???

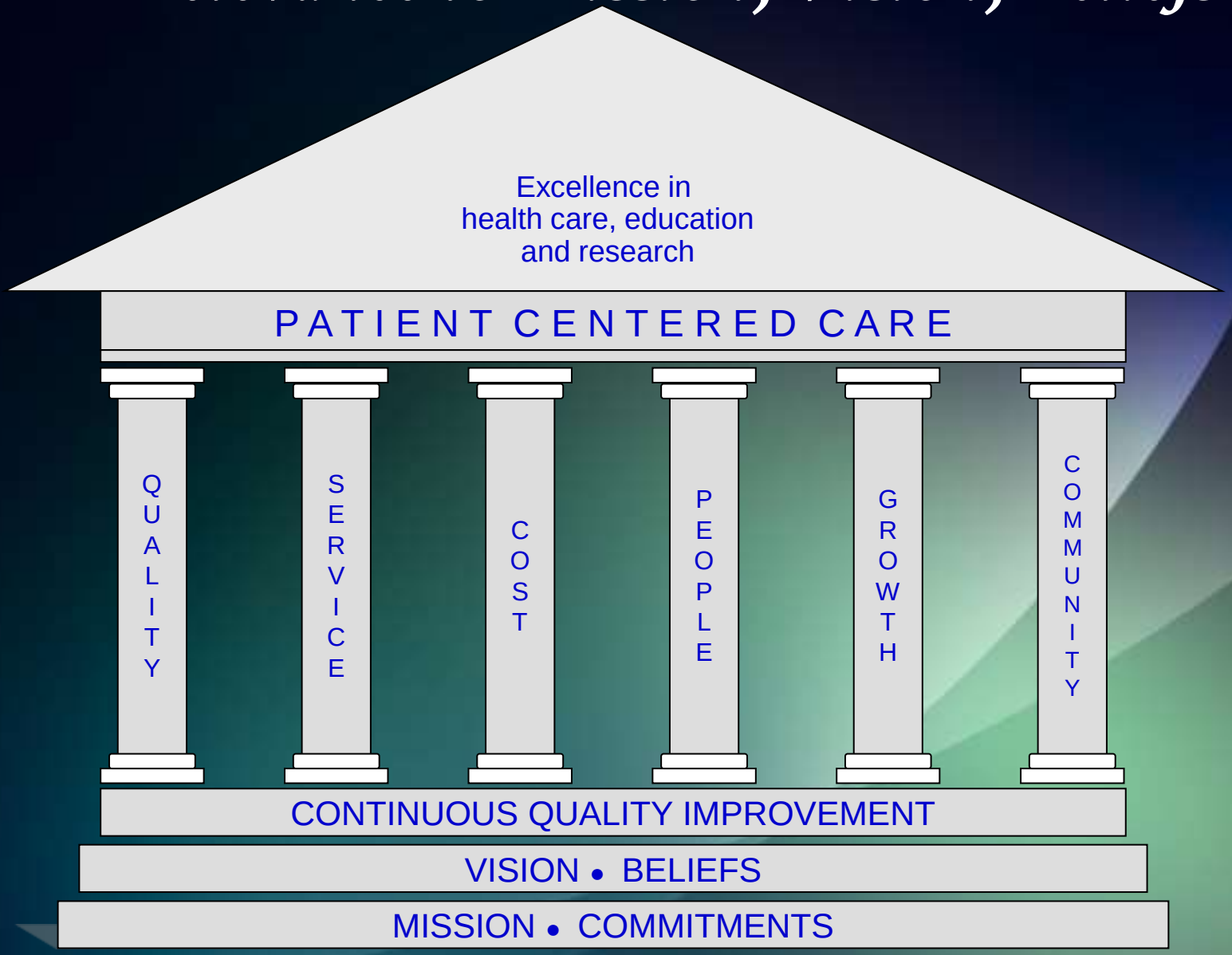
- It is not prescriptive & does not provide a standard design solution to fit all situations.
- It is not static but ever evolving as the body of research grows

EBD Timeline



Adapted from Malone, Mann-Dooks & Strauss, 2007

EBD Relevance to Mission, Vision, Beliefs



Evidence-Based Design Elements:

Linkage to Pillars

Number	Design Element	Description	Q	S	C	P	G	COM
1	Adjacencies	Use adjacencies to improve patient flow and minimize patient/material transport		X	X			
2	Centralized v. Decentralized	Balance the needs of efficiency for the campus and the needs for each floor/hospital		X	X			
3	Design for Safety	Use of Evidence-Based design to incorporate safety in every aspect of the facility design	X	X	X	X		X
4	Eco-Friendly	Use of LEED principles to create a sustainable environment and to be good stewards to the environment			X			X
5	Efficiency	Maximize efficiency throughout the hospital and within each operating unit	X	X	X	X	X	
6	Family Engagement	Families should feel welcomed and have the ability to have as much or as little engagement in the care process as they want		X				X
7	Flexibility	Facility design will allow for adaptability to changes in patient populations and technology and allow for future growth on the campus			X		X	X
8	Infection Control	Design to minimize the opportunity of spreading infectious diseases		X	X	X		X
9	Lean	Use of lean principles to continue to reduce non-value added tasks (muda)	X		X	X		X
10	Patient Centeredness	Care and processes will be designed around the patients interests and needs		X				X
11	Patient Engagement	Patients should be informed and engaged in their care processes throughout their hospital visit		X				X
12	PlaneTree	Planetree principles will be integrated into design which have been found to improve patient outcomes and patient/staff satisfaction	X	X		X		X
13	Pre-Testing Design Tactics	Equipment, new technology, and flows will be tested prior to occupying the new building or piloted prior to implementation	X			X		
14	Seamless Integration	technology will be integrated into practice to reduce errors, improve efficiency, and improve patient/staff satisfaction from pre-care to post-care	X	X	X	X		
15	Staff Engagement	Staff will have input into the design of the new facility				X		
16	Standardization	Areas will be standardized as much as possible to improve efficiency and quality of care	X	X	X	X		
17	Technology	Ensure that we are using technology to improve efficiency and add value to the processes	X		X			
18	Way-finding	way-finding system will make access to services visible, easy to recognize, readily accessible, and welcoming		X		X		X

Principals- Impacts- Patient & Staff Safety

Adjacencies/ Departments

Adjacency to ED/ diagnostics services

Medication Distribution System

Unit Configuration & Layout

Dedicated Medication Safety Zone

Decentralized Nurse work Stations

Room Configuration & Layout

Single rooms, Patient Rooms/ Bathroom Layout, Family Zone

Ventilation & Air Conditioning

HEPA Filtration and Ventilation System

Acoustic Environment

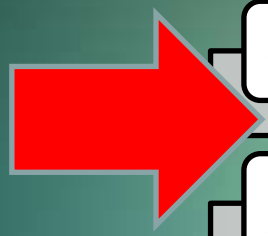
Sound absorbing ceiling tiles

FF & E

Sinks, Gel Dispensers, Hand washing, water disinfection, ceiling lifts

Interior Material

Easy to clean surface materials



- Healthcare Associated Infections
- Medical Errors
- Patient Falls
- Staff Back Injuries
- Increase Social Support
- Noise stress
- improve speech intelligibility

Principals-Impacts- Quality of Care and Work Efficiency

Building location/site optimization

Gardens, Building location, Parking, Provide Light, Improved way Finding

Unit Configuration & Layout

Decentralized Nurse work Stations

Supplies located close to patient rooms

FF&E

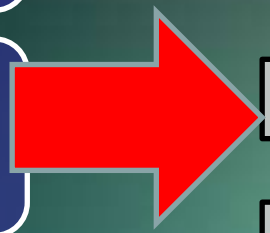
Artworks, Music, Amenities, Wireless technology

Building envelope

Window view, insulation

Interior Material

Homelike materials



- Patient Stress
- Patient Satisfaction
- Patient Comfort
- Patient Waiting
- Patient Sleep Quality
- Staff Travel Distance
- Flow Time Throughput
- Job Satisfaction

1. More evidence than expected: 1000+ rigorous studies
2. Many designs make hospitals more stressful & riskier for patients, families & staff.
3. A LOT of good evidence is available

Source: Ulrich, R. S., Zimring, C. M., Zhu, X., DuBose, J., Seo, H., Choi, Y., et al. (2008). A review of the research literature on evidence-based healthcare design. Health Environments Research & Design, 1(3), 61-125.

Bed Configuration

Single v/s Multiple

Single vs. Double Rooms: Safety

- Single rooms have lower infection rates than semi-private rooms or open bays (Van Enk and Nyirenda)
- Fall rate decreases in single rooms (Brandis)
  - Falls reduced 75% at Clarion Methodist Hospital by changing double rooms to single rooms
  - Wide bathroom doors prevent falls
- Room transfers are associated with increased medical errors
  - Due to communication discontinuities between staff

Single vs. Double Rooms:
Nurses Prefer Single Occupancy Rooms

- Nurses favor single-occupancy rooms (Chaudhury, Mahmood, Valente, 2006)
  - Flexible family accommodation
  - Suitable for patient exams
  - Higher patient comfort level
  - Improved patient recovery rate
  - Lower rates of medication errors
  - Less probable diet mix-ups

Single vs. Double Rooms:
Patient Satisfaction / Costs

- Roommate can be source of stress (Ulrich, 2004)
- Higher patient satisfaction (Press Ganey)
- Confidentiality / Privacy (Pease and Finlay, 2002)
  - Reduced embarrassment
  - Opportunity for family members to participate in care
  - Avoidance of upsetting other patients
- Incompatibility among roommates leads to costly room transfers (Pebble Project-Bronson Methodist)

Single vs. Double Rooms: Noise

- **Noise negatively impacts outcomes**
  - Widespread annoyance among patients and perceived stress in staff (Hilton, Bayo, Garcia and Garcia)
  - Sleep loss / sleep fragmentation (Yinnon, Hilton, Berg)
  - Increased blood pressure (Yinnon, Hilton)

- **Noise level is a greater problem in double rooms**
  - More frequent at higher levels
  - Noise results from roommate, family of roommate, staff attending roommate
  - Stressful for patients and caregivers

- Studies on adult patients show that 85%-90% of the time roommates are source of **stress** not positive social support

Effective Design Measures for Creating Quiet Healthcare Buildings

- Single-bed patient rooms
- Install high-performance sound-absorbing ceilings
- Reduce noise sources (provide noiseless messaging systems, etc.)

For 100% single patient rooms

- Healthcare Associated Infection
- Slips, trips and falls
- Staff to patient communication
- Patient confidentiality and privacy
- Family support
- Patient stress (noise and sleep deprivation)
- Reduction in patient transfers
- Bed availability
- Patient satisfaction

Against 100% single patient rooms

- Increased nursing resource required
- Reduced staff to patient observation
- Reduced social interaction
- Isolation
- Space hungry
- Cost

Design to Reduce Stress

Impact of light

Positive distractions

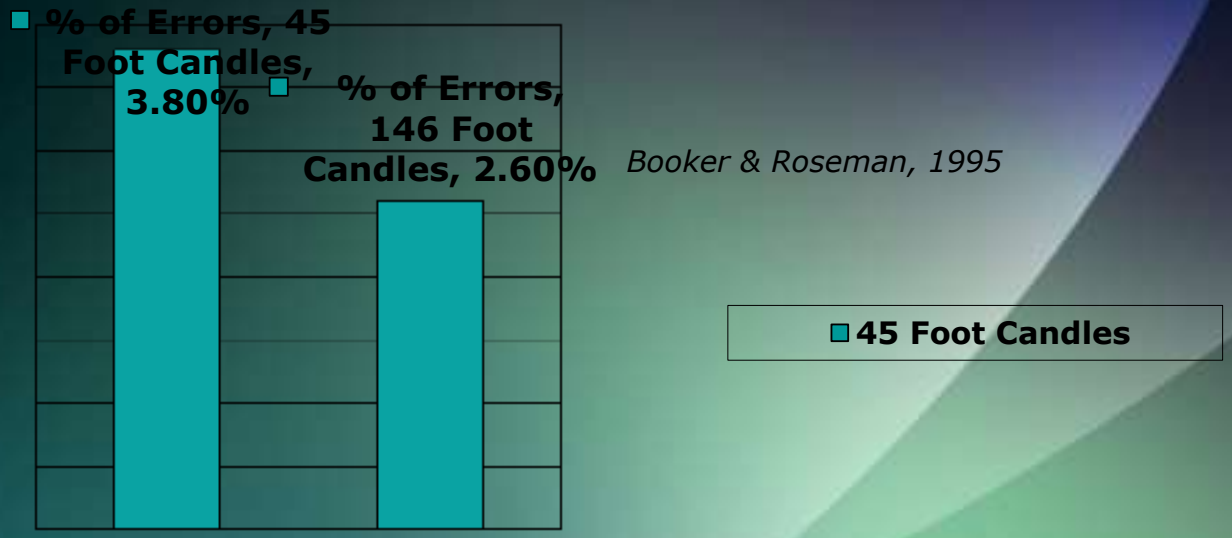
Florence Nightingale on Light, 1860

"Second only to fresh air… I should be inclined to rank light in importance for the sick. Direct sunlight, not only daylight, is necessary for speedy recovery… I mention from experience, as quite perceptible in promoting recovery, the being able to see out of a window, instead of looking against a dead wall…"

» **Notes on Nursing.: What It Is and What It Is Not, 1860.**

Lighting

Improved Lighting Reduced Pharmacy Errors



Booker & Roseman, 1995

Errors Reduced by 30% with lighting increase from 45 to 146 foot-candles

Design to Reduce Stress

Design to ensure exposure to nature, calming gardens, and natural light that reduce stress and help lower pain

Windows Versus No Windows

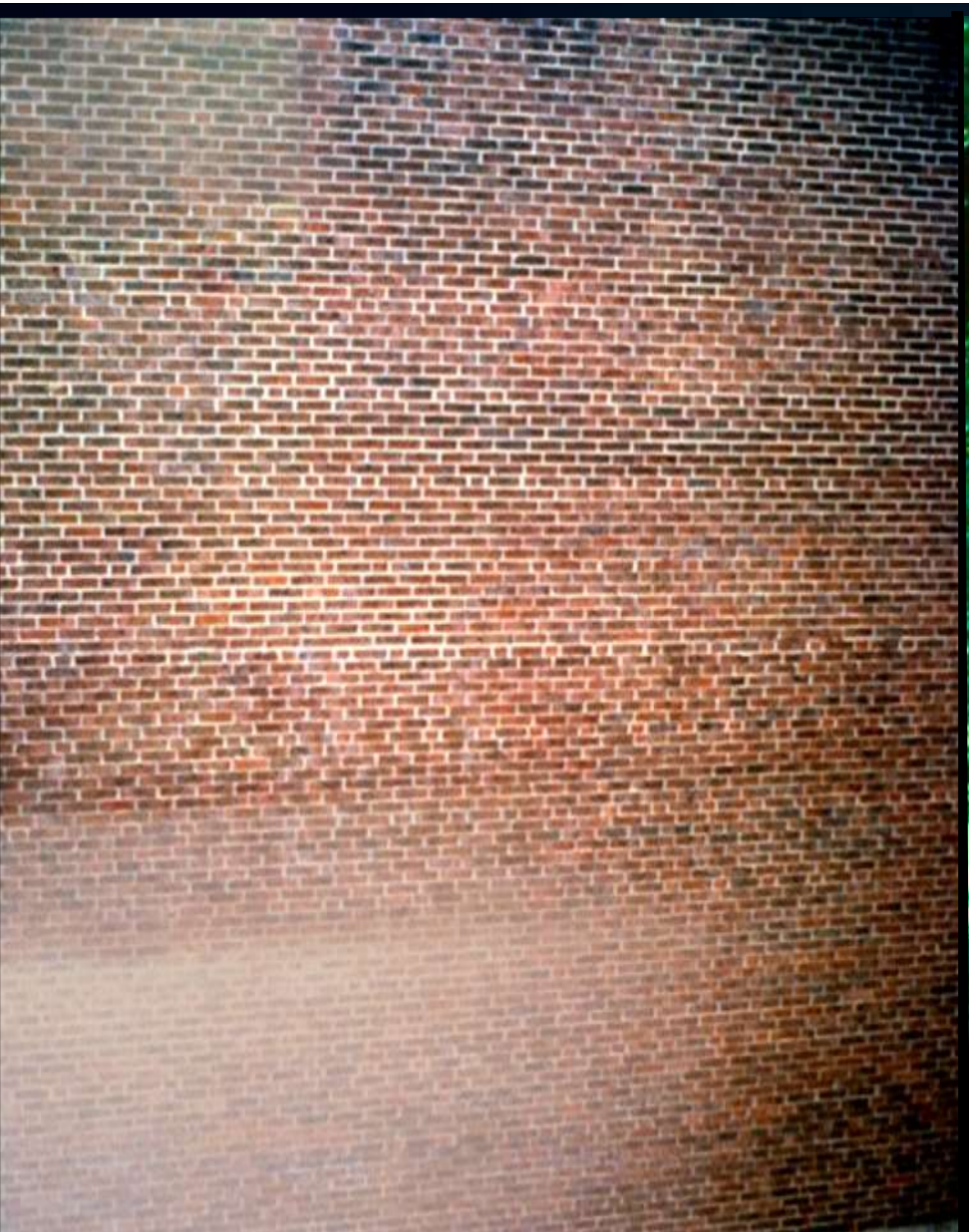
- Absence of windows linked with high anxiety rates and depression (Keep et al., Parker and Hodge)
- Lack of windows may aggravate sensory deprivation (Ulrich)
- Natural light/sunlight has bio-chemical and physiological effects that foster improved outcomes in many types of patients
- Employees with views of nature report: (Leather et al.)
  - Less stress
  - Better health status
  - Higher job satisfaction (less turnover)

Effects of Viewing Nature

- Quickly lowers psychological and physiological stress
- Produces clinically important pain alleviation in adults
- *Other:* reduces aggression, improves satisfaction

Effects of nature window view on recovery from surgery (Ulrich, 1984)

RESEARCH EXAMPLE



- **Shorter stays**
- **Less pain**
- **Fewer minor complications**
- **Better emotional well-being**

Positive Distractions

- Reduce patient stress/anxiety
- Provide a welcoming, homelike environment
- I Reduce pain & pain medication
- Improve patient satisfaction
- Reduce length of stay
- Increase reimbursement

"Distraction Therapy with Nature Sights and Sounds Reduces Pain During Flexible Bronchoscopy" (Diette et al., 2003)

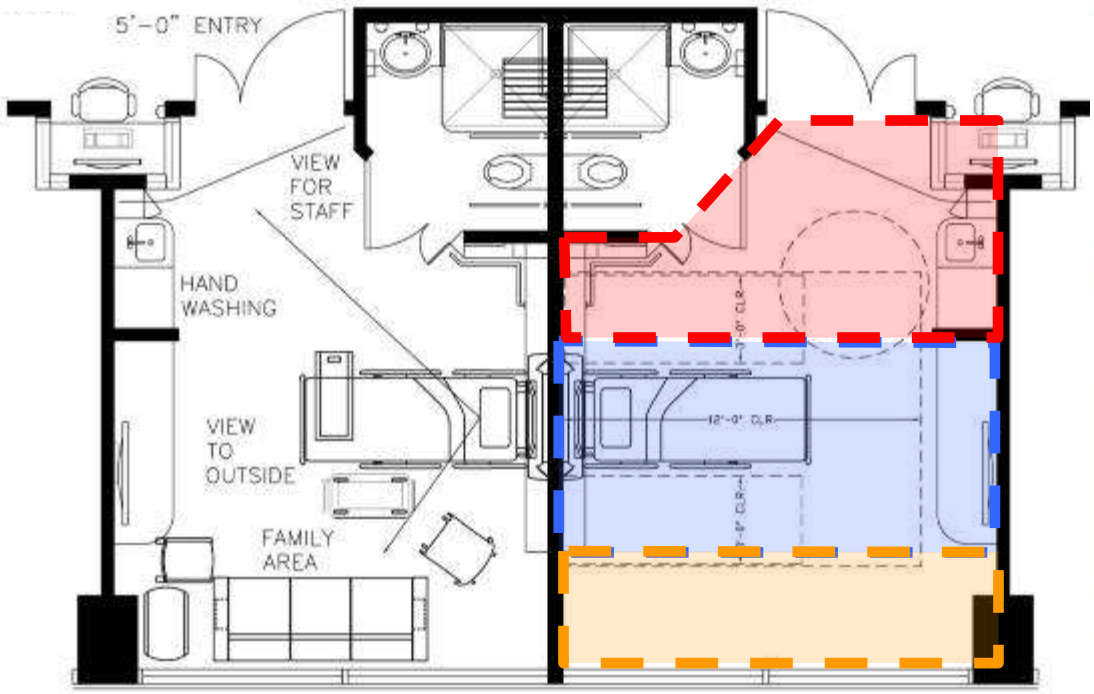
Children's Garden

Legacy Hospital

Portland, Oregon


Children’s Garden
Legacy Health
Portland

Private Medical / Surgical Patient Room



STAFF ZONE

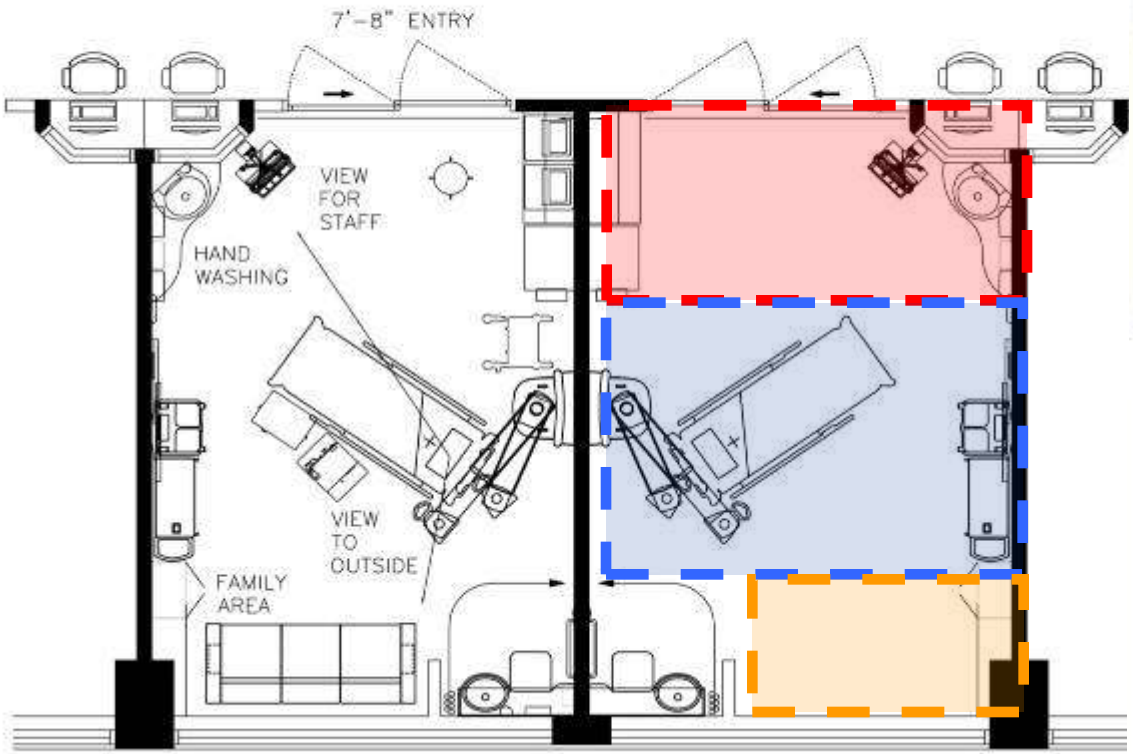
PATIENT ZONE

FAMILY ZONE

The Journey: Beyond the Built Environment

- **Evidence-Based Design: Focus on complexity of work environment, physical space, and technology**
  - How do we enable the provider to spend more time at the bedside?

Critical Care Patient Room



STAFF ZONE

PATIENT ZONE

FAMILY ZONE

Ergonomics

- Develop and implement patient-centered care in healing environments
- Physical environment is vital to the healing process of the patient
- Designing and maintaining an uncluttered environment encourages patient mobility and a sense of ‘safe shelter
- Increase Staff Effectiveness, Reduce Errors, and Increase Staff Satisfaction by Designing Better Workplaces
- Improve Staff Health and Safety through Environmental Measures (e.g. In-door air quality, thermal environment)

Decentralized nurse stations improve observation of patients, outcomes, safety

Acuity-Adaptable, Family Centered CCU

Methodist Hospital, Indianapolis

Design: BSA LifeStructures

Source: Roger Ulrich

"Influences of Noise on Outcomes in Coronary Critical Care"

Blomkvist, Theorell, Ulrich, Erikson, Hagerman and Rasmanis, 2004

Problem: Unwashed Staff Hands

Low hand washing compliance has strong causal link with contact transmission of infection

- Compliance in busy units: **14-28%**
- Education inadequate and transient

Make Hand Washing Unavoidably Available

- Out of sight is out of mind.
- The sink must be immediately visible and easy to access.
- Alcohol gel dispensing devices are important additions, which should be located:
  - At the head of far-side of the patient's bed and foot
  - In the patient's bathroom
  - In the family zone
  - In the staff pod area

What is the current staff hand-washing rate?
What is the Hospital-Acquired Infection rate?

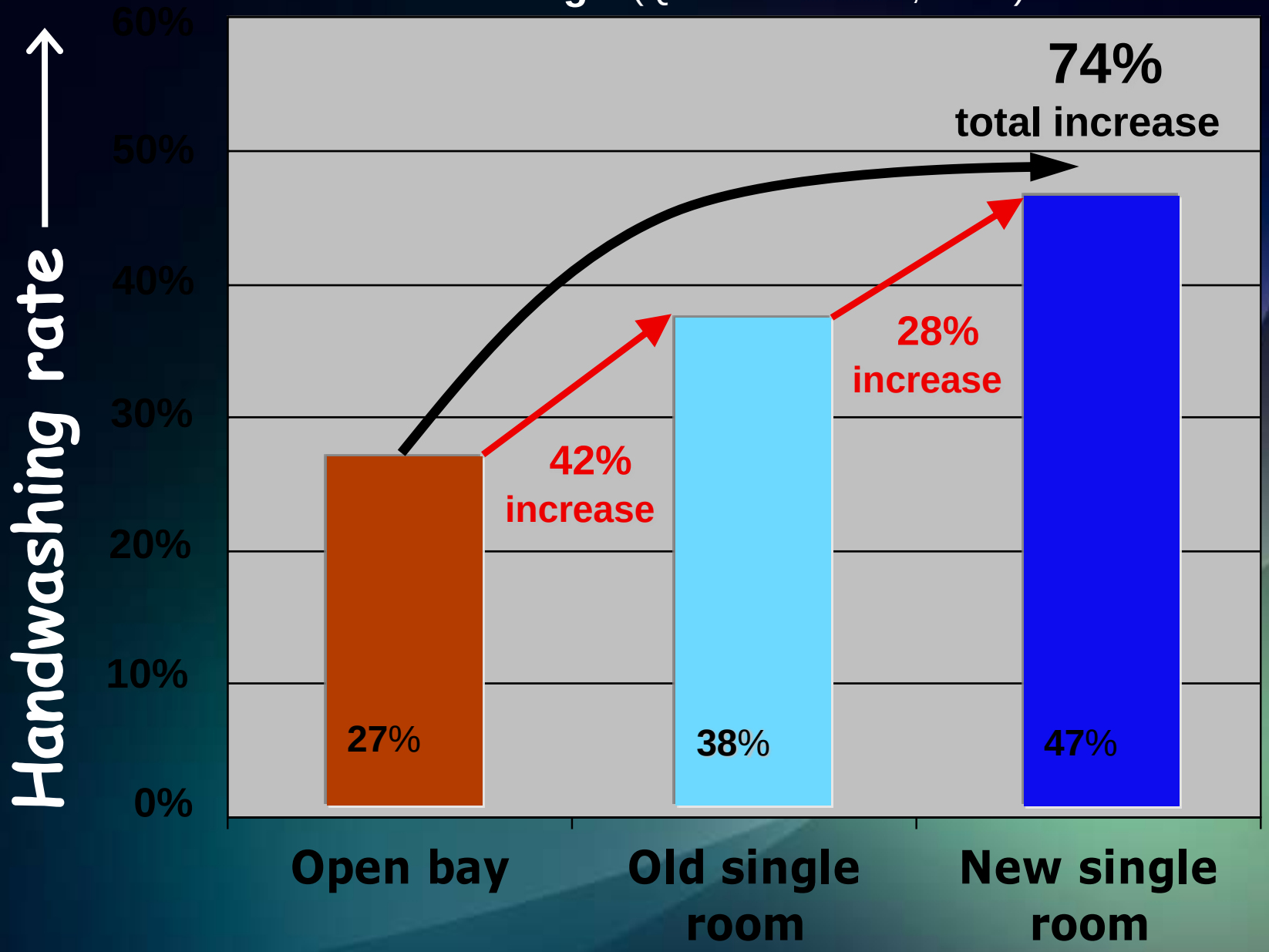
Design to Increase Hand Washing

Conveniently located sink

Sinks and gel dispensers should be close to staff movement paths

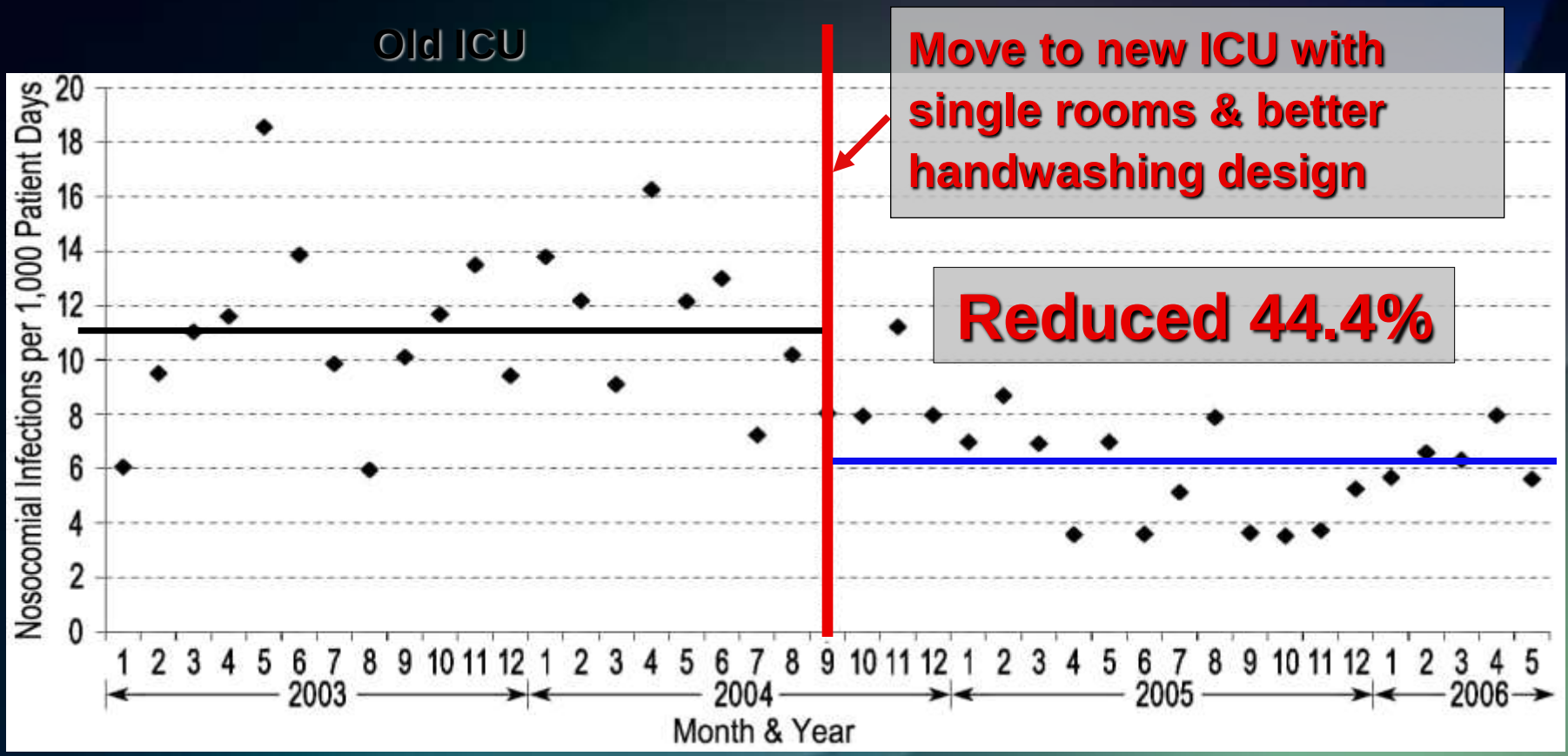
Source: Roger Ulrich

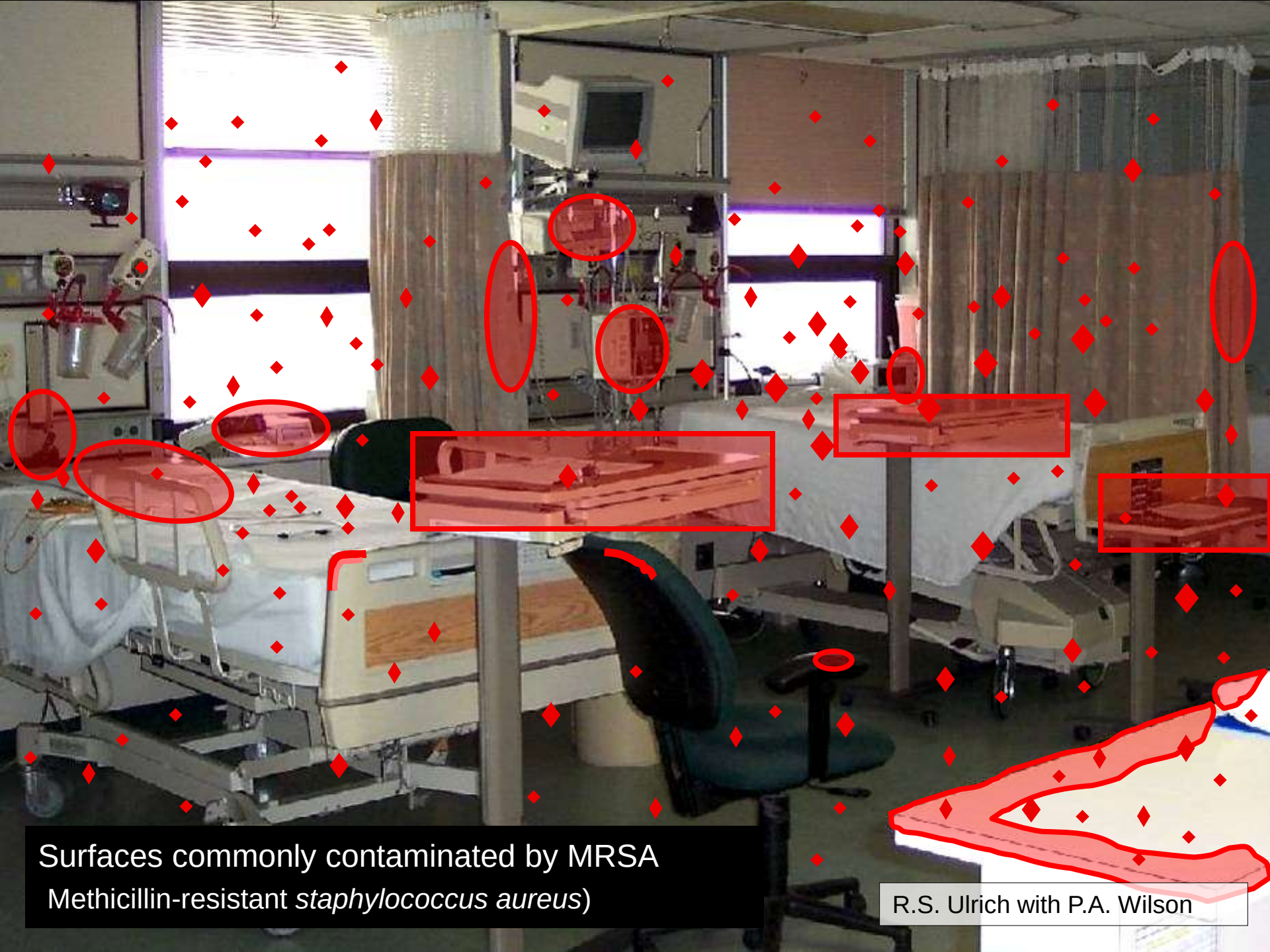
Findings (Quan and Ulrich, 2006)



Infection Rates in Old vs New ICUs

source: Quan and Ulrich, 2006



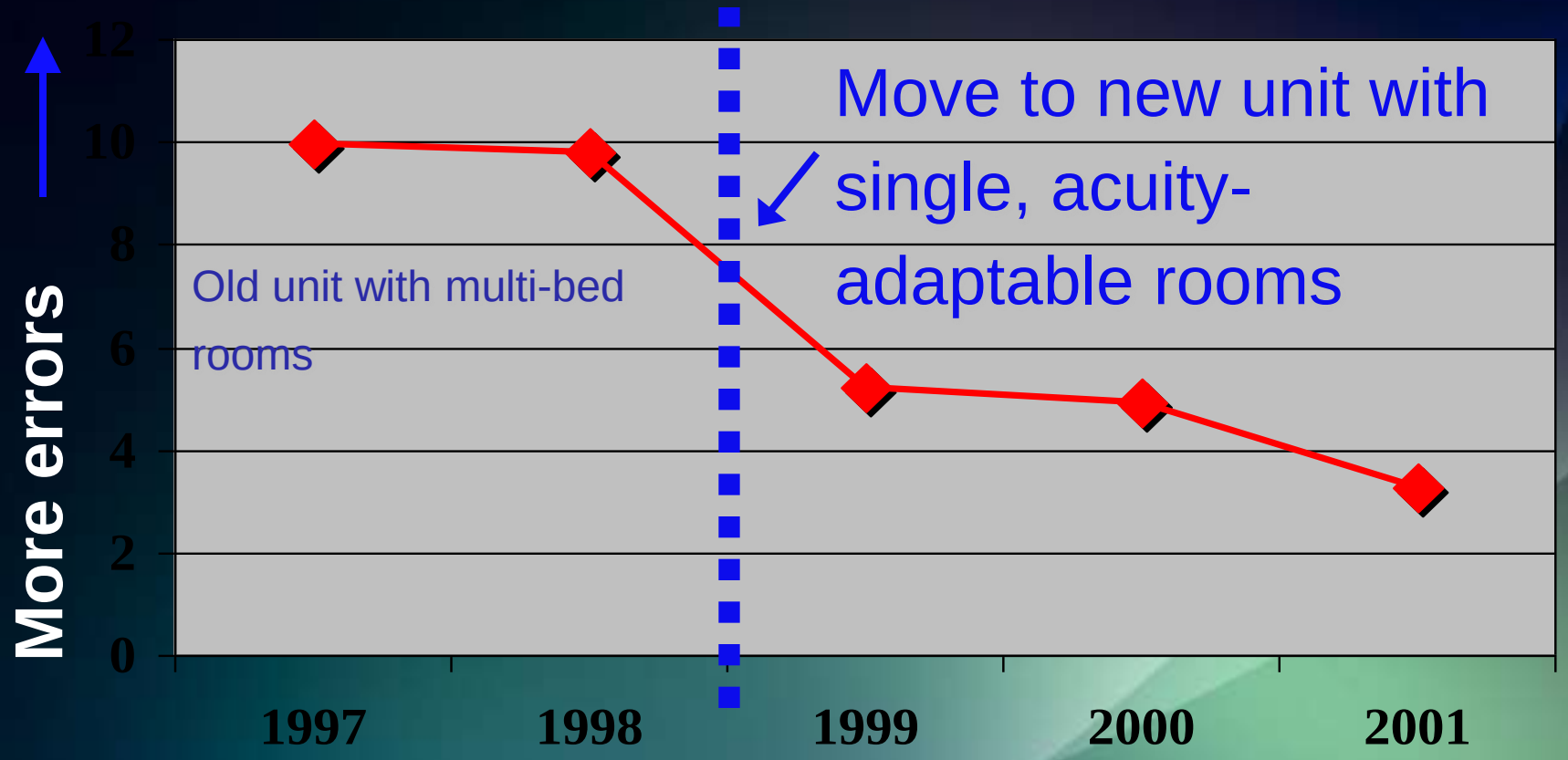

Surfaces commonly contaminated by MRSA
Methicillin-resistant *staphylococcus aureus*)
R.S. Ulrich with P.A. Wilson

Transfers Worsen Patient and Staff Safety

- Increase infections
- Transfers cause sharp peaks in medical errors
- Major cause of staff injuries
- Each transfer requires hours of staff time and paperwork
- Each transfer adds .5 day to LOS

Annual Medication Error Index

(errors/patient days) coronary critical care

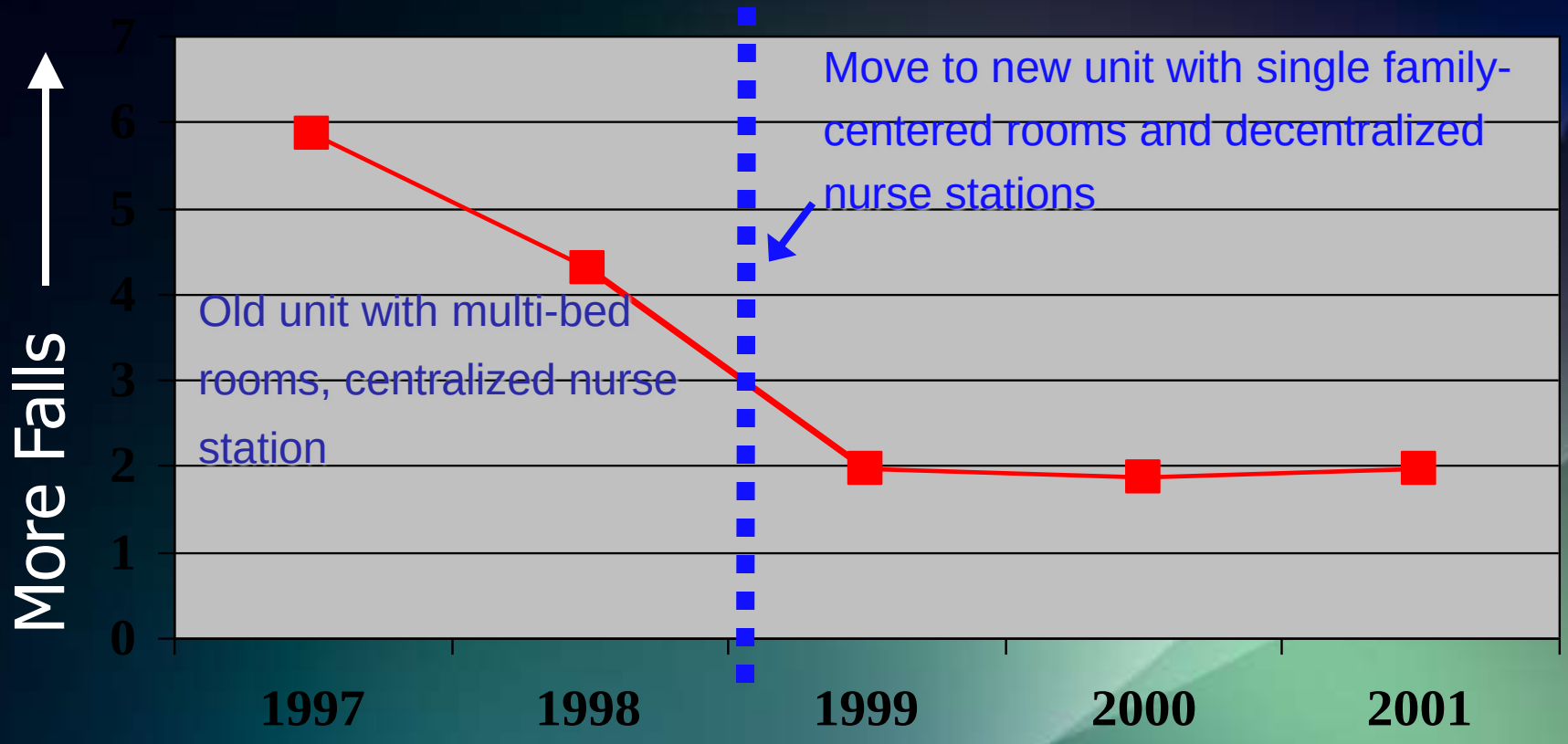


Source: A. Hendrich (2004). In *Keeping Patients Safe: Transforming the Work Environment of Nurses. Quality Chasm Series,* Institute of Medicine

Problem: Falls

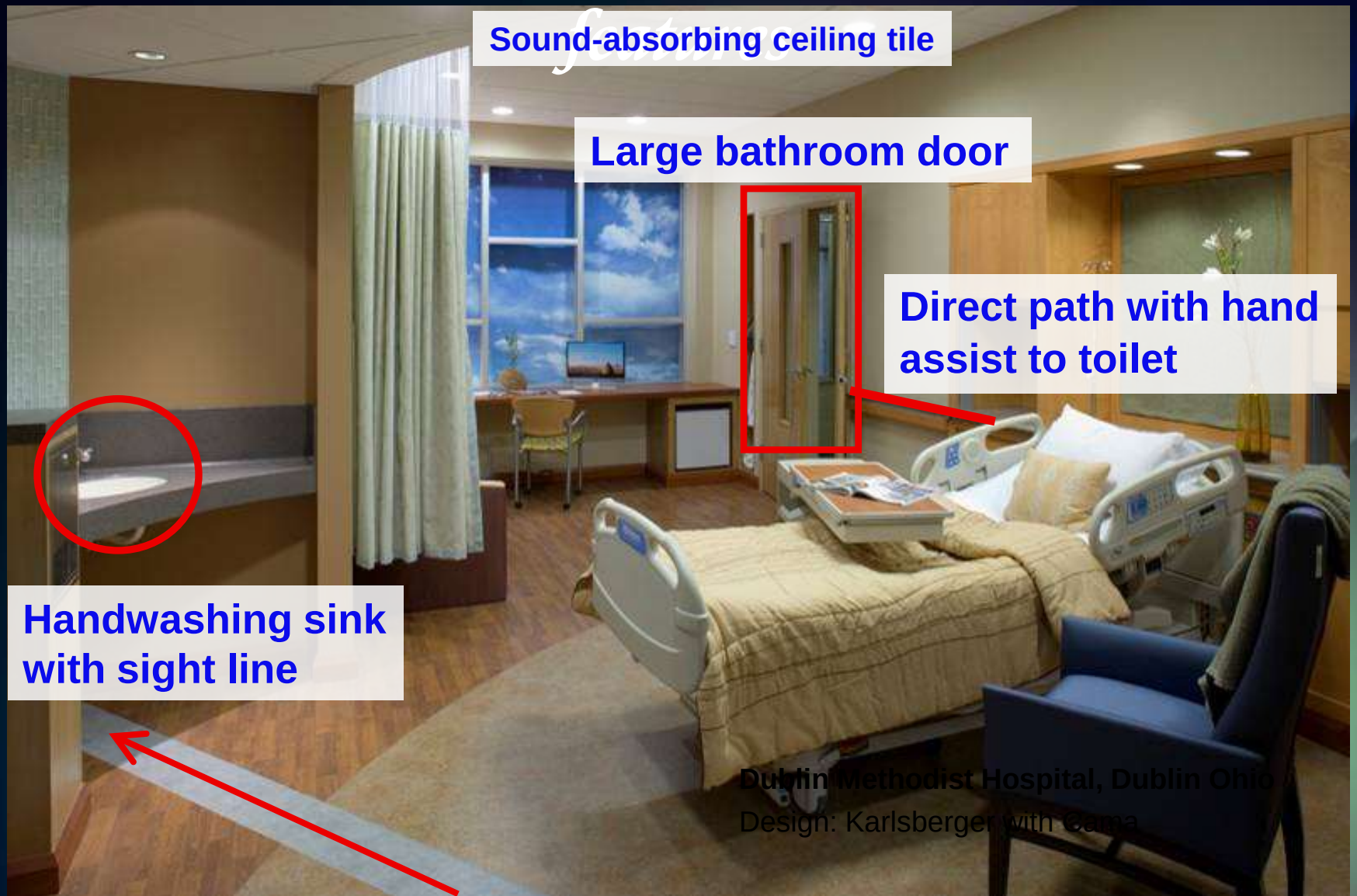
- Most falls occur when patients get out of bed unassisted. Design for increasing assistance for patients and thereby reducing falls includes:
  - Decentralized nurse stations
  - Single-bed rooms designed to support family presence

Patient Fall Index (falls per 100 patient days)



Source: A. Hendrich (2004). In *Keeping Patients Safe: Transforming the Work Environment of Nurses. Quality Chasm Series,* Institute of Medicine.

Same-handed single patient room
With evidence-based design (EBD) safety



Evidence-Based Flooring

- Floorings should be/ have
  - Stable, firm, Slip, trip and fall resistant
  - Balance of energy-absorbent properties
  - Joints, seams, and high contrast should be minimized
  - High sound-absorbing properties and low sound-transmitting properties while accommodating roller mobility and balance
  - Appropriate finishes and cleaning procedures should be used
  - Must be tested for optimal performance under different conditions (wet/dry/greasy)
  - Areas where high spillage is likely, it should be impermeable and easily cleaned, with texture to prevent slips

Evidence Based Design

- Address Latent Conditions
- Single bed rooms in almost all situations
- Reduce noise levels
- Reduce patient stress
- Develop effective way finding systems
- Improve ventilation
- Access to natural lighting and full spectrum lighting
- Reduce staff walking and fatigue
- Accessibility to patient information

Ulrich & Zimring

The Healing Environment

- Access to direct sunlight
- Positive distraction (art, television, web, etc)
- Social/family interaction
- Views of nature
- Control over immediate environment
- Pleasant, quality surroundings
- Dignity and respect
- Privacy
- Quiet and calm

Sustainable (Green) Design Principles

What is "Green" Design?

- Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in six broad areas:
  - Sustainable Sites
  - Water Efficiency
  - Energy and Atmosphere
  - Materials and Resources
  - Indoor Environmental Quality
  - Innovation in Design

The Journey: Lessons Learned

- Evidence-Based Design principles must be incorporated into the organization's mission, values, beliefs in order to gain traction

- User-input, while time consuming, ensures the organization has sought opinions of those who will provide healthcare.

What Do We Do Now?

- Focus on outcomes
- Choose evidence-based interventions
- Build the business case
- Create an integrated healing environment

Innovations

- Evidence-based physical design
  - Universal rooms
  - Innovative patient rooms
    - Large family areas
    - Operable windows
    - Family/patient access to IT
  - Re-designed work areas: no traditional nursing station
  - Respite areas for staff, families, patients
  - Natural light, 9 healing gardens
- IT
  - Vocera
  - Complete interoperablity
- Culture
- Care Process Change

Smart Suite Technology in the support of EBD

The Cerner Smart Suite combines innovative technologies, medical device interoperability and workflow solutions to improve patient care and clinician efficiency. The Smart Suite incorporates key elements of the patient and clinician experience to streamline care. The objective of the Smart Suite is to create an environment that:

- Connects medical devices to the EMR
- Allows caregivers to view relevant clinical data from the EMR and medical devices
- Empowers patients and their families by connecting them to their personal health record.

CareAware myStation
Offers interactive health information, education and entertainment to improve the patient and family experience.

CareAware iAware
Provides clinicians a personalized view of all information relevant to patient care by enhancing communication and access to information.

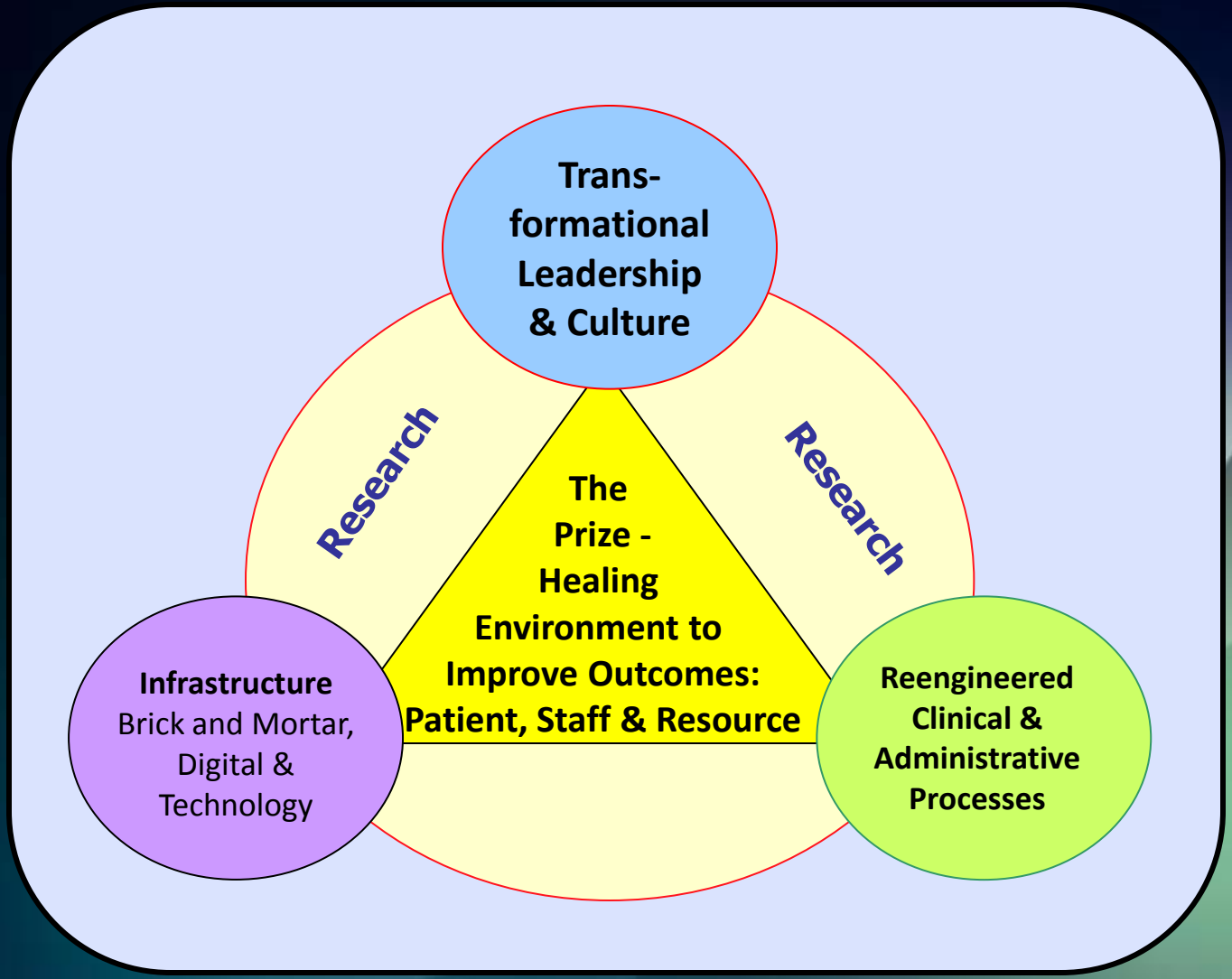
CareAware iBus including Bed Connectivity
CareAware iBus™ is the core component of the *CareAware* architecture that manages two-way communication between devices and the EMR.

CareAware RoomLink
Electronic signage outside a patient room to communicate appropriate data to clinicians, including falls risk and allergies, as well as whether or not a clinician visit is in-progress.

CareAware EPS
A fully integrated, enterprise-wide positioning and real time location solution that delivers clinical integration and process improvement benefits.

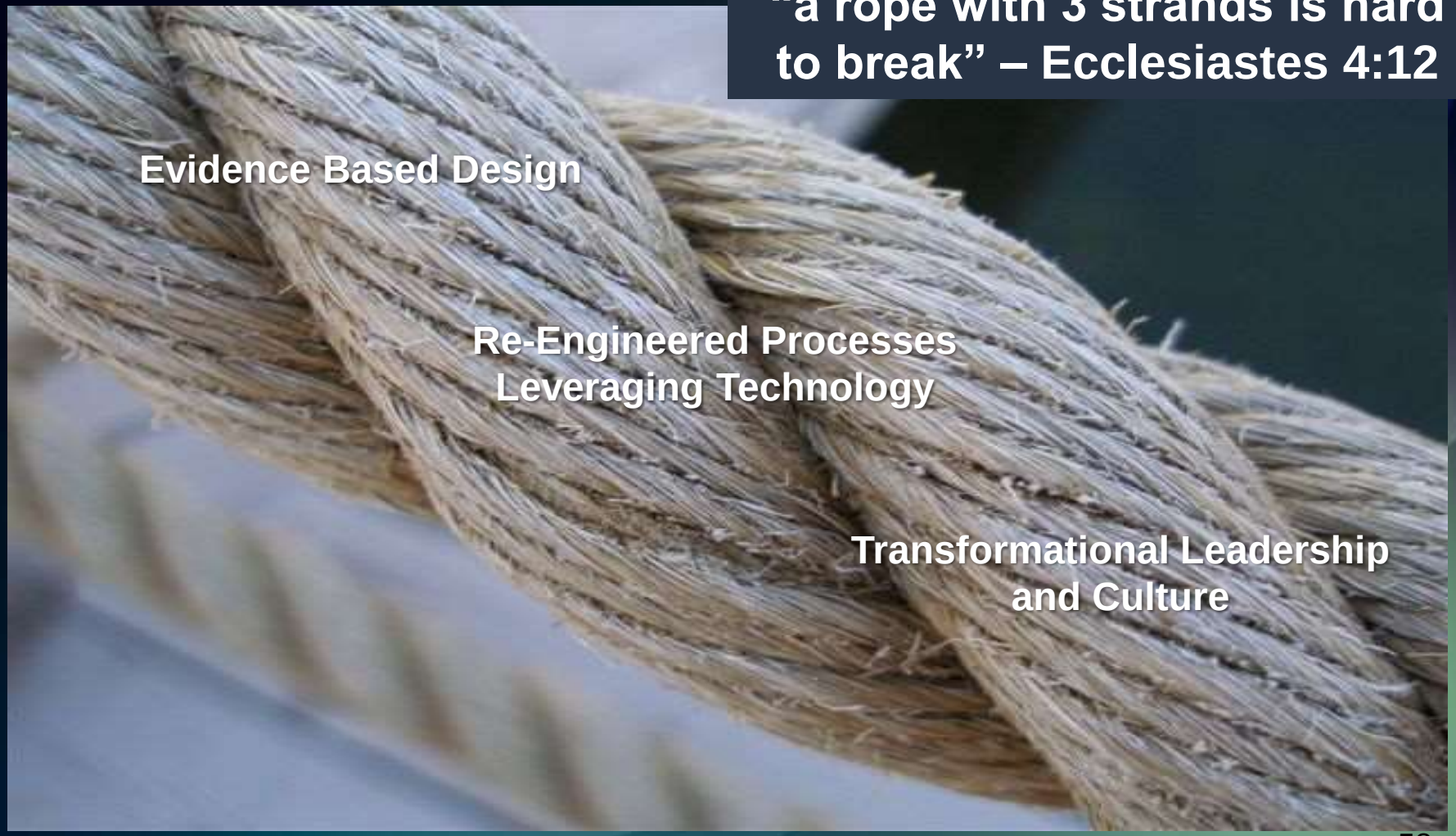
CareAware AlertLink
Improves patient outcomes by routing alerts to a clinician's mobile device.

Creating Healing Environments thru EBD



Sustainable Transformation

“a rope with 3 strands is hard to break” – Ecclesiastes 4:12



“First we shape our buildings; thereafter, they shape us.” ~ *Winston Churchill*

THANK YOU

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