ISQua 26th International Conference -- 2009

Evidence-Based Hospital Design for Patient Safety

Roger S. Ulrich, Ph.D.
Center for Health Systems and Design
Texas A&M University

Evidence-Based Design

Evidence-based design (EBD) is the deliberate attempt to base building decisions on the best available evidence with the goal of achieving the best possible safety and outcomes

sources: Hamilton, 2004, 2009; NACHRI, 2008

EBD Gaining Momentum

- New research and professional journals established
- Endorsed by U.S. Agency for Healthcare Research and Quality (AHRQ)
- Endorsed by International Joint Commission for hospital accreditation
- Endorsed by National Association of Children's Hospitals (NACHRI)
- Endorsed by credit rating agencies

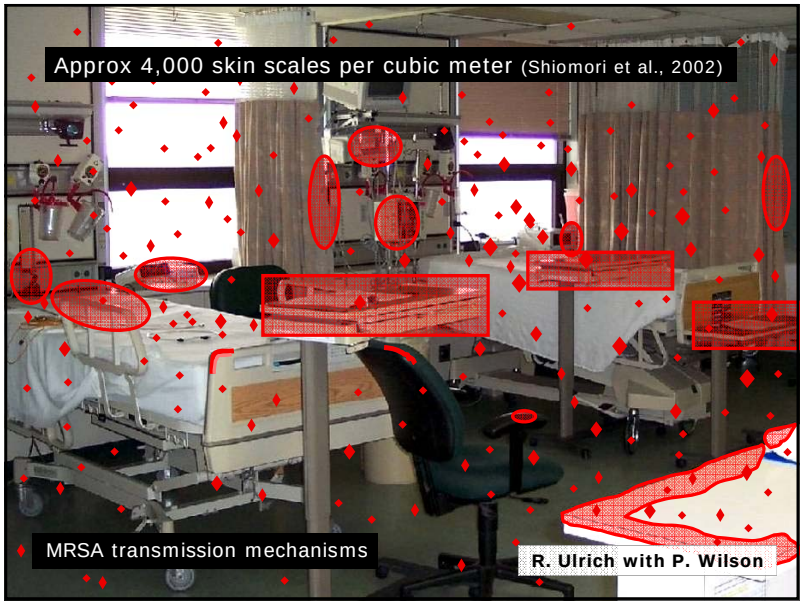
Fiona Stanley University Hospital, Perth, Australia

Children's Memorial Hospital, Chicago

Karolinska Hospital Stockholm

What is the single most important EBD recommendation for improving safety and outcomes for ALL patients?

- Provide single-bed rooms



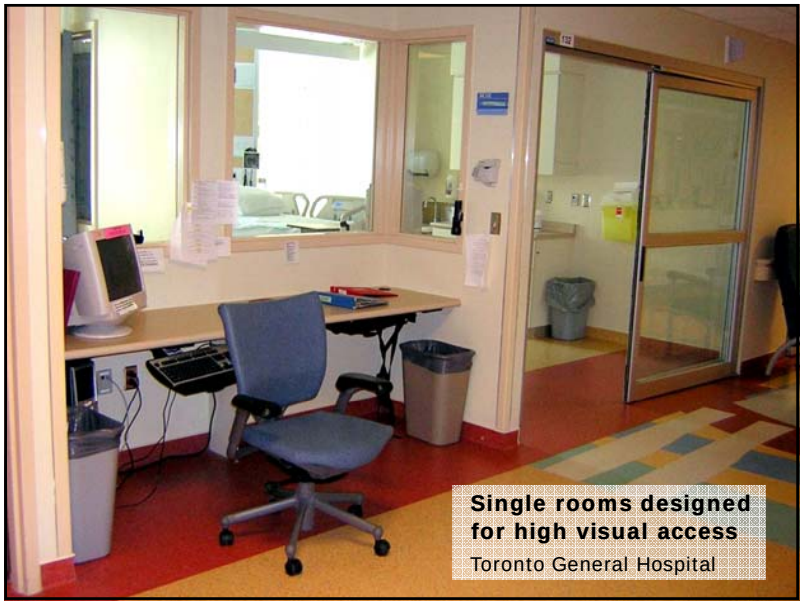
Single-Bed Rooms Reduce Infection Rates

- For example, singles enable proactive separation of patients upon admission, making it possible to prevent infection from unrecognized carriers of pathogens
- Easier to clean and decontaminate after patient is discharged
- Private toilets help contain outbreaks of *C. difficile* and norovirus

Widely held beliefs obstructing adoption of single-bed rooms

- **Beliefs are <u>not</u> evidence-based**

- **Single rooms prevent visual observation of patients, therefore worsening safety**
- **Single rooms require much higher nurse staffing levels (41%), greatly increasing costs**
- **Many patients (up to 50%) like having roommates**



Single rooms designed for high visual access

Toronto General Hospital

Hexham Hospital

Northumbria NHS

Design: Jonathan Bailey

Cromer Children's
Univ. of Chicago
Chicago, USA

Cromer Children's
Univ. of Chicago

Single rooms now required in new hospitals in 40+ U.S. states

"In new construction, the maximum number of beds per room shall be one . ."

2006 Guidelines for Design and Construction of Health Care Facilities (section 3.1.1.1, p. 40)

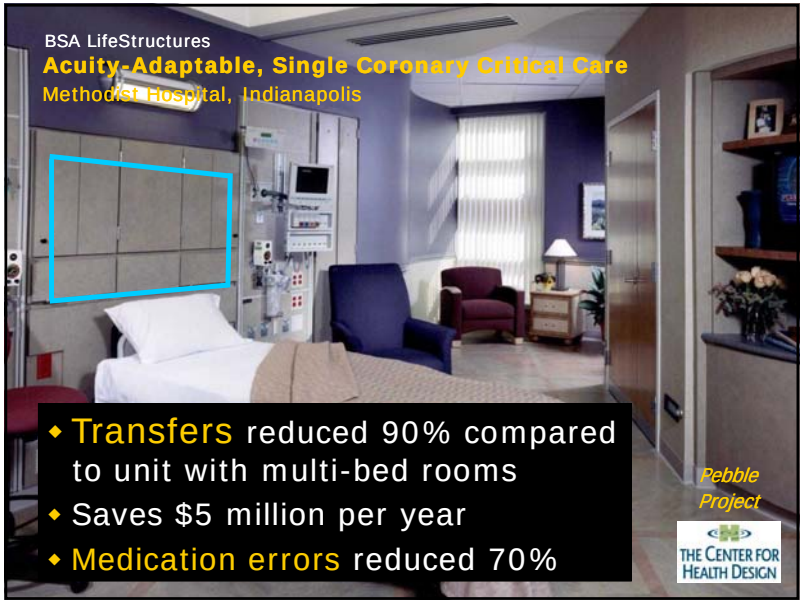
Published by: **The Facility Guidelines Institute**
American Institute of Architects
U.S. Department of Health and Human Services

Do many patients like having roommates?

- Studies show that 85%-90% of the time roommates are source of **stress** not positive social support
  - *Stress examples:* roommate who is unfriendly or seriously ill
  - Roommates generate much noise and reduce privacy
  - Roommate incompatibility causes many **room transfers**

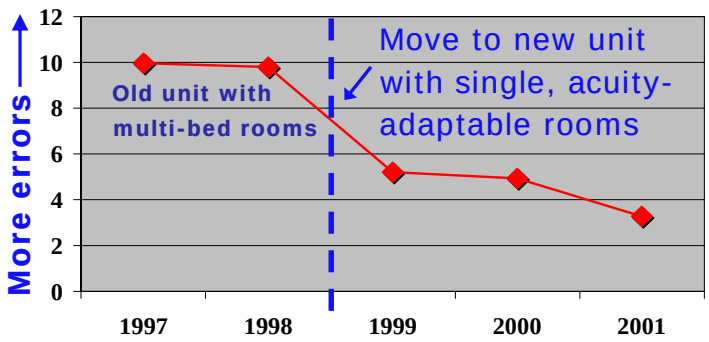
Transfers Worsen Patient and Staff Safety

- Increase infections
- Transfers cause medical complications and worsen outcomes, especially in high acuity patients
- Cause sharp peaks in errors
- A major cause of staff injuries
- Each transfer requires hours of staff time and paperwork
- Each transfer adds .5 day to hospital stay



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

Is your organization thinking of building a new facility?

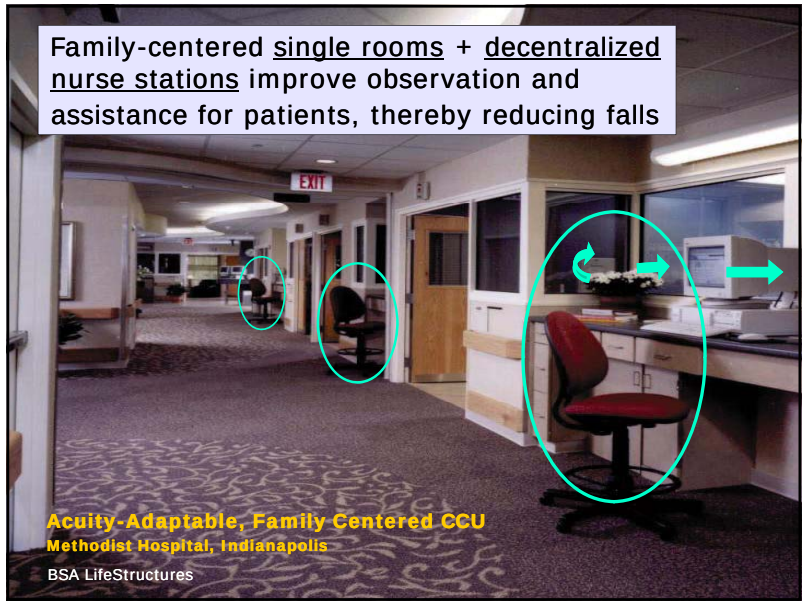
If so, it presents a rare opportunity that can have lasting benefits in improving safety and other outcomes.

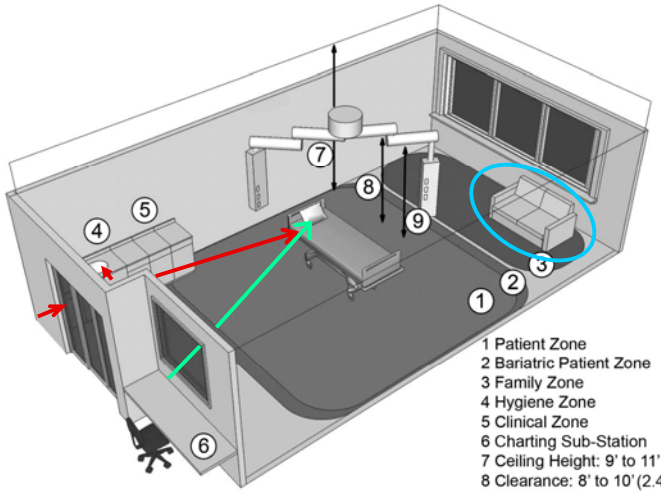
For best overall results:

- **First design the care process** (pathways, organization, care culture)
- **Then design the building**

Design for Reducing Falls

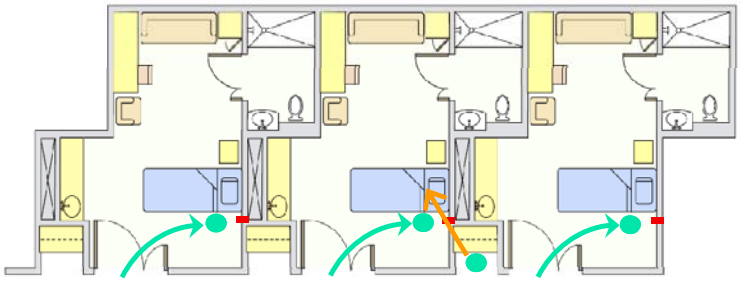
- Bedrails ineffective
- No clear evidence showing any single traditional design measure is consistently effective (lighting, flooring, handrails)
  - But bundles of design measures can be effective
  - Limited evidence suggests design for good visual access reduces falls
  - Electronic sensors are promising, but good research is lacking





Hamilton, K. and Ulrich, R., 2008, in *Core Topics in Cardiothoracic Critical Care.* Cambridge Univ Press.

No well-controlled research yet shows same-handed rooms reduce errors



Dublin, Ohio -- Ohio Health

Identical rooms hypothesized to reduce errors

Premise: standardization reduces errors

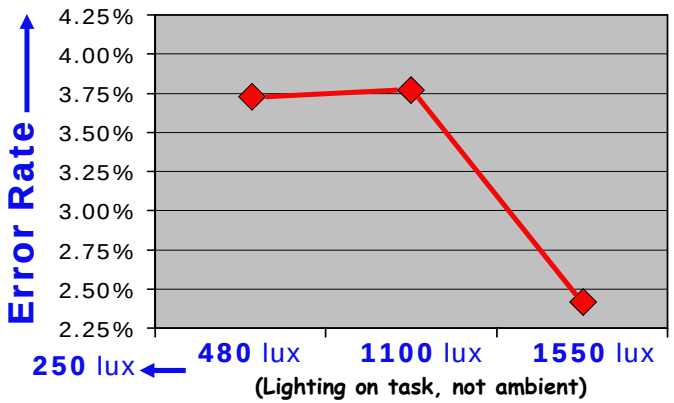
Design for Reducing Errors

- EBD measures shown to reduce errors:
  - Single rooms – via reduced transfers
  - Very good lighting in spaces for medication dispensing and data entry
  - Reduced noise and distraction
  - Decentralized medication storage or dispensing areas (long walks by staff linked to safety 'shortcuts' and errors)

Lighting Levels and Medication Dispensing Errors

- Randomized controlled studies have shown that lighting levels affect medication dispensing errors
- Higher illumination levels (1500 lux) on task are associated with fewer errors than lower levels (150-500 lux) common in healthcare spaces

Medication Dispensing Error Rates by Illumination Level (Buchanan et al., 1991)



Ceiling-mounted patient lifts reduce staff injuries and costs

- Back injuries from lifting represent 44% of all injuries to nursing staff in US hospitals
- Can be reduced by providing hoists

* Fragala, G. and Bailey, L. 2003. "Addressing Occupations Strains and Sprains: Musculoskeletal Injuries in Hospitals." AAORN Journal 51 (6): 252-259.

Peace Health, Oregon
WORKPLACE SAFETY - Reducing manual lifting injuries
(Fritz and Joseph, 2006)

Unit	Direct Cost*	# Injuries	Avg direct cost per injury*	Avg indirect cost (2x)**	Total Cost one injury	Avg # injuries per year	Total Annual Cost
Neuro	$222,646	15 (3 yrs)	$14,843	$29,686	$44,529	5	$222,645
ICU	$ 95,003	10 (2 yrs)	$9,500	$19,000	$28,500	5	$142,500
subtotal							$365,145

* Direct costs of just patient handling injuries
** Indirect costs include light duty salaries, replacement salaries, and training costs

Unit	Direct Cost	# Injuries	Avg direct cost per injury*	Avg indirect cost (2x)**	Total Cost one injury	Avg # injuries per year	Total Annual Cost
Neuro	$ 43,728	6 (2 yrs)	$ 7288	$ 14,576	$ 21,864	3	$ 54,660
ICU	$	1 (3 yrs)	$ 0.	$ 0	$ 0	.3	$ 0
subtotal	$ 43,728	7	$ 6,247	$ 12,494	$ 18,741	2.8	$61,845

- 83% reduction in total annual costs