Designing the Hospital of the Future

Improving the Quality of Care through facility design
Presentation Outline

1. .................. The Hospital of the Future

2. ......................... Nursing Unit Design

3. ............ Diagnostic and Treatment Area Design
The Hospital of the Future

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Family-centered Supportive Environments

- Privacy, dignity, respect
- Clear intuitive way-finding
- “On-stage / off-stage”
Improve Quality & Safety

- Standardization
- Advanced communications systems
- Improved lighting
- Better acoustic control
- Improved visibility

First, Do No Harm: Building a Safer Health System

Institute of Medicine

Crossing the Quality Chasm: A New Health System for the 21st Century

Institute of Medicine

2000

2001
Leverage Scarce Resources

The Staffing Crisis will continue at many levels:

- radiology nurses
- radiology technologists
- radiologists
- “PACS” specialists

New types of personnel are evolving in the procedural environment:

- “Image-guidance” radiologists
- Surgical Imaging Technologists
- Surgical IT Managers
- Non-surgical Interventionalists
Leverage Remote Specialists

- Tele-radiology
- “e-ICU”®
- Call Centers
- Remote Outreach Facilities

Photo courtesy of Sutter Health
Increase Productivity
During the 6 months following CMS’s 2001 PET reimbursement approval for certain oncology use, PET utilization grew by over 50% .... and continues ....
Competition among surgeons, interventional radiologists and cardiologists continues.

- Visionary leaders are beginning to mandate multi-specialty collaboration.
- Many specialists are willing to collaborate rather than compete.
Enhance Brand Identity
平衡初始成本和生命周期成本

- 考虑通货膨胀仍然是最重要的成本因素。
- 生命周期成本超过了初始建设成本。
- 空间项目过于紧缩会限制未来的灵活性。
- 设施缺乏“冗余”能力将限制未来的灵活性（并且未来升级将花费更多）。
- 管理服务和电力（MEP）系统占建设成本的40%-60%。
Nursing Unit Design

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Patient Lifts

Video courtesy of Ann Hendrich
Projected costs of patient handling injuries based on cost per injury prior to ceiling lifts (PeaceHealth – Springfield, OR).

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

*Direct costs of just patient handling injuries

** Indirect costs include light duty salaries, replacement salaries, and training costs
Actual preliminary savings after ceiling lifts are installed and used (PeaceHealth – Springfield, OR).

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<th>Total Annual Cost</th>
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</thead>
<tbody>
<tr>
<td>Neuro</td>
<td>$ 331</td>
<td>1 (1 yrs)</td>
<td>$ 331</td>
<td>$ 662</td>
<td>$ 993</td>
<td>1</td>
<td>$ 993</td>
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<tr>
<td>ICU</td>
<td>$ 0</td>
<td>0 (2 yrs)</td>
<td>$ 0</td>
<td>$ 0</td>
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*Direct costs of just patient handling injuries
**Indirect costs include light duty salaries, replacement salaries, and training costs
Patient Lifts

RETURN ON INVESTMENT:

$2, 149,914
cost of lifts installed

÷

$874,839
preliminary annual savings

= Payback within

2.46 years
Acuity-adaptable Patient Rooms

- Rooms that can “swing” from Acute Care to Critical Care
- Reduces need to transfer patients.
- This where most patient falls occur.
- ↓ patient falls, ↓ staff injuries, ↓ cost
- Most units “swing” best between Acute/TCU or TCU/ICU due to “cultural issues”
- Requires larger patient room
Acuity-adaptable Patient Rooms

Patient Room – Patient Area

Patient Room – Footwall & Family Area

© Anshen+Allen Associated Architects for Palomar Pomerado Health
Acuity-adaptable Patient Rooms

Patient Room – Area Comparison

<table>
<thead>
<tr>
<th></th>
<th>ACUTE CARE DESIGN</th>
<th></th>
<th>ACUITY ADAPTABLE DESIGN</th>
</tr>
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<tbody>
<tr>
<td>Patient Room</td>
<td>240 SF</td>
<td>Toilet Room</td>
<td>280 SF</td>
</tr>
<tr>
<td>40 SF</td>
<td></td>
<td>40 SF</td>
<td>Room</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>280 SF</strong></td>
<td><strong>320 SF</strong></td>
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</table>

Premium: $384 / SF x 40 SF = $ 15,360 / room

© Anshen+Allen Associated Architects for Palomar Pomerado Health
Acuity-adaptable Patient Rooms

Patient Room – Electrical Comparison

**ACUTE CARE DESIGN**

- Dimmers not required
- 2 duplex
- Emergency power not required

**ACUITY ADAPTABLE DESIGN**

- Dimmers required
- 6 duplex
- Emergency circuit required

Premium: $1,794 / room

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### Patient Room – Medical Gas Comparison

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Acute Care Design</th>
<th>Acuity Adaptable Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Gas Outlets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Gas Outlets</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Premium of 6 Gas Outlets = $6,000 / room**

**Premium for flow meters = $3,300 / room**
“Same-handed” Patient Rooms

Definition:

A design that provides consistent orientation of the room elements (door, bed, headwall/footwall, toilet/shower, etc.) to all patient rooms.
"Same-handed" Patient Rooms

Potential Benefits:

• Consistent approach and care practice

• Possible reduction in staff error

• Most beneficial for high stress areas (ICU)
“Same-handed” Patient Rooms

TRADITIONAL “MIRRORED” ORIENTATION

“SAME HANDED” PATIENT ROOM

Non-shared plumbing wall premium = $987 / room
“Same-handed” Patient Rooms

- Designed for safety because everything is in the same place
- Do providers get disoriented (which patient)?
- Need to provide distinguishing visible landmarks
- Where is the evidence?
Design of Diagnostic and Treatment Areas
Softening Technology

- Positive distractions
- Hide ancillary equipment
- Erode barriers between patients and caregivers
- Give patients control of environmental features

Photos courtesy of SmithGroup
Erosion of Departmental Boundaries

- Avoid duplication of scarce staff, expensive equipment and limited space
- Provide flexibility for complex medical procedures
- Accommodate future conversion of modalities
- Envision multi-disciplinary collaboration

The Integrated Interventional Suite

- Endoscopy
- IR / Cath
- Surgery
- Level 2 Recovery
- PACU
- Intake/Prep
- Shared prep/recovery
The Integrated Interventional Suite

Potential Benefits:
- Consolidation of Prep, Recovery and Support areas / staff
- Integrated material and supply distribution
- Improved infection control for interventional procedures
- Long term flexibility/adaptability
The Integrated Interventional Suite

Planning Infrastructure:

- Flexible structural system
- High floor to floor height
- Robust floor loading capacity
- Strategic placement of soft space
- “Loose-fit” programming
The Integrated Interventional Suite

Challenges:

- Collective vision to minimize turf battles
- Differing protocol for infection control in Surgery, Interventional Radiology and Interventional Cardiology
- Contiguous space for multiple services
- Cross-training for some support staff
- Cost of excess infrastructure capacity for future areas of change
MRI Safety
Landmark Incident (2001)

Call for oxygen led to MRI death

How the accident happened

A sequence of events in the accident that fatally injured 6-year-old Michael Colombini at Westchester Medical Center July 27:

4. The doctor becomes concerned that the boy needs oxygen. He says he opens the door of the room in which the MRI was located, and indicates he needs oxygen, and a radiology nurse hands him a tank. He says he never stepped outside the MRI room. The nurse says the doctor walked outside the room to ask for oxygen and she handed it to him.

5. The powerful magnets in the MRI pull the metal oxygen bottle into the tube of the machine, striking Michael in the head.

1. Michael is transferred to the MRI area for a postoperative exam in the early afternoon. Sedated, Michael is put head first into the MRI and receives oxygen through a tube under his nose. The oxygen tube is connected to an oxygen spigot in the wall.

2. The doctor, an anesthesiologist who is overseeing the procedure, detects a problem with the oxygen. He knocks on the window of the control room, where two technicians are sitting, to indicate the problem.

3. A technician opens the door and says the problem will be taken care of. Both technicians go into a room next to the MRI room to switch to a second oxygen tank, leaving the MRI room unmonitored.

Source: Staff research

MRI facilities and adjoining rooms

July 27, 2001: Westchester (NY) Medical Center

Source: The Journal News June 1, 2002
MRI Safety

American College of Radiology (ACR) MRI Safety Guidelines

ZONE 1: Unrestricted [outside MR suite]

ZONE 2: Restricted to supervision by MR personnel [reception, waiting, toilets, dressing]

ZONE 3: Highly restricted area where serious injury can occur [control room, computer room]

ZONE 4: Most highly restricted where all non-MR personnel must be in direct visual supervision of Level 2 MR staff at ALL times [MR scanner room]
MRI Safety Planning Implications

Scrutinize MRI Workflow Issues:
- Secure access to entire dept
- Highly supervised entrance to Scan Room vicinity (Zones 3-4)

Potential conflicts between security and life safety:
- MR safety personnel as first responders, not fire-fighters

Design Control Room to maximize visual supervision:
- Maximum supervision of both patient couch and scan room entrance
- Ante room between scan room entrance and corridor?
MRI Safety Planning Implications

Future 4th Scanner

MRI suite with 3 scanners

ZONE 1

ZONE 2

ZONE 3

ZONE 4

Imaging Department
MRI Safety Planning Implications

- Secure MRI suite boundary (Zones 3 & 4)
- Secure MRI suite door
- Through-traffic does not enter MRI suite
MRI Safety Planning Implications

- One Tech can see 2 MRI rooms
- Both Techs can see entrance to “Security Vestibule”
- Security-controlled Corridor
Magnetic Resonance Imaging (MRI) in the Operating Room (OR)

**Design Implications**

**Magnet Types**
- Stationary
- Pivoting
- Traveling
- Portable

**Room Types**
- Single Room
- Dual Room
- Many Rooms
MR/OR in One Integrated Room

RF shield entire room or only the surgical zone

Imaging and Procedure Zone (MR compatible surgical instruments)

Source: Odin Medical / Medtronics

Portable Magnet
MR/OR in One Integrated Room

RF shield entire room

Imaging Zone

Procedure Zone

Traveling Patient
MR/OR in One Integrated Room

RF shield entire room

Traveling Magnet
MR/OR in One Integrated Room

RF shield entire room

Traveling Magnet

Courtesy of Stantec Architects, Ltd. Calgary, AB
MRI in the OR

DESIGN IMPLICATIONS

- Design for MRI safety (ACR safety guidelines)
- Locate MRI for either “scrubbed” or “street clothes” access
- Protect against RF and/or magnetic interactions with adjacent occupants
- Increase structural, air and cooling capacities
I said *heel*, not heal. Bad dog. Bad dog.